SLOVENSKI STANDARD
oSIST prEN IEC 63563-7:2024

01-julij-2024

Različica specifikacije Qi 2.0 - 7. del: Odkrivanje, zaznavanje tujkov (Hitri postopek)

Qi specification version 2.0 - Part 7: Foreign object detection (Fast track)

Ta slovenski standard je istoveten z: **prEN IEC 63563-7:2024**

ICS:

29.240.99	Druga oprema v zvezi z omrežji za prenos in distribucijo električne energije	Other equipment related to power transmission and distribution networks
33.160.99	Druga avdio, video in avdiovizuelna oprema	Other audio, video and audiovisual equipment
35.200	Vmesniška in povezovalna oprema	Interface and interconnection equipment

oSIST prEN IEC 63563-7:2024 **en,fr,de**

100/4128/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

PROJECT NUMBER:	
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DATE OF CIRCULATION:	CLOSING DATE FOR VOTING:
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IEC TA 15 : WIRELESS POWER TRANSFER	
SECRETARIAT:	SECRETARY:
Korea, Republic of	Mr Ockwoo Nam
OF INTEREST TO THE FOLLOWING COMMITTEES:	PROPOSED HORIZONTAL STANDARD:
TC 106,TC 108	☐
	Other TC/SCs are requested to indicate their interest, if any, in this CDV to the secretary.

FUNCTIONS CONCERNED:

☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY

☐ SUBMITTED FOR CENELEC PARALLEL VOTING ☒ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:

Qi Specification version 2.0 - Part 7: Foreign Object Detection (Fast track)

PROPOSED STABILITY DATE: 2029

NOTE FROM TC/SC OFFICERS:

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WIRELESS POWER CONSORTIUM

Qi Specification

Foreign Object Detection

Version 2.0

April 2023

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RELEASE HISTORY

Specification Version	Release Date	Description
v2.0 Final Draft	April 2023	Initial release of the 2.0 Qi Specification.

Table of Contents

1 General

The Wireless Power Consortium (WPC) is a worldwide organization that aims to develop and promote global standards for wireless power transfer in various application areas. A first application area comprises flat-surface devices such as mobile phones and chargers in the Baseline Power Profile (up to 5 W) and Extended Power Profile (above 5 W).

1.1 Structure of the Qi Specification

General documents

- Introduction
- Glossary, Acronyms, and Symbols

System description documents

- Mechanical, Thermal, and User Interface
- Power Delivery
- Communications Physical Layer
- Communications Protocol
- Foreign Object Detection
- NFC Tag Protection
- Authentication Protocol

Reference design documents

- Power Transmitter Reference Designs
- Power Receiver Design Examples

Compliance testing documents

- Power Transmitter Test Tools
- Power Receiver Test Tools
- Power Transmitter Compliance Tests
- Power Receiver Compliance Tests

NOTE: The compliance testing documents are restricted and require signing in to the WPC members' website. All other specification documents are available for download on both the WPC public website and the WPC website for members.

1.2 Scope

The *Qi Specification, Foreign Object Detection* (this document) defines methods for ensuring that the power transfer proceeds without heating metal objects in the magnetic field of a Power Transmitter. Although the Power Transmitter may optionally use any of these methods, some of them require assistance by the Power Receiver.

1.3 Compliance

All provisions in the *Qi Specification* are mandatory, unless specifically indicated as recommended, optional, note, example, or informative. Verbal expression of provisions in this Specification follow the rules provided in ISO/IEC Directives, Part 2.

Table 1: Verbal forms for expressions of provisions

Provision	Verbal form
requirement	"shall" or "shall not"
recommendation	"should" or "should not"
permission	"may" or "may not"
capability	"can" or "cannot"

1.4 References

For undated references, the most recently published document applies. The most recent WPC publications can be downloaded from http://www.wirelesspowerconsortium.com. In addition, the *Qi Specification* references documents listed below. Documents marked here with an asterisk (*) are restricted and require signing in to the WPC website for members.

- Product Registration Procedure Web page*
- Qi Product Registration Manual, Logo Licensee/Manufacturer*
- Qi Product Registration Manual, Authorized Test Lab*
- Power Receiver Manufacturer Codes,* Wireless Power Consortium
- The International System of Units (SI), Bureau International des Poids et Mesures
- Verbal forms for expressions of provisions, International Electotechnical Commission

For regulatory information about product safety, emissions, energy efficiency, and use of the frequency spectrum, visit the regulatory environment page of the WPC members' website.

1.5 Conventions

1.5.1 Notation of numbers

- Real numbers use the digits 0 to 9, a decimal point, and optionally an exponential part.
- Integer numbers in decimal notation use the digits 0 to 9.
- Integer numbers in hexadecimal notation use the hexadecimal digits 0 to 9 and A to F, and are prefixed by "0x" unless explicitly indicated otherwise.
- Single bit values use the words ZERO and ONE.

1.5.2 Tolerances

Unless indicated otherwise, all numeric values in the *Qi Specification* are exactly as specified and do not have any implied tolerance.

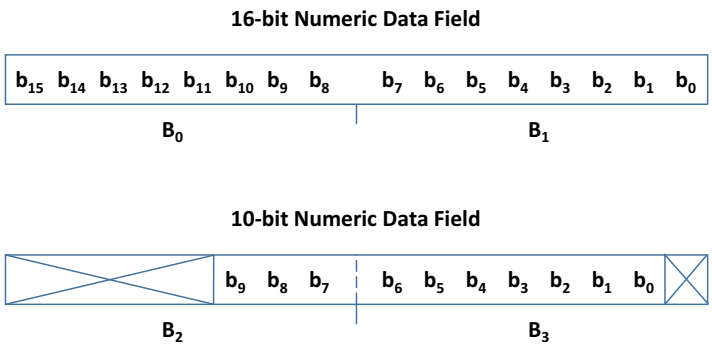
1.5.3 Fields in a data packet

A numeric value stored in a field of a data packet uses a big-endian format. Bits that are more significant are stored at a lower byte offset than bits that are less significant. Table 2 and Figure 1 provide examples of the interpretation of such fields.

Table 2: Example of fields in a data packet

	b_7	b_6	b_5	b_4	b_3	b_2	b_1	b_0
B_0	(msb) 16-bit Numeric Data Field							
B_1								(lsb)
B_2	Other Field					(msb)		
B_3	10-bit Numeric Data Field						(lsb)	Field

Figure 1. Examples of fields in a data packet



1.5.4 Notation of text strings

Text strings consist of a sequence of printable ASCII characters (i.e. in the range of 0x20 to 0x7E) enclosed in double quotes ("). Text strings are stored in fields of data structures with the first character of the string at the lowest byte offset, and are padded with ASCII NUL (0x00) characters to the end of the field where necessary.

EXAMPLE: The text string “WPC” is stored in a six-byte fields as the sequence of characters 'W', 'P', 'C', NUL, NUL, and NUL. The text string “M:4D3A” is stored in a six-byte field as the sequence 'M', ':', '4', 'D', '3', and 'A'.

1.5.5 Short-hand notation for data packets

In many instances, the *Qi Specification* refers to a data packet using the following shorthand notation:

<MNEMONIC>/<modifier>

In this notation, <MNEMONIC> refers to the data packet's mnemonic defined in the *Qi Specification, Communications Protocol*, and <modifier> refers to a particular value in a field of the data packet. The definitions of the data packets in the *Qi Specification, Communications Protocol*, list the meanings of the modifiers.

For example, EPT/cc refers to an End Power Transfer data packet having its End Power Transfer code field set to 0x01.

1.6 Power Profiles

A Power Profile determines the level of compatibility between a Power Transmitter and a Power Receiver. Table 3 defines the available Power Profiles.

- *BPP PTx*: A Baseline Power Profile Power Transmitter.
- *EPP5 PTx*: An Extended Power Profile Power Transmitter having a restricted power transfer capability, i.e. $P_{\mathrm{L}}^{(\mathrm{pot})}$ = 5 W.
- *EPP PTx*: An Extended Power Profile Power Transmitter.
- *BPP PRx*: A Baseline Power Profile Power Receiver.
- *EPP PRx*: An Extended Power Profile Power Receiver.

Table 3: Capabilities included in a Power Profile

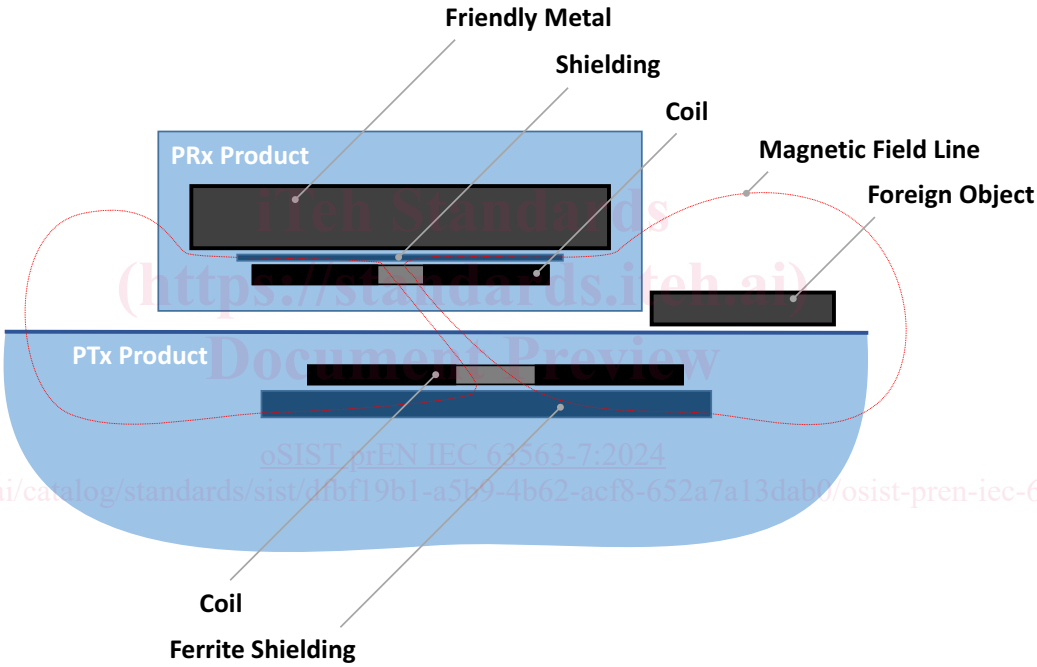
Feature	BPP PTx	EPP5 PTx	EPP PTx	BPP PRx	EPP PRx
A*x* or B*x* design	Yes	Yes	No	N/A	N/A
MP-A*x* or MP-B*x* design	No	No	Yes	N/A	N/A
Baseline Protocol	Yes	Yes	Yes	Yes	Yes
Extended Protocol	No	Yes	Yes	No	Yes
Authentication	N/A	Optional	Yes	N/A	Optional

2 Introduction

In a normal use case of a power transfer according to the *Qi Specification*, the Power Signal (magnetic field) of the Power Transmitter interacts with the Power Receiver Product only. However, sometimes a user accidentally places metallic objects such as coins, paper clips, keys, or pieces of aluminum foil next to or underneath the Power Receiver Product, either before the power transfer starts, or while it is ongoing. The *Qi Specification* refers to such objects as Foreign Objects.

A problem with Foreign Objects is that they can dissipate power from the magnetic field, and as a result heat up to unsafe temperature levels. The system should therefore not initiate the power transfer, limit the power level, or stop the power transfer when it detects that one or more Foreign Objects are present.

Figure 2. Power transfer system including a Foreign Object



A factor complicating Foreign Object Detection (FOD) is the presence of Friendly Metals in the magnetic field. A Friendly Metal is similar to a Foreign Object in the sense that it can dissipate power from the magnetic field. However, unlike a Foreign Object, it is an integral part of the Power Receiver Product or Power Transmitter Product. In many cases, it is hard for a Power Transmitter to distinguish properly between Foreign Objects and Friendly Metals. Typically, no single method is sufficient to solve the problem. Accordingly, the Power Transmitter should use multiple methods to maximize the probability of detecting Foreign Objects, while minimizing the probability of false alarms.

3 Avoidance of Foreign Object heating

As explained in Section 2, *Introduction*, the Power Signal can heat up Foreign Objects that are present in the Operating Volume. Therefore, a Power Transmitter Product shall ensure that such Foreign Objects do not reach unsafe temperature levels. This may involve limiting or terminating the power transfer.

The Power Transmitter can use several approaches to prevent excessive of heating Foreign Objects and apply those before starting the power transfer and/or while the latter is in progress. The main use cases that FOD should address include

- A user placing a Foreign Object before placing a Power Receiver Product
- A user placing a Foreign Object together with a Power Receiver Product
- A user placing a Foreign Object after placing a Power Receiver Product

The methods described in Section 4, *Pre-power transfer FOD methods*, address the first two use cases. Detecting a Foreign Object before starting the power transfer lets the Power Transmitter take one or more of the following actions.

- Warn the user of a potential unsafe situation
- Refuse to start the power transfer until a user has removed the Foreign Object
- Proceed to transfer power but at a reduced level

The methods described in Section 5, *In-power transfer FOD methods*, address the third use case. They also address the use case in which the Power Transmitter proceeds with the power transfer even though it suspects a Foreign Object is present. In general, these methods enable the Power Transmitter to limit the power loss to Foreign Objects (by reducing the power level), with the aim to limit their heating.

If the Power Transmitter does not detect a Foreign Object before starting the power transfer, it may use that knowledge to calibrate the system to improve its sensitivity for power loss (see Section 5.2, *Calibrated power loss accounting*, for details). However, when it detects a Foreign Object and proceeds to transfer power at a reduced level anyway, it should ensure that any of such calibrations it may perform do not degrade its sensitivity.

Some of the methods described in Section 4, *Pre-power transfer FOD methods*, and Section 5, *In-power transfer FOD methods*, involve the Power Receiver sending information about its design properties to the Power Transmitter. The Power Receiver shall provide the design information associated with all those methods.

In addition to the methods described in Section 4, *Pre-power transfer FOD methods*, and Section 5, *In-power transfer FOD methods*, the Power Transmitter can monitor the temperature of its Interface Surface for hot spots. Moreover, it can actively cool its Interface Surface to drain heat away from the Power Receiver and Foreign Objects.

3.1 Representative Foreign Objects

Foreign Objects can have many different sizes, shapes, and material compositions. To address this diversity, the *Qi Specification, Foreign Object Detection* (this document) defines the required FOD capabilities of a Power Transmitter in terms of a set of Representative Foreign Objects. Table 4 lists these objects.

Table 4: Representative Foreign Objects

Designator	Shape	Material	Dimensions	Limit / C°
RFO#1	Disk	Steel 1.1011 DIN RFe160	ø15 mm, 1 mm thick	60
RFO#2	Ring	DIN 3.2315 EN AW-6082 ISO AlSi1MgMn	ø20 mm (inner) ø22 mm (outer) 1 mm thick	60
RFO#3	Foil	EN AW-1050 DIN 3.0255 Al99.5	ø20 mm, 0.1 mm thick	80
RFO#4	Disk	DIN 3.2315 EN AW-6082 ISO AlSi1MgMn	ø22 mm, 1 mm thick	60

When one of the Representative Foreign Objects is present in the Operating Space, the Power Transmitter shall not heat it to a temperature above the limit associated with that object.