



BSI Standards Publication

Qi Specification version 2.0

Part 11: MPP System Specification

National foreword

This British Standard is the UK implementation of EN IEC 63563-11:2025. It is identical to IEC 63563-11:2025.

The UK participation in its preparation was entrusted to Technical Committee EPL/100, Audio-visual equipment.

A list of organizations represented on this committee can be obtained on request to its committee manager.

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2025
Published by BSI Standards Limited 2025

ISBN 978 0 539 31157 0

ICS 29.240.99; 35.240.99

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 March 2025.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

English Version

Qi Specification version 2.0 - Part 11: MPP Communications
Protocol
(IEC 63563-11:2025)

Spécification Qi version 2.0 - Partie 11: Protocole de
communications PPM (Profil de puissance magnétique)
(IEC 63563-11:2025)

Qi Spezifikation Version 2.0 - Teil 11: Mpp
Kommunikations-Protokoll
(IEC 63563-11:2025)

This European Standard was approved by CENELEC on 2025-03-17. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 100/4255/FDIS, future edition 1 of IEC 63563-11, prepared by TC 100/Technical Area 15 "Wireless Power Transfer" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 63563-11:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2026-03-31 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2028-03-31 document have to be withdrawn

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 63563-11:2025 was approved by CENELEC as a European Standard without any modification.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

QI SPECIFICATION VERSION 2.0 –
Part 11: MPP System Specification**FOREWORD**

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 63563-11 has been prepared by technical area 15: Wireless Power Transfer, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is an International Standard.

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

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

Draft	Report on voting
100/4255/FDIS	100/4276/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.

This document was 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/publications.

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

- reconfirmed,
- withdrawn, or
- revised.



Qi Specification

MPP Communications Protocol

Version 2.0

April 2023

DISCLAIMER

The information contained herein is believed to be accurate as of the date of publication, but is provided “as is” and may contain errors. The Wireless Power Consortium makes no warranty, express or implied, with respect to this document and its contents, including any warranty of title, ownership, merchantability, or fitness for a particular use or purpose. Neither the Wireless Power Consortium, nor any member of the Wireless Power Consortium will be liable for errors in this document or for any damages, including indirect or consequential, from use of or reliance on the accuracy of this document. For any further explanation of the contents of this document, or in case of any perceived inconsistency or ambiguity of interpretation, contact: info@wirelesspowerconsortium.com.

RELEASE HISTORY

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

Contents

Contents	2
List of Tables	5
1 Introduction	8
1.1 Overview.....	8
2 Magnetic Power Profile	10
2.1 Overview.....	10
2.1.1 Restricted Mode	10
2.1.2 Full Mode.....	10
2.2 Power Receiver Requirements	11
2.2.1 Amplitude Shift Keying (ASK).....	11
2.2.2 Startup Behavior	11
2.2.3 Profile Activation	13
2.3 Power Transmitter Requirements.....	15
2.3.1 Frequency Shift Keying (FSK)	15
2.3.2 Timings Override	16
2.3.3 Startup Behavior	16
2.4 Supporting EPP and MPP protocols	19
2.4.1 MPP/EPP Support on PRx.....	19
2.4.2 MPP/EPP Support on PTx.....	20
3 Negotiation Phase	21
3.1 Overview.....	21
3.2 Requirements.....	21
3.2.1 Negotiation Phase Timings.....	22
3.2.2 FSK Cycles.....	22
3.2.3 Entering Negotiation Phase With Error Status	22
3.2.4 Power Transfer Contract Extension	23
3.3 Negotiation Phase - 128kHz.....	24
3.3.1 Nominal negotiation flow	24
3.3.2 Negotiation flow with PTx error status.....	26
3.3.3 Frequency Selection	27
3.4 Negotiation Phase - 360kHz.....	27
3.4.1 PRx Extended Capabilities.....	30
3.4.2 PTx Extended Capabilities.....	30
3.4.3 Exchange Power Loss Accounting Parameters	30

3.4.4	Power Negotiation.....	30
3.4.5	Retrieve PTx Extended ID.....	30
3.4.6	Exchange Enabled Data Streams.....	30
3.4.7	Power Control Profile	30
3.4.8	Cloaking Duration.....	30
3.4.9	MPP Proprietary Requests / Packets.....	31
3.5	NFC Identification (Informative)	32
4	Power Transfer Phase	33
4.1	Overview.....	33
4.2	Extended Control Error Packet.....	33
4.2.1	Handling.....	33
4.2.2	PTx Response	34
4.2.3	Example	34
4.3	Power Loss Accounting Packet	36
4.3.1	Handling.....	36
4.3.2	PTx Response	37
4.4	Control Status	37
4.5	GET Request	37
4.5.1	PRx Initiated.....	37
4.5.2	PTx Initiated	38
4.5.3	Examples.....	38
4.6	MPP-Restricted to Full mode Transition.....	39
4.6.1	Transition with power interruption	40
4.6.2	Transition without power interruption.....	40
5	Cloak Phase	43
5.1	Overview.....	43
5.2	Cloak Ping Requirements.....	43
5.3	Cloak Entry	43
5.3.1	PRx Initiated.....	44
5.3.2	PTx Initiated	44
5.4	Cloak Exit	45
5.5	Detect ping.....	46
5.6	State Diagram	46
5.7	Cloak Timings	49
5.8	Examples.....	50
6	Extended Data Streams	56
6.1	Overview.....	56
6.2	Simultaneous Data Stream Extension	56
6.2.1	Error Handling	57
6.2.2	Timings.....	57
6.2.3	Cloaking Compatibility	57
6.3	Data Integrity Extension	58
6.4	Examples.....	58
7	Packets and Streams	67
7.1	Power Receiver data packets	67
7.1.1	Cloak - CLOAK (0x18)	69
7.1.2	Extended Control Error - XCE (0x19)	70
7.1.3	Specific Request - SRQ (0x20).....	71

7.1.4	Specific Request [Frequency Selection] - SRQ/freqsel (0x20)	75
7.1.5	Specific Request [Power Level] - SRQ/egpl (0x20)	76
7.1.6	Specific Request [Cloak Ping Delay - Low Byte] - SRQ/cloakl (0x20)	77
7.1.7	Specific Request [Cloak Ping Delay - High Byte] - SRQ/cloakh (0x20)	78
7.1.8	Specific Request [Power Control Profile] - SRQ/pcp (0x20)	79
7.1.9	Specific Request [Cloak Detect Ping Delay] - SRQ/detect (0x20)	80
7.1.10	Specific Request [Proprietary Parameters] - SRQ/MppProp (0x20)	81
7.1.11	Get Request - GET (0x28)	82
7.1.12	Enabled Data Streams - EDS (0x29)	83
7.1.13	Simultaneous Auxiliary Data Transport - SADT (multiple header codes)	84
7.1.14	Simultaneous Data Stream Response - SDSR (0x38)	85
7.1.15	Simultaneous Auxiliary Data Control - SADC (0x48)	86
7.1.16	Report - REPORT (0x58:0)	87
7.1.17	Report [PRx Identification] (0x58:0)	88
7.1.18	Power Loss Accounting (0x58:1)	89
7.1.19	Power Loss Accounting Parameters - PLAP (0x78)	90
7.1.20	Qi MPP Extended Identification - MPP-XID (0x81)	91
7.1.21	Extended Power Receiver Capabilities - ECAP (0x84)	92
7.2	Power Transmitter data packets	93
7.2.1	Error Status - ERR (0x01)	94
7.2.2	Cloak Request - CLOAK (0x1E:0)	95
7.2.3	Regulation Control Status - RCS (0x1E:3)	96
7.2.4	Charge Status - CHS (0x1F)	97
7.2.5	Get Request - GET (0x2E)	98
7.2.6	Enabled Data Streams - EDS (0x2F)	99
7.2.7	Inverter Voltage - INV (0x3F:0)	100
7.2.8	Simultaneous Auxiliary Data Transport - SADT (multiple header codes)	101
7.2.9	Simultaneous Data Stream Response - SDSR (0x3F:1)	102
7.2.10	Estimated K - KEST (0x3F:2)	103
7.2.11	Simultaneous Auxiliary Data Control - SADC (0x4F)	104
7.2.12	Power Loss Accounting Parameters - PLAP (0x5F)	105
7.2.13	Extended Power Transmitter Identification - XID (0x8F:0)	106
7.2.14	Extended Power Transmitter Extended Capabilities - ECAP (0x8F:1)	107

List of Tables

1.1	MPP Specifications Departure from Qi EPP.....	8
2.1	MPP ID Packet Parameters.....	11
2.2	MPP FSK Parameters.....	14
2.3	MPP FSK Patterns.....	14
2.4	MPP PTx Parameters Override	15
3.1	PRx packets allowed during MPP negotiation phase.....	20
3.2	MPP Negotiation Phase Timing Parameters.....	21
3.3	MPP Power Transfer Contract Elements	23
4.1	MPP Control Error Parameters.....	33
4.2	Power Loss Accounting Timing Parameters.....	35
4.3	PTx Initiated GET Timing Parameters.....	37
4.4	MPP Restricted to Full Transition Timing Parameters.....	39
5.1	Cloak Detect Parameters	45
5.2	Cloak Time Parameters	48
6.1	Data Streams Identifiers	55
6.2	Extended Data Streams Timing	56
6.3	Data Stream CRC Properties.....	57
7.1	MPP PRx ASK Packets.....	68
7.2	PRx End Of Power Reason Codes	69
7.3	End Of Power Request FSK Responses.....	69
7.4	Extended Control Error FSK Responses.....	70
7.5	MPP Specific Requests.....	71
7.6	Specific Request Frequency Selection parameters	72
7.7	Frequency Selection Request FSK Responses	72
7.8	Power Level Selection Request FSK Responses	73
7.9	Cloak Ping Delay Selection Request SRQ/cloakl - FSK Responses	74
7.10	Cloak Ping Delay Selection Request SRQ/cloakh - FSK Responses	75
7.11	Power Control Profile Values	76
7.12	Power Control Profile Selection Request FSK Responses.....	76
7.13	Cloak Detect Ping Delay Selection Request FSK Responses	77
7.14	Proprietary Specific Parameters Request FSK Responses.....	78
7.15	PRx Get Request Types	79
7.16	Simultaneous Auxiliary Data Transport - SADT FSK Responses	81

7.17 PRx Simultaneous Data Stream Response Type.....	82
7.18 Simultaneous Auxiliary Data Control Request Field.....	83
7.19 Simultaneous Auxiliary Data Control Parameter Field	83
7.20 Report ID Field.....	84
7.21 Report [PRx Identification] FSK Responses	85
7.22 PLA FSK Responses.....	86
7.23 Received Power Parameters FSK Responses.....	87
7.24 PRx Capabilities Packet FSK Responses.....	89
7.25 MPP PTX FSK Packets	90
7.26 PTx Error Status Codes.....	91
7.27 PTx End Of Power Reason Codes.....	92
7.28 PTx Regulation Control Status Values.....	93
7.29 PTx Charge Status Values.....	94
7.30 PTx Get Request Fields.....	95
7.31 PTx Simultaneous Data Stream Response Type	99
7.32 PTx Power Limit Reason Code	104

Introduction

1

1.1 Overview

Magnetic power profile (MPP) is a protocol extension that provides additional messages, new power states/modes, new power transfer contract elements, and aims to provide the following functionalities:

- Operating Frequency Negotiation
- Cloaking (Power Pause)
- Generic Information Exchange
- Simultaneous Data Stream Transactions
- Fast PTx to PRx communication
- Maximum Power and Power Control Profiles Determination
- Extended Power Negotiation
- Extended PTx/PRx Identification and Capabilities
- Extended Control Error Packets and Received Power Packets
- Power Transmitter Battery Level Reporting
- Ecosystem Scalability

A summary of differences between Magnetic Power Profile and EPP is listed below in Table 1.1.

MPP extension allows devices to operate under Restricted mode (no PTx communication) at 360kHz without performing any explicit negotiation with the Power Transmitter. This flexibility enables devices with limited resources (e.g., devices with no FSK support) to take advantage of the frequency change feature.

Table 1.1: MPP Specifications Departure from Qi EPP

Feature	EPP	MPP
PTx Handshake Message	EPP FSK ACK Message	MPP FSK ACK Message (Section 2.3.1)
FSK Parameters Negotiation	EPP allows FSK parameters negotiation	Fixed FSK parameters
Data Streams	Single Stream Transfer	Multiple Concurrent Transfer
Foreign Object Detection	FOD Packet, Calibration, RP	Replaced with MPP Power Loss Accounting Packet

Magnetic Power Profile

2

2.1 Overview

This chapter describes the Power Receiver and Power Transmitter requirements for Magnetic Power Profile and the modes devices may use to communicate.

MPP supports two protocol modes:

1. **Restricted Mode:** One-way communication (PRx to PTx) with limited power levels (*5W PRECT*) using Qi Baseline Protocol
2. **Full Mode:** Supports bi-directional communication and enables negotiation of higher power levels

2.1.1 Restricted Mode

MPP Restricted mode allows PRx to establish a charging session with PTx using one-way communication (PRx to PTx) at 360kHz operating frequency using Qi Baseline Protocol.

PTx and PRx shall follow the Qi Baseline Protocol specifications when operating in Restricted mode.

(Informative)

MPP Restricted mode can be used when PRx is operating under a constrained environment e.g., device is fully discharged

PRx is allowed to transition from MPP Restricted to MPP Full mode to enable bi-directional communication and higher power levels. Refer to Section 4.6 for more details on how to perform the transition.

2.1.2 Full Mode

MPP Full mode enables a charging session with bi-directional communication between PTx and PRx allowing devices to perform more complex operations such as exchange of identification information, devices capabilities, ecosystem scalability coefficients, power negotiation and perform authentication.

In MPP Full mode, devices may transition between different protocol phases such as Negotiation, Power Transfer, Cloak and are able to negotiate higher power levels compared to Restricted mode.

MPP Full mode is based on Qi Extended Power Profile (EPP) protocol. PTx and PRx shall follow the Qi EPP specifications when operating in this mode. Changes to the EPP specifications are explicitly stated in this document.

Changes to specifications include:

1. Added MPP Power Transfer Contract Elements and removed support for EPP RP (Received Power) contract elements
2. Added MPP data packets and removed support for EPP FOD data packets
3. Overriding time parameters

2.2 Power Receiver Requirements

MPP ASK specification is based on Qi EPP, all the timing requirements/specifications specified by Extended Power Profile apply to MPP.

All standard Qi packets used in MPP follow the Qi specifications. Changes to the handling or the definition of the packets are explicitly stated in this document.

2.2.1 Amplitude Shift Keying (ASK)

MPP follows the Qi ASK specifications.

2.2.2 Startup Behavior

An MPP-compatible Power Receiver shall start by sending the following sequence of packets during the ping/configuration phase.

1. Signal Strength (SIG)
2. Identification (ID)
3. Extended Identification (XID)
4. Power Control Hold-Off (PCH) - *Optional*
5. Configuration Packet (CFG)

The packets shall contain the MPP identifiers as described in this section to allow an MPP-compatible Power Transmitter to identify the Power Receiver.



Figure 2.1: MPP ID/CFG Phase Packets

Signal Strength (SIG)

Power Receiver shall report the Signal Strength (SIG) data packet following the Qi specifications.

Identification (ID)

Power Receiver shall report the Identification Packet (ID) with the following parameters as shown in Figure 2.2 and Table 2.1.

	b7	b6	b5	b4	b3	b2	b1	b0
B0	Major				Minor			
B1	PRMC							
B2								
B3	Ext	Random Identifier						
B4								
B5								
B6	Mfg Rsvd							

Figure 2.2: MPP ID Packet Structure**Table 2.1:** MPP ID Packet Parameters

Field	Value
Major Version	2
Minor Version	0
Manufacturer Code (PRMC)	Assigned PRMC code
Ext	1
Random Identifier	Follows Random Device Identifier Policy
Mfg Reserved	Reserved for Manufacturer's use (Proprietary)

Refer to Qi Communications Protocol section 8.11 for more information on Random Device Identifier policy

Extended Identification (XID)

Power Receiver shall report the MPP-Extended Identification Packet (XID) to advertise MPP support. Detailed packet definition is described in section 7.1.20.

	b7	b6	b5	b4	b3	b2	b1	b0				
B0	0xFE											
B1	Restricted	Mfg Rsvd										
B2	Mfg Rsvd											
B3	VRECT											
B4	Alpha0 Rx											
B5	Alpha1 Rx											
B6	Alpha-Kth Rx											
B7	Mfg Rsvd											

Figure 2.3: MPP XID Packet Parameters

Power receiver may choose to advertise MPP-compatibility and operate under MPP restricted mode by setting the Restricted bit as described in Section 7.1.20. Otherwise, the Power Receiver may request to operate under MPP Full mode by setting the Restricted bit to zero.

Power Receiver may choose to not advertise MPP capabilities by performing one of the following:

1. Setting the (XID Sub Header) field to any value other than 0xFE
2. Skipping XID packet, and setting Ext bit to 0 in ID packet

Power Control Hold-Off (PCH) - Optional

Power receiver may choose to operate in Restricted mode and later switch to MPP full mode. This transition requires the Power Receiver to report PCH packet during the configuration phase.

Refer to Section 4.6 for more details on value selection.

Configuration (CFG)

Power Receiver shall report the Configuration (CFG) packet according to the Qi specifications.

2.2.3 Profile Activation

Depending on the selected operating mode in XID packet (Section 2.2.2), Power Receiver shall proceed as follows:

1. **MPP - Restricted:** PRx shall proceed to Restricted Power Transfer Phase at 360kHz (Follows Qi Baseline Protocol)
2. **MPP - Full:** PRx shall enable the FSK decoder, depending on the decoding result:
 - a) FSK MPP Pattern: PRx shall proceed to MPP Negotiation Phase (Section 3)
 - b) FSK NAK Pattern: PRx shall proceed to MPP Negotiation Phase with MPP error status (Section 3)
 - c) Timeout / Else: PRx shall proceed according to the Qi specifications (*BPP/EPP*)

1. FSK pattern response to Configuration (CFG) packets is always transmitted using the default 512 switching cycles.
2. Refer to MPP System Specifications - Communications Physical Layer: FSK (Section 6.2) for more information on FSK parameters.

Figure 2.4 summarizes the flow.

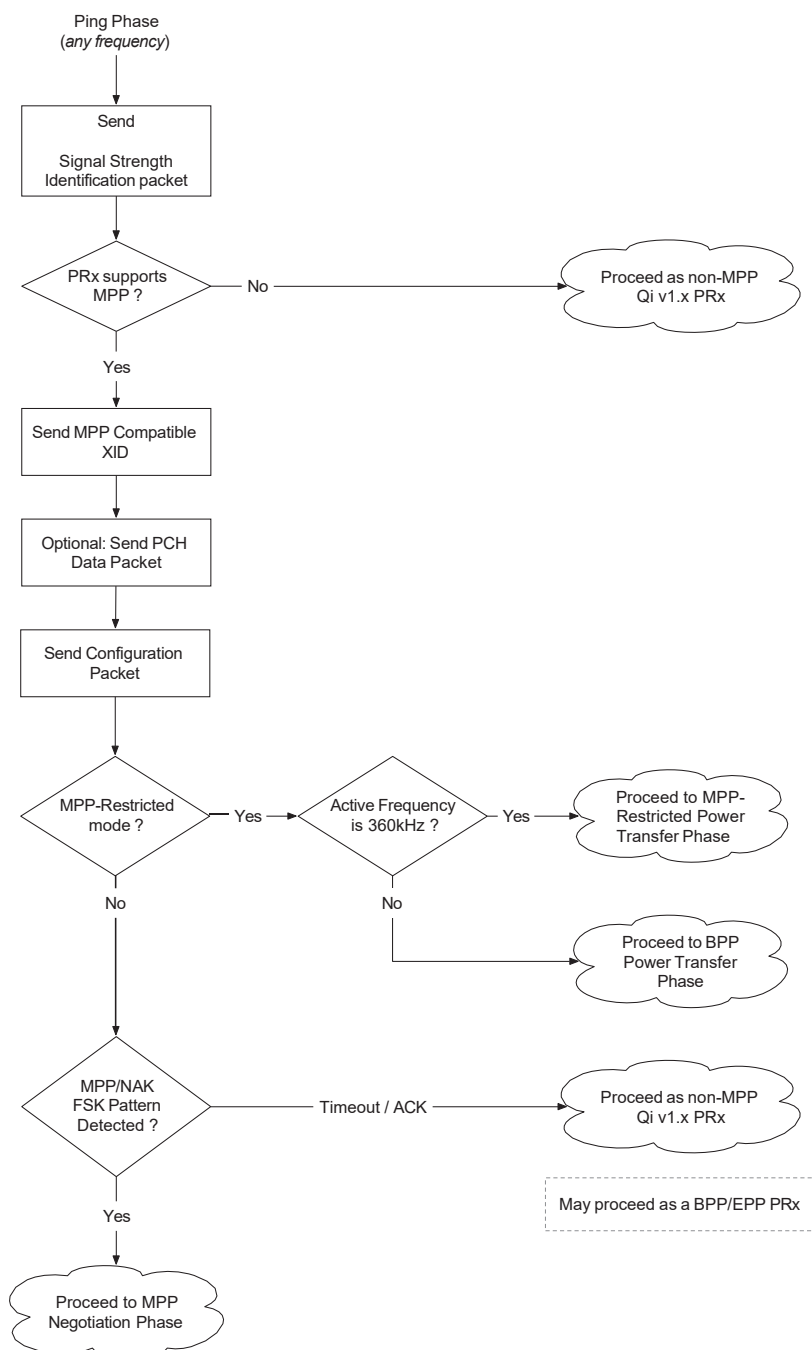


Figure 2.4: MPP Power Receiver Configuration Phase Decision Tree

2.3 Power Transmitter Requirements

MPP FSK specification is based on Qi EPP, all the timing requirements/specifications specified by Extended Power Profile apply to MPP. Updated parameters are explicitly stated in this document.

2.3.1 Frequency Shift Keying (FSK)

Magnetic Power Profile v1.x defines fixed FSK parameters:

Table 2.2: MPP FSK Parameters

Parameter	Value	Notes
Switching Cycles	512 / 128	FSK 512 switching cycles is only used when PTx responds to CFG packet (Section 2.2.3) Otherwise, PTx shall use 128 switching cycles
Preamble	4-bits (1111)	Applies to FSK Packets only (Patterns are excluded)

MPP uses predefined FSK parameters as specified in MPP System Specifications - Communications Physical Layer: FSK (Section 6.2)

Packet Format

MPP FSK Packet structure is shown in Figure 2.5.



Figure 2.5: MPP FSK Packet Structure

FSK Pattern

MPP extends Qi EPP FSK pattern responses with MPP Pattern (Table 2.3, Figure 2.6).

Table 2.3: MPP FSK Patterns

Response	Pattern b0..b7	Notes
ACK	1111 1111	
NAK	0000 0000	
ND	1010 1010	
ATN	1100 1100	
MPP	1000 1000	MPP Pattern
APP	1111 0000	Reserved proprietary pattern (Note)

Note on APP pattern:

The proprietary precursor implementation to MPP uses this pattern. To prevent interoperability problems, use of this pattern is reserved.

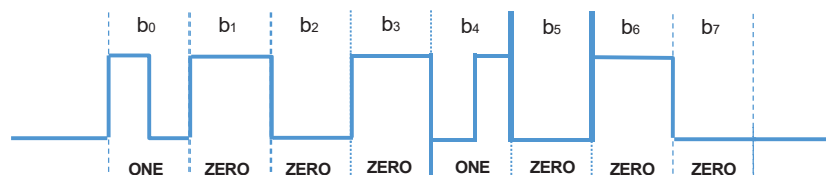


Figure 2.6: MPP FSK Pattern Format

2.3.2 Timings Override

FSK Response Window

Due to the addition of preamble to the FSK packets, the start of the FSK packet now points to the start of preamble of the FSK packet as shown in Figure 2.7.

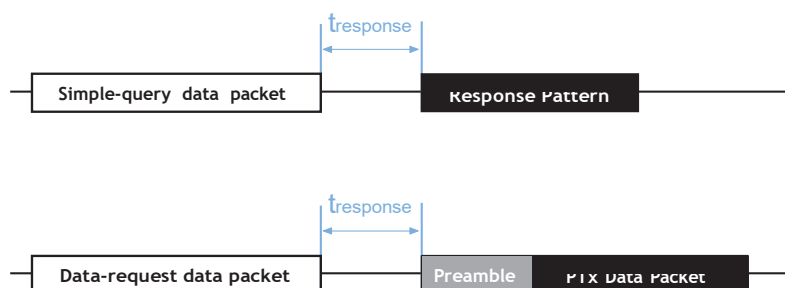


Figure 2.7: MPP FSK Response Timing

No Power Signal Window

Time duration between two consecutive pings (t_{nopower}) has been updated. Refer to table 2.4.

Table 2.4: MPP PTx Parameters Override

Parameter	Symbol	Minimum	Target	Maximum	Unit
No Power Signal window	t_{nopower}	50	N/A	N/A	ms

2.3.3 Startup Behavior

After detecting PRx placement on the charging surface, MPP PTx shall perform digital ping and identify the Power Receiver using the information embedded in ID and XID packets as described in Section 2.2.2.

From the PTx's perspective, a PRx supports MPP if both of the following conditions are satisfied:

1. **Qi Version:** Qi protocol version in ID packet (Section 2.2.2) is set to (Major=2, Minor=0) or higher.
2. **MPP Support Advertised:** Sub-header (byte 0) in XID packet is set to MPP selector (Section 7.1.20)

If the conditions are not satisfied, the Power Transmitter shall proceed to the next phase according to the Qi specifications.

Depending on the digital ping level used to establish the communication at 128kHz frequency, PTx shall set an internal error status as following:

- **Error = None:** Communication at 128kHz was established using 'Qi_HB_Low' digital ping level
- **Error = digital ping level mismatch:** Otherwise

PTx shall then proceed to the requested MPP operation mode reported in MPP-XID packet as following:

- Activate Restricted Mode: If Restricted flag is set to one.
- Activate Full mode: If Restricted flag is set to zero.

PTx shall clear the error status if it decides to remove the power signal for any reason i.e., error status shall not persist across communication restarts.

MPP Restricted Mode

PRx may choose to operate under MPP- Restricted Power Mode by setting the Restricted field in MPP-XID packet to 1.

PTx shall decode the MPP-XID packet and proceed as following:

- **If active frequency is 360kHz:** Proceed assuming MPP Restricted mode
- **Else:** Proceed depending on the error status

If the error status is not set, PTx shall remove Power Signal and start digital ping using 360kHz as operating frequency after $t_{nopower}$. Otherwise, PTx shall remove the power signal and perform digital ping again using 128 kHz and 'Qi_HB_Low' digital ping level.

Figure 2.8 describes the frequency change behavior under Restricted mode.

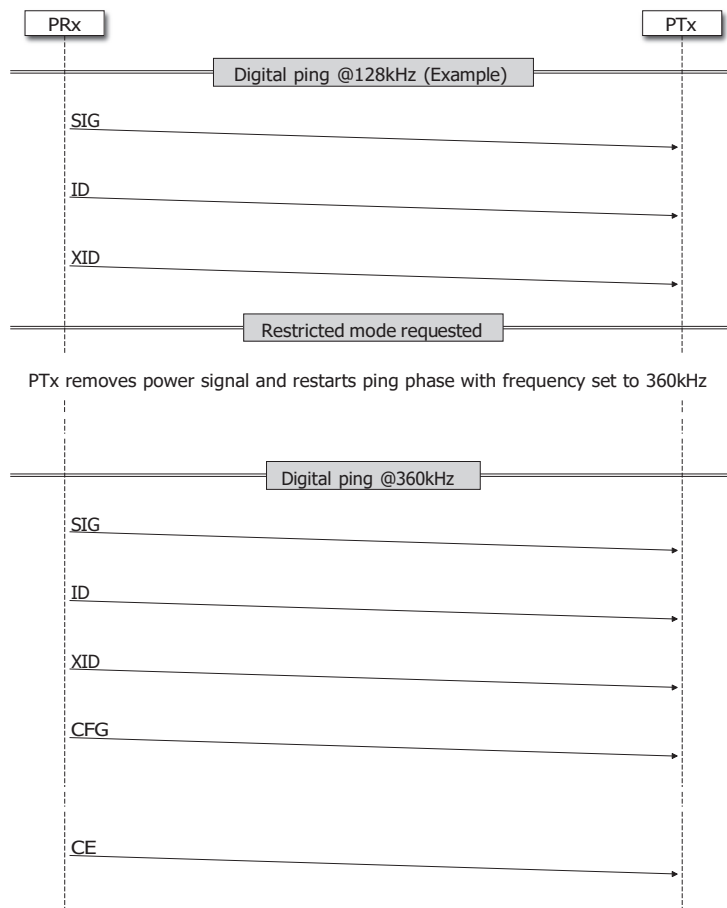


Figure 2.8: MPP Restricted Frequency Change Sequence

MPP Full Mode

PTx shall continue processing all packets in configuration phase and respond to the Configuration (CFG) packet as following:

- FSK MPP Pattern: error status is not set
- FSK NAK Pattern: error status is set

PTx shall generate the FSK response using 512 switching cycles. After responding with FSK, PTx shall proceed to MPP negotiation phase as described above.

FSK patterns are described in Table 2.3

Figures below summarize the 128kHz and 360kHz digital pings behavior for both Restricted and Full modes.

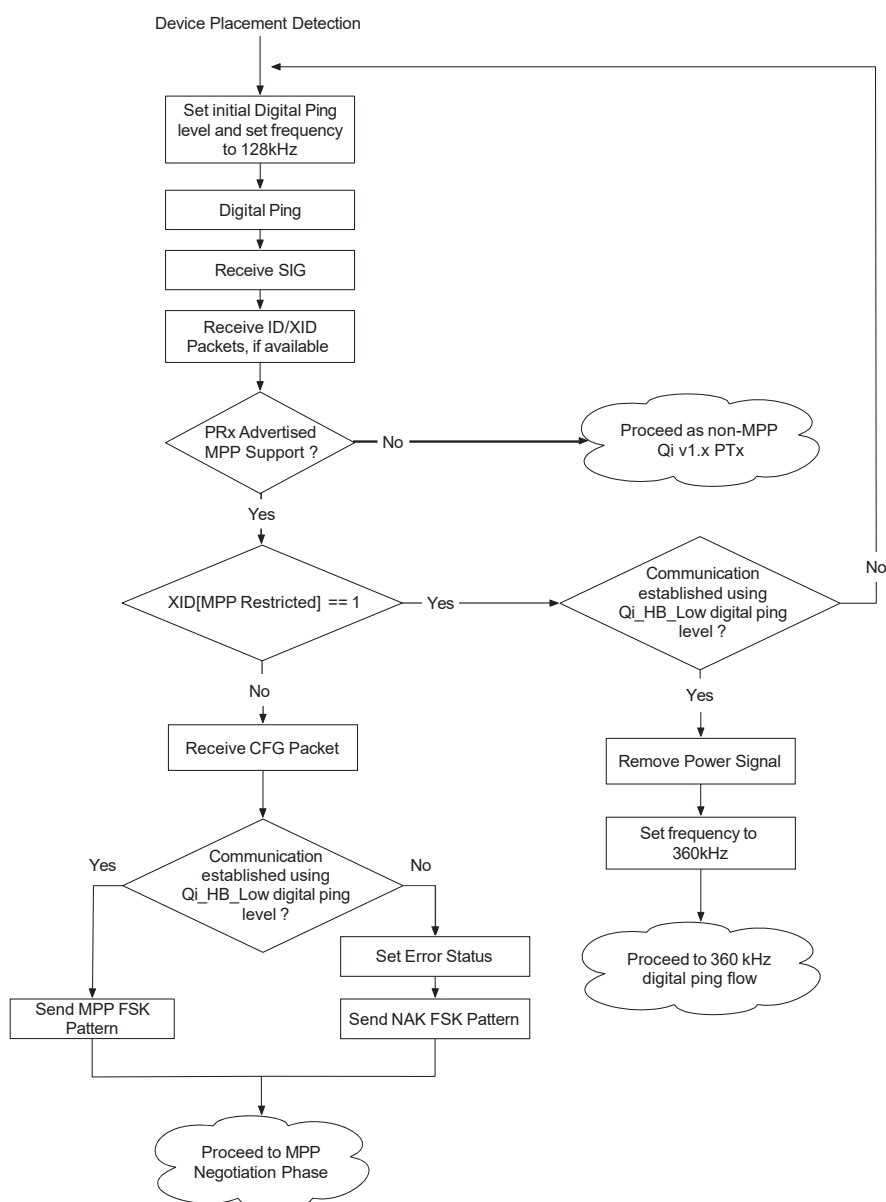


Figure 2.9: MPP Power Transmitter Configuration Phase Decision Tree Flow - 128kHz ping

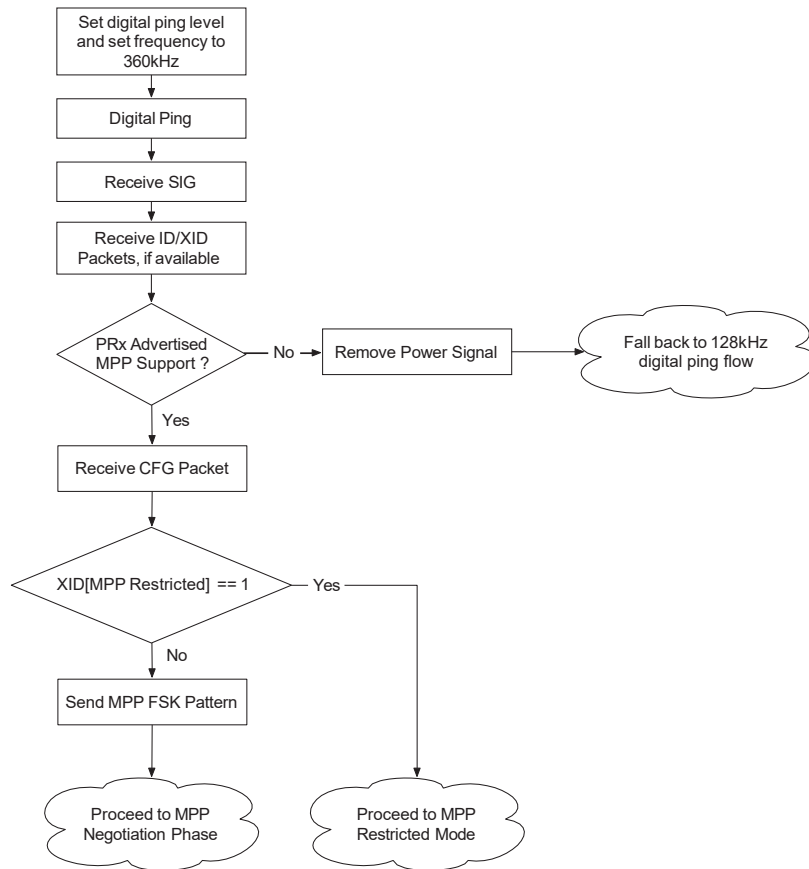


Figure 2.10: MPP Power Transmitter Configuration Phase Decision Tree Flow - 360kHz ping

2.4 Supporting EPP and MPP protocols

Devices may choose to support multiple power profiles / protocols e.g., PRx/PTx may support EPP in addition to MPP. This section discusses how these devices behave when attached to another device that supports EPP, MPP or both.

2.4.1 MPP/EPP Support on PRx

PRx may choose to advertise MPP and EPP support by performing the following:

- MPP Support: Described in section 2.2.2
- EPP Support: Follow the Qi communications protocol specifications

PRx will send the MPP-XID packet to the Power Transmitter, and also properly set the configuration packet to advertise EPP support (e.g. FSK parameters, NEG bit set to 1, etc.).

After sending the CFG data packet, PRx will have to attempt to decode FSK, PRx will proceed depending on the decoding result:

- MPP Supported Patterns received (MPP, NAK): PTx supports MPP, PRx shall proceed using MPP protocol
- ACK Pattern received: PTx supports EPP, PRx shall proceed using EPP protocol
- Timeout: PRx shall proceed using BPP protocol

2.4.2 MPP/EPP Support on PTx

Depending on the data provided by PRx during configuration phase, the PTx will be able to determine which power profile is supported by the PRx.

- MPP Support advertised: PRx advertises MPP support as described in section 2.2.2
- EPP Support advertised: PRx advertises EPP support as described in Qi communications protocol book (e.g., NEG bit is set in CFG packet)

PTx may detect a PRx that supports one or more profiles, PTx shall proceed as following:

- PRx supports MPP and EPP: PTx shall always prioritize MPP protocol by responding with a supported FSK pattern (MPP, NAK) to CFG packet as described in Section 2.3.3
- PRx supports EPP: PTx shall proceed with EPP protocol by responding with ACK pattern to CFG packet as described in Qi communications book

PTx uses fixed FSK parameters when engaged in MPP session. If PTx decides to engage in EPP session, PTx shall use the FSK parameters as described in CFG data packet

Negotiation Phase

3

3.1 Overview

MPP Negotiation phase is based on Qi EPP specifications i.e., EPP timing specifications, packets, and rules apply to MPP negotiation phase. Any changes to the specifications are explicitly stated.

Note on EPP compatibility

MPP does not support **FOD** packet or FOD calibration phase.

3.2 Requirements

After Configuration phase, PRx and PTx shall proceed to negotiation phase if the PRx requested to enable MPP full operating mode.

In this phase, PRx shall only use packets that are allowed to be used in negotiation phase by Qi EPP specifications and MPP specifications (Table 3.1)

If PTx detects a power transfer phase packet e.g. CE packet before completing the MPP negotiation, it shall remove the power signal, and proceed to Ping Phase. Receiving a CE packet after entering MPP negotiation phase indicates that PRx was unable to decode MPP FSK pattern correctly. Removing the power signal allows the PTx to retry activating MPP.

Table 3.1: PRx packets allowed during MPP negotiation phase

Mnemonic	Name	Section
-	Qi negotiation phase packets	
SRQ	Specific Requests	
GET	Get request	7.1.11
EDS	Enabled Data Streams	7.1.12
REPORT	Report	7.1.16
PLAP	Power Loss Accounting Parameters	7.1.19
ECAP	Extended Received Capabilities	7.1.21
PROPn	MPP PRx Proprietary Packets	7.1

PRx negotiation behavior may differ based on the active operating frequency e.g., PRx may perform PTx identification and Frequency Selection at 128kHz negotiation phase, and perform power negotiation after switching to 360kHz base frequency (in MPP negotiation phase).

3.2.1 Negotiation Phase Timings

MPP negotiation phase timings follow the EPP timings as described in Qi communications protocol book with the addition of the following timings parameters:

Table 3.2: MPP Negotiation Phase Timing Parameters

Parameter	Side	Symbol	Minimum	Target	Maximum	Unit
Re-negotiation Timeout	PTx	$t_{\text{renegotiate}}$	700	800	900	ms

$t_{\text{renegotiate}}$ only applies to renegotiation phase. Timing diagram is shown in Figure 3.1.

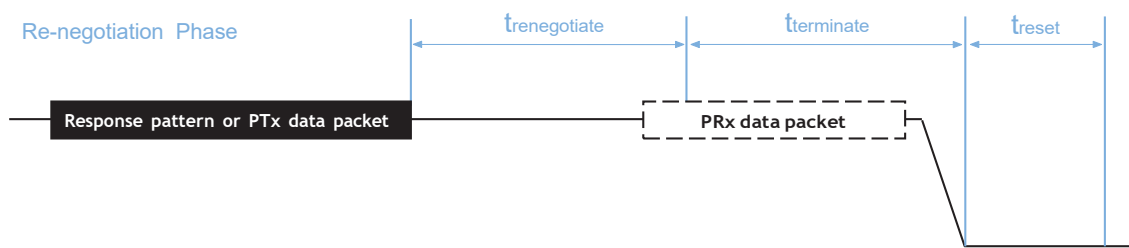


Figure 3.1: Negotiation Phase Timing Parameters - $t_{\text{renegotiate}}$

3.2.2 FSK Cycles

PRx and PTx shall update FSK switching cycles to 128 cycles, immediately upon entering MPP negotiation phase.

PRx and PTx shall set FSK cycles to 512 after entering ping phase (e.g., after disconnect).

3.2.3 Entering Negotiation Phase With Error Status

In some scenarios, PTx may decide not to proceed with MPP-Full mode. Reason could be due to the ping configuration used to estimate-k (e.g., digital ping level is not 'Qi_HB_Low'). PTx shall let the PRx know by responding with FSK NAK pattern to CFG data packet as described in Section 2.2.3. After receiving NAK pattern, PRx shall enter negotiation phase with error status.

In negotiation phase, PRx may optionally retrieve any information such as the error status data packet from PTx using *GET [Error Status]*. PTx shall respond with ERR data packet 7.2.1.

When ready, PRx shall request communication restart using *EPT/rst* instead of sending *SRQ/en* to avoid entering Power Transfer Phase.

PTx shall not allow PRx to enter power transfer phase and shall respond to *SRQ/en* with *NAK*.

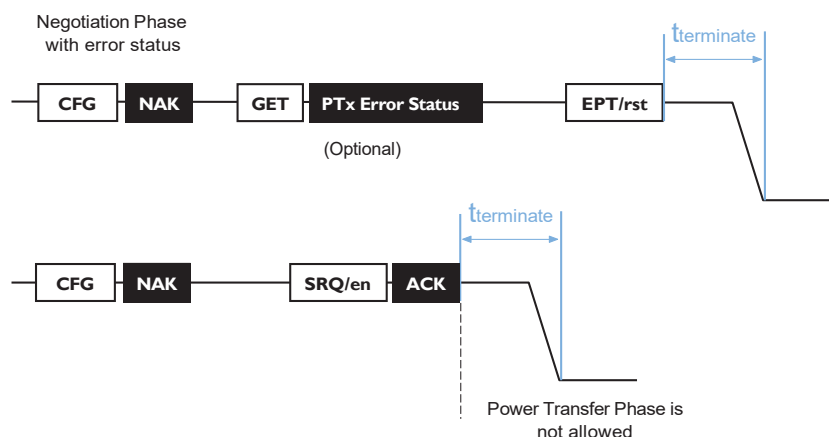


Figure 3.2: Negotiation with error status

3.2.4 Power Transfer Contract Extension

MPP uses Qi EPP power transfer contract elements as a baseline and adds / removes elements as described in this section.

Not supported elements:

1. *Received Power window size*: This element is non-negotiable in this version of the specification. Refer to MPP System Specifications - MPLA PRx Specifications Section 7.3.2.1 for more information.
2. *Received Power window offset*: This element is non-negotiable in this version of the specification. Refer to MPP System Specifications - MPLA PRx Specifications Section 7.3.2.1 for more information.
3. *Reference Power*: This element is non-negotiable and not used in this version of the specification.
4. *Received Power Resolution*: This element is non-negotiable in this version of the specification and it is automatically set to PLA header (0x58). Refer to Qi Communication Protocols Section 6.1 for more information.
5. *FSK Polarity and Modulation depth*: This element is non-negotiable in this version of the specification.
6. *Guaranteed Power*: Replaced by *Extended Guaranteed Power* element, PRx/PTx shall not use this version of the element.
7. *FSK Switching Cycles*: Specifies the number of switching cycles per FSK bit. This element is non-negotiable in this version of the specification.

Supported elements:

1. *Power Control Hold-off*: Refer to Qi Communication Protocols for more information.
2. *Re-ping delay*: Refer to Qi Communication Protocols Section 6.1 for more information.
3. *Potential Load Power*: Refer to Qi Communication Protocols Section 6.1 for more information.
4. *Extended Guaranteed Power*: Allows PRx to negotiate the guaranteed power value in 100mW resolution. This element replaces the Qi Guaranteed Power transfer contract element.
5. *Frequency Selection*: Allows PRx to negotiate a different operating frequency (e.g., negotiate 360kHz when operating at 128kHz)

6. *Cloak Ping Delay*: PRx can request a temporary interruption of power (*cloak*). This element allows PRx to negotiate the delay between cloak pings.
7. *Cloak Detect Ping Delay*: Allows PRx to negotiate the time delay between subsequent short cloak detect pings.
8. *Power Control Profile*: Allows PRx to select a specific power control profile depending on coupling and other parameters (Refer to MPP System Specifications - Section 5.8.2.2.4).

Default values for the new elements added by MPP are described in Table 3.3.

Refer to Qi Communication Protocols Section 6.1 for more information on the default values of Qi power contract elements

Table 3.3: MPP Power Transfer Contract Elements

Element	Symbol	Unit	Negotiable	Default Value	Details
Frequency Selection	N/A	Hz	Yes	Active frequency	Section 7.1.4
Extended Negotiated Power	N/A	W	Yes	5W	Sections 7.1.5
Cloak Ping Delay	t_{cloak}	ms	Yes	500 ms	Sections 7.1.6, 7.1.7
Cloak Detect Ping Delay	$t_{\text{cloakdetect}}$	ms	Yes	0 ms (disabled)	Section 7.1.9
Power Control Profile	N/A	N/A	Yes	0	Section 7.1.8

3.3 Negotiation Phase - 128kHz

3.3.1 Nominal negotiation flow

PRx shall use the 128kHz negotiation phase to select the 360kHz operating frequency using SRQ/freqsel as described in section 3.3.3).

In addition to frequency selection, PRx may perform the following actions before exiting the negotiation phase.

1. **Request PTx ID**: Retrieve Qi protocol version and manufacturer code using GRQ data packet (*Refer to Qi Communications Protocol for more information*)
2. **Request Extended PTx ID**: Retrieve MPP PTx Extended ID using *GET [PTx ID]* Request (Section 7.1.11)
3. **Extend re-ping duration**: Extend the time delay before the next 360kHz ping when PRx sends EPT/rep.

It is recommended to perform power related negotiation at the preferred operating frequency i.e. at 360kHz instead of 128kHz, to avoid losing the negotiated contract elements due to power signal removal caused by operating frequency changes.

After completing the transactions, PRx shall terminate the negotiation using SRQ/en and then send EPT/rep to start the frequency change flow as shown in Figure 3.3.

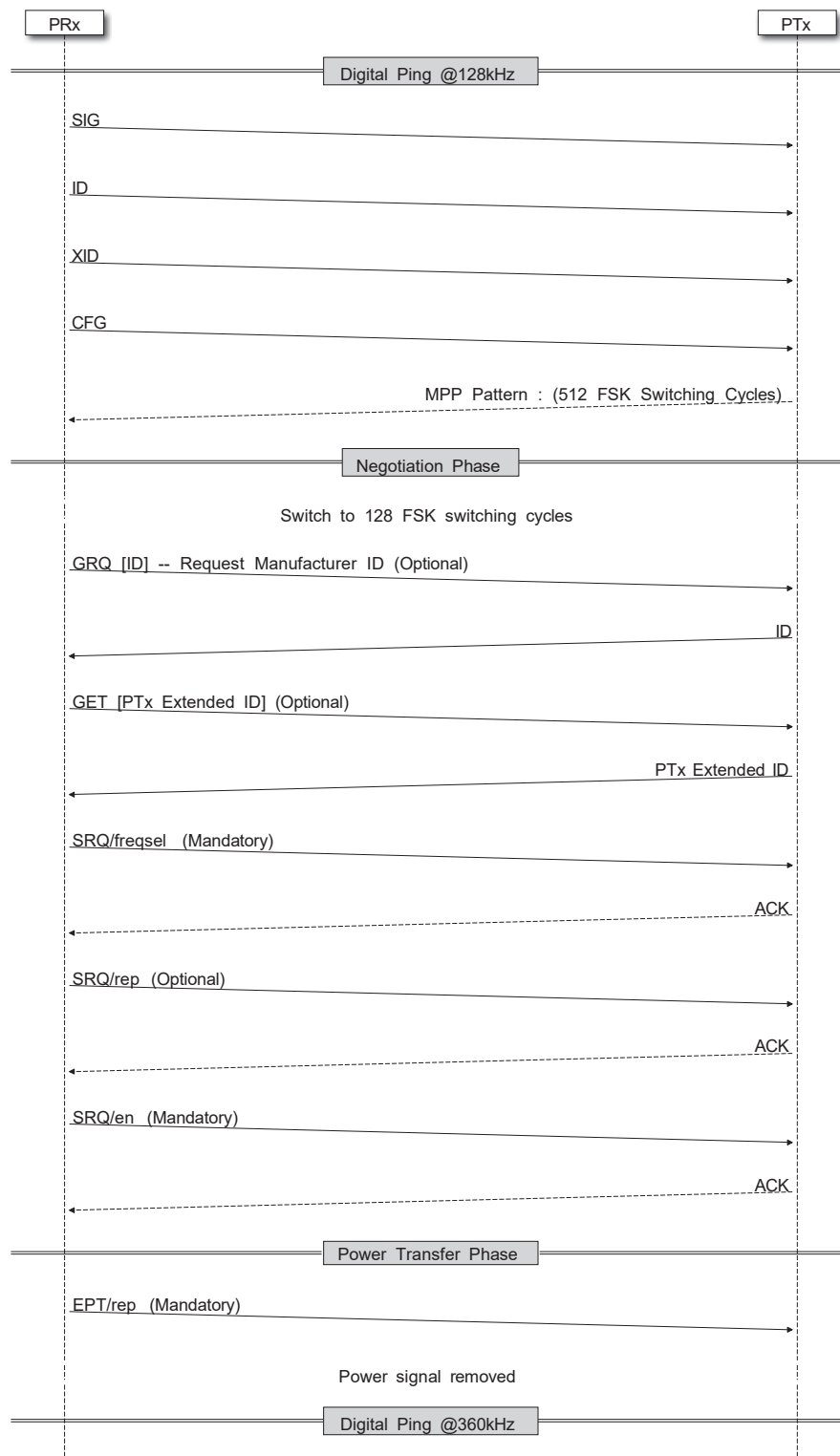


Figure 3.3: MPP Power Negotiation Flow at 128kHz without error

3.3.2 Negotiation flow with PTx error status

Refer to section 3.2.3 for more information.

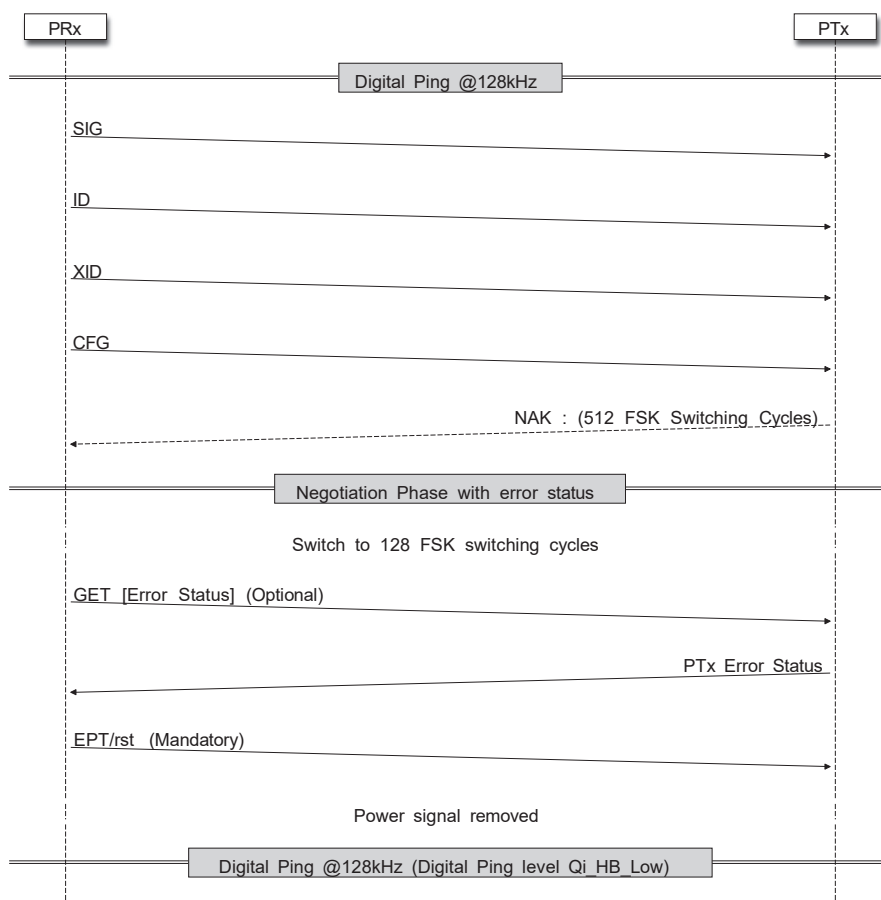


Figure 3.4: MPP Power Negotiation Flow at 128kHz with error status

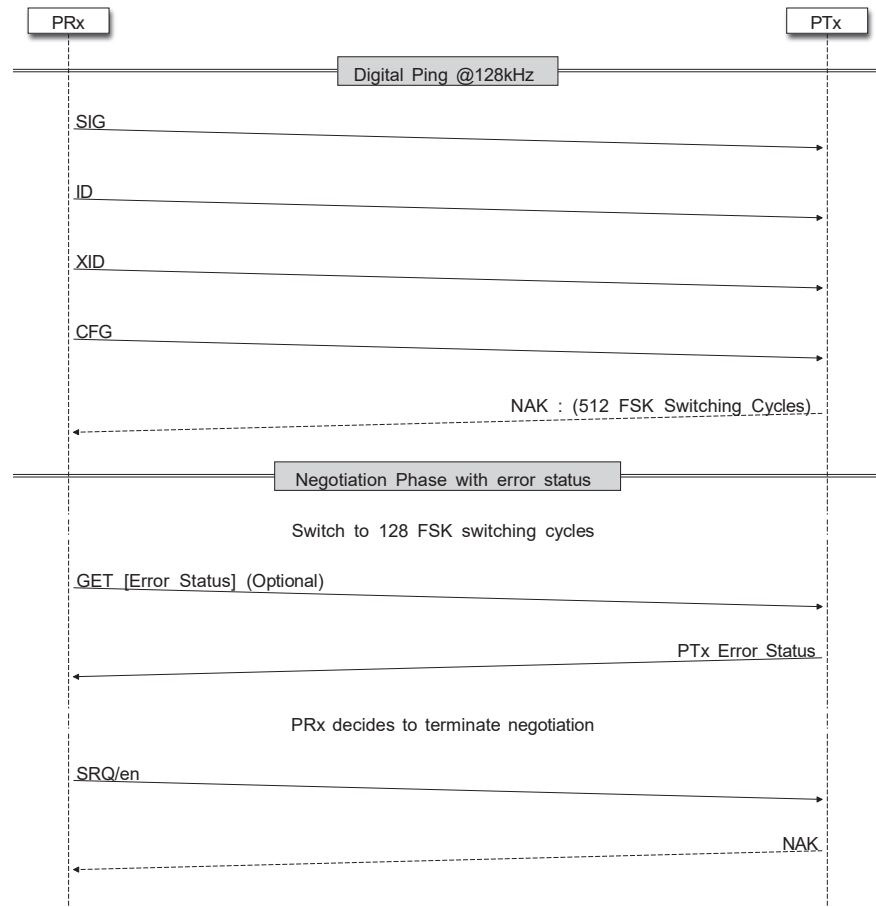


Figure 3.5: MPP Power Negotiation Flow at 128kHz with error status - Misbehaving PRx

3.3.3 Frequency Selection

PRx shall select a new operating frequency (360 kHz) using *SRQ/freqsel* (Section 7.1.4).

After selecting the new frequency and terminating the negotiation using *SRQ/en*, PRx shall request a re-ping using *EPT/rep* to allow PTx to activate the new selected frequency.

1. *EPT/rep* will cause the PTx to remove the power signal, change the operating frequency to the selected value and reset the power contract elements.
2. *EPT/rst* will cause the PTx to remove the power signal, change the operating frequency to 128kHz and reset the power contract elements.

PTx shall follow *EPT/rep* and *EPT/rst* timings as specified in Qi Communications Protocol book.

3.4 Negotiation Phase - 360kHz

PRx shall use the 360kHz negotiation phase to negotiate the required power contract elements before entering power transfer phase.

PRx shall perform the following actions in 360kHz negotiation phase:

1. **Send ECAP:** PRx shall send its extended capabilities data packet to PTx (Section 3.4.1)
2. **Request ECAP:** PRx shall request PTx extended capabilities using *GET [ECAP]* Request (Section 7.1.11)
3. **Request PLAP:** PRx shall request PTx power loss accounting parameters using *GET [PLAP]* Request (Section 7.1.11) - PLAP exchange is described in Section 3.4.3.
4. **Send PLAP:** PRx shall send its power loss accounting parameters to PTx using *PLAP* data packet (Section 7.1.19)

PRx may also perform the following actions before exiting the negotiation phase:

1. **Request Extended PTx ID:** Retrieve MPP PTx Extended ID using *GET [PTx ID]* Request (Section 7.1.11)
2. **Power Level Negotiation:** Refer to section 3.4.4.
3. **Exchange Supported Data Streams:** Refer to section 3.4.6.
4. Negotiate other elements described in this chapter

After completing the transactions, PRx shall terminate the negotiation using *SRQ/en* and transition to Power Transfer Phase as shown in Figure 3.6.