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Part 10: MPP System Specification

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It is based on *Qi Specification version 2.0, MPP System Specification* and was submitted as a Fast-Track document.

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

Draft	Report on voting
100/4254/FDIS	100/4275/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.

The structure and editorial rules used in this publication reflect the practice of the organization which submitted it.

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- reconfirmed,
- withdrawn, or
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WIRELESS POWER CONSORTIUM

Qi Specification

MPP System Specification

Version 2.0

April 2023

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RELEASE HISTORY

Specification Version	Release Date	Description
2.0	April 2023	First release of this v2.0 specification.

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1 General Description

1.1 Introduction

1.1.1 Scope

This specification defines MPP (Magnetic Power Profile), an extension to Qi v1.3 BPP (Baseline Power Profile). Manufacturers can use this specification to implement PTx and/or PRx that are interoperable.

1.1.2 Document organization

The MPP (Magnetic Power Profile) Specification is organized as these documents:

1. MPP System Specification (this document)
2. MPP Communications Protocol Specification

MPP is an extension of the Baseline Power Profile (BPP) and utilizes some (but not all) features defined in the Extended Power Profile (EPP). Where relevant, refer to the Qi v2.0 Specification.

1.1.3 Design goals

Magnetic Power Profile (MPP) is an interface which allows for:

- Never missing the sweet spot - ease of attach through ring of magnets
- Ecosystem of powered and unpowered accessories
- Conveniently using your device while charging
- Delivering high power (15W) safely
- Preventing interference with vehicle key fobs without regulatory issues by operating at 360 kHz
- Compatibility with Qi 2.0 BPP products and maintaining near-parity backward compatibility with Qi 1.x BPP products

Sweet spot

The goal for MPP is to enable a new wireless charging experience for users where they will never miss the charging "sweet spot" and can consistently, efficiently, and safely charge their devices at high power. To achieve accurate alignment between the PTx and PRx coils, a circular array of magnets has been added that surround the coils. The magnetic alignment provides tactile feedback to the user guiding accurate placement even in the case where the user isn't directly looking at the PTx. Conveniently, the magnetic attachment enables users to use their device while it is charging and greatly simplifies docking functionality.

Magnet array

The magnet array has been carefully designed so that it can coexist with the wireless power transfer system to deliver high power transfer at high efficiency. Figure 2.1.3: 1 shows the multipole magnet design that tightly couples strong permanent magnetic fields within the region of the magnet array, keeping most of the strong fields away from the magnetic shielding material of the power transfer coils.

Because of the consistent accurate alignment, the magnetic state-space that the system must be designed to work across is reduced. Figure 2.1.3: 2 shows data from a study where 99.9% of placements aligned the PTx and PRx within a 2mm radius [1]. By reducing the state-space, the design of features like foreign object detection is simplified.

[1] The placement study used a case with integrated magnets as shown in Figure 2.1.3:

Benefits

The benefits of MPP also extend further than just wireless charging: it enables an ecosystem of powered and unpowered accessories. Because of the convenience of magnetic attach, it is expected that a new category of portable charging products will arise, and with this in mind, MPP has been designed to ensure that charging at 360 kHz will not cause interference with vehicle key fobs. All these benefits and experiences have been enabled in MPP while also being compatible with Qi 2.0 BPP and having nearly 100% backwards compatibility with Qi 1.x BPP.

Figure 2.1.3: 1 Multipole magnet design that tightly couples strong permanent magnetic fields within the region of the magnet array .

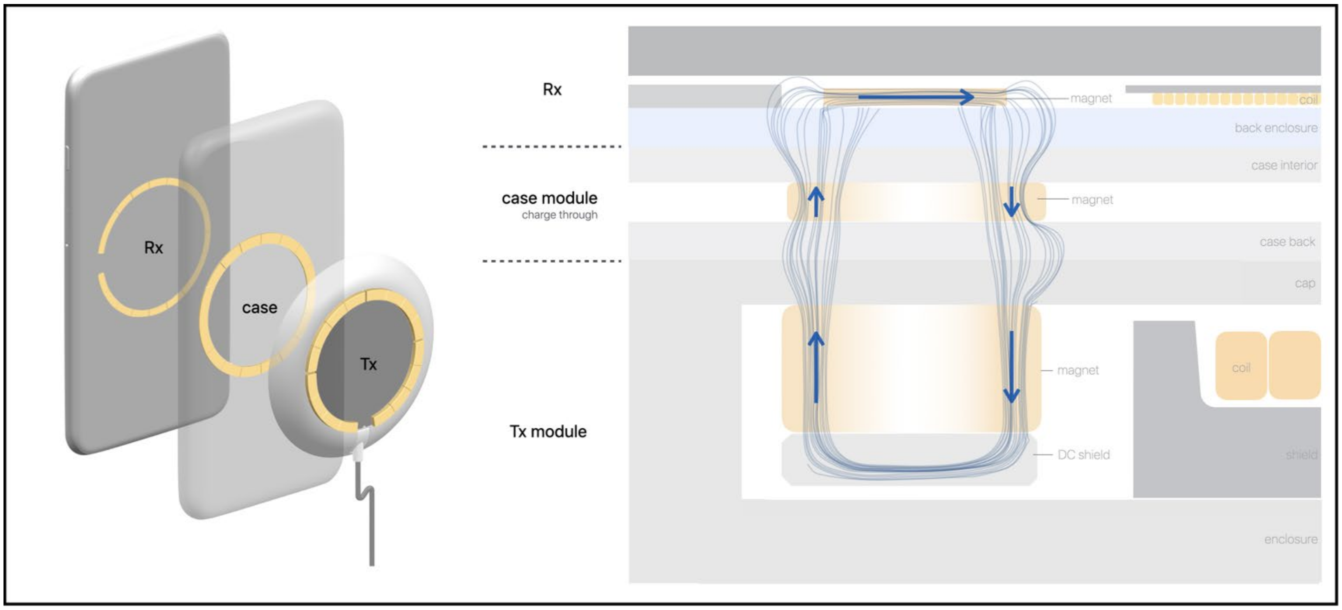
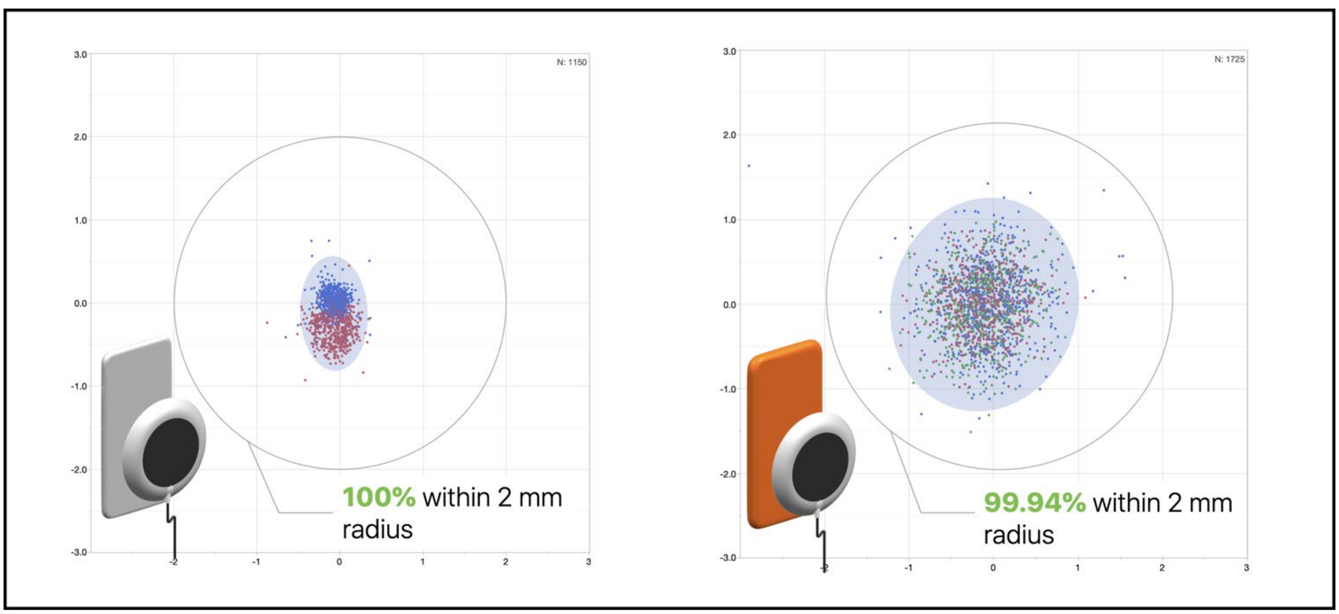


Figure 2.1.3: 2 Accurate magnetic alignment within a 2mm radius (without case and with silicone case).



1.1.4 BPP and MPP interoperability

Backward compatibility with PRx or PTx that do not support MPP is achieved by operating in BPP at up to 5 W:

- MPP PTx support operation as a BPP PTx (i.e., 5 W)
- MPP PRx support operation as a BPP PRx (i.e., up to 5 W)

To support both MPP and BPP, the system uses dynamic re-tuning. Dynamic re-tuning is achieved by switching appropriate capacitors in series with the Primary Coil in the PTx, and the Secondary Coil in the PRx.

Compared to BPP, this requires:

- For PTx: two additional capacitor values and two switches (e.g., MOSFETs)
- For PRx: one additional capacitor value and one switch

The magnet array resolves the problem of magnetic flux density in Shielding materials reaching saturation (associated with the deprecated magnetic alignment feature in Reference Designs A1, A5, A9). See § 4.2 PTx Coil System Model and § 4.3 PRx Coil System Model .

The deprecated magnetic alignment feature is described in Qi v1.2.2 Pt 4, Sec 2 Overview:

"*NOTE Power Receivers that use thin magnetic Shielding have been found to experience reduced performance on Power Transmitters that contain a permanent magnet in or near the Active Area. Such Power Receivers may exhibit, for example, less positioning freedom and/or a longer charging time. For this reason Power Transmitter designs A1, A5, and A9 have been deprecated as of version 1.2 of the Qi Power Class 0 Specification.*"

For BPP PRx that implements Shielding with a low saturation property, the magnet array in an MPP PTx can cause saturation. Such combinations of MPP PTx and BPP PRx can exhibit sub-harmonic oscillation. A solution for this is described in § 8.2 Mitigation of Saturation for BPP .