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Specifikacija Qi - Različica 2.3 - 9. del: Komunikacijski protokol (hitri postopek)

Qi Specification - Version 2.3 - Part 9: Communications protocol (Fast Track)

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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

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100/4552/CDV

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☒ SUBMITTED FOR CENELEC PARALLEL VOTING **Attention IEC-CENELEC parallel voting** The attention of IEC National Committees, members of CENELEC, is drawn to the fact that this Committee Draft for Vote (CDV) is submitted for parallel voting. The CENELEC members are invited to vote through the CENELEC online voting system.	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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WIRELESS POWER

CONSORTIUM

Qi Specification

Communications Protocol

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Version 2.3

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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. An important application area comprises flat-surface devices such as mobile phones and chargers operating at power levels up to 25 W.

1.1 Structure of the Qi Specification

General documents

- Introduction
- Glossary, Acronyms, and Symbols
- Technical System Overview
- Power Profiles

System description documents

- Mechanical, Thermal, and User Interface
- Power Delivery
- Communications Physical Layer
- Communications Protocol
- Foreign Object Detection
- NFC Tag Protection
- Authentication Protocol
- MPP Communications Protocol
- MPP Magnetics Design
- MPP Power Delivery
- MPP Communications Physical Layer
- MPP Foreign Object Detection
- MPP Design Guidelines (Informative)
- Magnetic Covers
- Active Alignment System
- Thermal Management Protocol

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1.2 Scope

The *Qi Specification*, *Communications Protocol* (this document) defines the messaging between a Power Transmitter and a Power Receiver. The primary purpose of this messaging is to set up and control the power transfer. As a secondary purpose, it provides a transport mechanism for higher level applications such as Authentication. The communications protocol comprises both the required order and timing relations of successive messages.

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.

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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 (table)

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

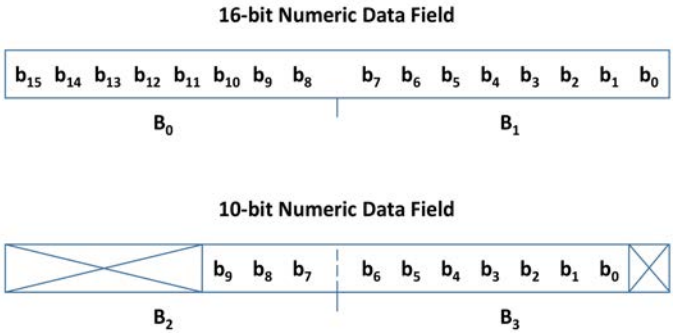


Figure 1 - Examples of fields in a data packet

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.

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2. Overview

When a user places a Power Receiver within the Operating Volume of a Power Transmitter, the two start to communicate with the aim to configure and control the power transfer. The Power Signal provides the carrier for all communications. The *Qi Specification*, *Communications Physical Layer* defines the low-level formats of data bits, data bytes, and data packets. The *Qi Specification*, *Communications Protocol* (this document) defines the payloads of the data packets and their use in the power control protocols.

2.1 Protocol phases

The *Qi Specification* defines two communications protocols.

- *Baseline Protocol*—the original protocol introduced in version 1.0 of the Qi Power Class 0 Specification, which uses Power Receiver to Power Transmitter communications only.
- *Extended Protocol*—added in version 1.2 of the Qi Power Class 0 Specification to support bi-directional communications and enhanced Foreign Object Detection (FOD) features. Version 1.3 of the *Qi Specification* adds data transport stream functionality and authentication options.

As shown in Figure 2, the communications protocol comprises several phases. The negotiation phase is not present in the Baseline Protocol.



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Figure 2 - Protocol phases

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- *Ping phase.* The Power Transmitter tries to establish communications with a Power Receiver. Before doing so, it typically performs measurements to determine if there are objects such as bankcards, coins or other metals, which can damage or heat up during the power transfer. These measurements proceed without waking up the Power Receiver. See the *Qi Specification*, *Power Delivery*, for restrictions on such measurements.

  NOTE: The Power Transmitter typically postpones a conclusion whether detected metals are Foreign Objects or Friendly Metals to the negotiation phase, after obtaining design information from the Power Receiver. See the *Qi Specification*, *Foreign Object Detection*, for details about recommended methods.

- *Configuration phase.* The Power Receiver sends basic identification and configuration data to the Power Transmitter. Both sides use this information to create a baseline Power Transfer Contract. Moreover, the Power Transmitter and Power Receiver decide whether to continue with the Baseline Protocol or the Extended Protocol.

  NOTE: A Power Receiver can only make use of features such as enhanced FOD, data transport streams, and authentication if it implements the Extended Protocol.

- *Negotiation phase.* This phase is not present in the Baseline Protocol. The Power Transmitter and Power Receiver establish an extended Power Transfer Contract containing additional settings and limits. The Power Receiver also provides design information to the Power Transmitter, which the latter can use to complete FOD before switching to the power transfer phase. See the*Qi Specification*, *Foreign Object Detection*, for details about this information.
- *Power transfer phase.* This is the phase in which the power transfer to the Power Receiver's Load occurs. In the Extended Protocol, the Power Transmitter and Power Receiver perform a system calibration at the start of this phase. See the *Qi Specification*, *Foreign Object Detection*, for details about calibration. Occasional interruptions of this phase may occur to renegotiate an element of the Power Transfer Contract. However, the power transfer continues during such renegotiations.

Table 3 summarizes the main features of the two protocol variants.

Table 3 - Comparison of the Baseline Protocol and the Extended Protocol

Feature	Baseline Protocol	Extended Protocol
Power Transmitter design	Type A*x* and type B*x* designs only	All designs
Power Receiver to Power Transmitter Communications	Load modulation at a fixed 2 kHz clock	Load modulation at a fixed 2 kHz clock
Power Transmitter to Power Receiver Communications	N/A	Frequency shift keying at a frequency dependent clock of f_{op} /512
Operating phases	Ping, configuration, and power transfer	Ping, configuration, negotiation, and power transfer
Power level calibration	N/A	At the start of the power transfer phase
Authentication	N/A	Using data transport streams in the power transfer phase

2.2 Power Transfer Contract

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A Power Transfer Contract comprises the settings and limits governing the power transfer. The Power Receiver sets up an initial Power Transfer Contract as applicable to the Baseline Protocol. The first part of Table 4 shows the elements of this initial (or baseline) Power Transfer Contract. The Power Transmitter receives all information to duplicate the baseline Power Transfer Contract in the configuration phase of the protocol.

Some elements of the Power Transfer Contract are negotiable, enabling the Power Transmitter and Power Receiver to determine new values for these elements in the negotiation phase of the protocol (Extended Protocol only). In the Baseline Protocol, all elements of the Power Transfer Contract keep their values until the power transfer ends.

The Extended Protocol makes use of an extended Power Transfer Contract that contains the additional elements shown in the second part of Table 4. See the *Qi Specification*, *Power Delivery*, and *Section 6, Negotiation phase* , for details about the use of these elements.