QUINTIC

QN902x Private Profile Guide

Version 0.1

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1. Introduction

The QPP is used to transfer the raw data between BLE devices.

1.1 Profile Dependencies

This profile requires the Generic Attribute Profile (GATT).

1.2 Conformance

If conformance to this profile is claimed, all capabilities indicated as mandatory for this profile shall be supported in the specified manner (process-mandatory). This also applies for all optional and conditional capabilities for which support is indicated. All mandatory capabilities, and optional and conditional capabilities for which support is indicated, are subject to verification as part of the *Bluetooth* qualification program.

1.3 Bluetooth Specification Release Compatibility

This specification is compatible with any *Bluetooth* Core Specification that includes the Generic Attribute Profile (GATT) specification and the Bluetooth Low Energy Controller specification.

2. Configuration

2.1. Roles

The profile defines two roles: QPP Server and QPP Client.
● The QPP Server shall be a GATT server.
● The QPP Client shall be a GATT client.

2.2. Role/Service Relationships

The Diagram 2.1 shows the relationships between services and the two profile roles.
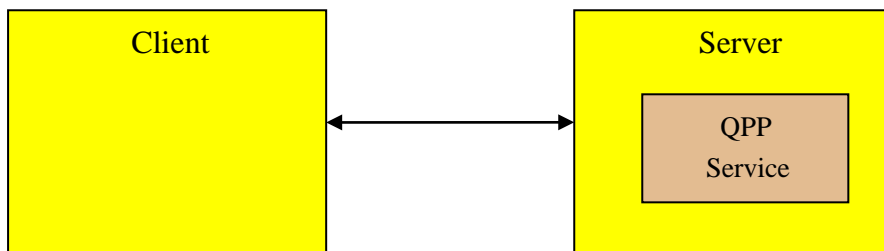
Diagram 2.1   Role / Service Relationships

Note: Profile roles are represented by yellow boxes and services are represented by orange boxes.

A QPP Server shall instantiates one and only one QPP Service.

2.3. Concurrency Limitations and Restrictions

There are no concurrency limitations or restrictions for the QPP Client and Server roles imposed by this profile.
For cases where bonding is supported multiple bonds may be supported, but is outside the scope of this profile.

2.4. Topology Limitations and Restrictions

The QPP Server shall use the GAP Peripheral role.
The QPP Client shall use the GAP Central role.

2.5. Transport Dependencies

This profile shall operate over an LE transport.

3. QPP Server Role Requirements

The QPP Server shall instantiate one and only one QPP Service.

Table 3.1   QPP Server Service Requirements

Service	Requirement
QPP Service	Mandatory

3.1 Incremental QPP Service Requirements

This section describes additional Server requirements beyond those defined in the QPP Server Service.

3.1.1. Service UUIDs AD Type

While in a GAP Discoverable Mode for initial connection to a Client, the QPP Server should include the QPP Service UUID defined in *Table 3.1* in the Service UUIDs AD type field of the advertising data. This enhances the user experience as a server may be identified by the client before initiating a connection.

3.1.2. Local Name AD Type

For enhanced user experience an QPP Server may include the Local Name in its Advertising Data or Scan Response data.

3.2 Service Characteristics

The following characteristics are exposed in the QPP Service. Unless otherwise specified, only one instance of each characteristic is permitted within this service.

Table 3.2 QPP Service characteristics

Characteristic Name	Requirement	Mandatory Properties	Optional Properties	Security Permissions	UUID
QPP Service Declaration (Primary Service)	M	Read		None.	UUID*
RX Char. Declaration	M	Read		None.	
RX Char. Value	M	Write Without Response		None.	UUID**
RX User Descriptor	M	Read		None.	
TX Char. (1) Declaration	M	Read		None.	
TX Char. (1) Value	M	Notify		None.	UUID***
TX Client Char(1). Configuration Descriptor	M	Read,Write			
TX Char. (2) Declaration	O	Read		None.	
……	……	……	……	…….	……

Characteristic Name	Requirement	Mandatory Properties	Optional Properties	Security Permissions	UUID
TX Char. (7) Declaration	O	Read		None.	
TX Char. (7) Value	O	Notify		None.	
TX Client Char(7). Configuration Descriptor	O	Read,Write		None.	UUID****

: The UUID of QPP Service should be a 128-bit value:0x 0000FEE900001000800000805F9B34FB

**: The UUID of RX characteristic is 0xD44BC439ABFD45A2B575925416129600*

***: The UUID of TX characteristic is 0xD44BC439ABFD45A2B575925416129601*

****: The UUID of TX characteristic is 0xD44BC439ABFD45A2B575925416129607*

Notes:

1. Security Permissions of "None" means that this service does not impose any requirements.
2. The alphabet 7 represents the maximum number of TX Characteristic.
3. TX(1) Characteristic is used for flow control.
4. In QPP profile code, we use the range from D44BC439-ABFD-45A2-B575-925416129601 to D44BC439-ABFD-45A2-B575-925416129607 as the UUID of TX Characteristic value and D44BC439-ABFD-45A2-B575-925416129600 as the UUID of RX Characteristic value for demo.
5. User should adjust these values in their products.

4. QPP Client Role Requirements

The Client shall support the QPP Service.

Table 4.1 QPP Client Service Requirements

Service	Requirement
QPP Service	Mandatory

This section describes the profile procedure requirements for an QPP Client.

Table 4.2 QPP Client Requirements

Profile Requirement	Section	Support
Service Discovery	4.2	Mandatory
- QPP Server Service Discovery	4.2.1	Mandatory
Characteristic Discovery	4.3	Mandatory
- QPP Server Service Characteristic Discovery	4.3.1	Mandatory
Transmit Data to Server	4.4	Mandatory
Retrieve Data from Server	4.5	Mandatory

4.1. GATT Sub-Procedure Requirements

Requirements in this section represent a minimum set of requirements for a Client. Other GATT sub-procedures may be used if supported by both Client and Server.
Table 4.3 summarizes additional GATT sub-procedure requirements beyond those required by all GATT Clients.

Table 4.3 Additional GATT Sub-Procedure Requirements

GATT Sub-Procedure	QPP Client Requirements
Discover All Primary Services	C1
Discover Primary Services by Service UUID	C1
Discover All Characteristics of a Service	C2
Discover Characteristics by UUID	C2
Discover All Characteristic Descriptors	M
Write Characteristic Value	M
Notifications	M

C1: Mandatory to support at least one of these sub-procedures.

C2: Mandatory to support at least one of these sub-procedures.

4.2. Service Discovery

The Client shall perform primary service discovery using either the GATT *Discover All Primary Services* sub-procedure or the GATT *Discover Primary Services by Service UUID* sub-procedure. Recommended fast connection parameters and procedures for connection establishment are defined in Section 5.2.2.

4.2.1. QPP Server Service Discovery

The Client shall perform primary service discovery to discover the QPP Server Service.
Service.

4.3. Characteristic Discovery

As required by GATT, the Client must be tolerant of additional optional characteristics in the service records of services used with this profile.

4.3.1. QPP Server Service Characteristic Discovery

The Client shall use either the GATT *Discover All Characteristics of a Service* sub-procedure or the GATT *Discover Characteristics by UUID* sub-procedure to discover the characteristics of the service.
The Client shall use the GATT *Discover All Characteristic Descriptors* sub-procedure to discover the characteristic descriptors described in the following sections.

4.3.1.1. TX Characteristic

The TX is relative to the server-side.
The Client shall discover the TX characteristic.
The Client shall discover the *Client Characteristic Configuration* descriptor of the TX characteristic.

4.3.1.2. RX Characteristic

The RX is relative to the server-side.
The Client shall discover the RX characteristics sequences.

4.4. Transmit Data to Server

The RX characteristic are used to transmit data from client to server.
Client can write data to this characteristic to transfer raw data.

4.5. Retrieve Data from Server

The TX characteristic is used to transmit data from server to client.
The number of TX characteristic can be configured when creating QPP service database.

5. Connection Establishment

This section describes the connection establishment used by a Client and Server in certain scenarios.

5.1. QPP Server Connection Establishment

5.1.1. Device Discovery

The Server should use the GAP *General Discoverable Mode* or *Limited Discoverable Mode* when establishing an initial connection.

5.1.2. Connection Procedure

This procedure is used for connection establishment when the Server connects to a Client. This may be initiated either through user interaction or autonomously when the Server has a notification is pending.

It is recommended that the Server advertises using the parameters in *Table 5.1*.

The interval values in the first row are designed to attempt fast connection during the first 30 seconds; however, if a connection is not established within that time, the interval values in the second row are designed to reduce power consumption for devices that continue to advertise.

Table 5.1 Recommended Advertising Interval Values

Advertising Duration	Parameter	Value
First 30 seconds (fast connection)	Advertising Interval	20 ms to 30 ms
After 30 seconds (reduced power)	Advertising Interval	1 s to 2.5 s

The advertising interval and time to perform advertising should be configured with consideration for user expectations of connection establishment time.

The Server shall accept any valid values for connection interval and connection latency set by the Client.The Server may change connection parameters that best suits its use case.

5.2. QPP Client Connection Establishment

5.2.1. Device Discovery

The Client should use the GAP *General Discovery Procedure* or *Limited Discovery Procedure* to discover a Server.

5.2.2. Connection Procedure

This procedure is used for connection establishment when the Client connects to a Server. This may be initiated either through user interaction or autonomously when a Client requires data from a Server.

A Client may use one of the following GAP connection procedures based on its connectivity requirements:

- *General Connection Establishment Procedure*. The Client may use this procedure when it requires data from one or more Servers. This procedure allows a Client to connect to a Server discovered during a scan without using the white list.
- *Direct Connection Establishment Procedure*. The Client may use this procedure when it requires data from a single Server.
- *Auto Connection Establishment Procedure*. The Client may use this procedure when it requires data from one or more Servers or other sensors. This procedure will automatically connect to a Server in the white list.
- *Selective Connection Establishment Procedure*. The Client may use this procedure when it requires data from one or more Servers. This procedure allows a Client to connect to a Server discovered during a scan while using the white list.

The Client should use the recommended scan interval and scan window values shown in *Table 5.2*. For the first 30 seconds (or optionally continuously for mains powered devices), the Client should use the first scan window / scan interval pair to attempt fast connection. However, if a connection is not established within that time, the Client should switch to one of the other scan window / scan interval options as defined below to reduce power consumption.

Table 5.2 Recommended Scan Interval and Scan Window Value

Advertising Duration	Parameter	Value
First 30 seconds (fast connection)	Scan Interval	30ms to 60ms
	Scan Window	30ms
After 30 seconds (reduced power) - Option 1	Scan Interval	1.28s
	Scan Window	11.25ms
After 30 seconds (reduced power) - Option 2	Scan Interval	2.56s
	Scan Window	11.25ms

6. Release History

REVISION	CHANGE DESCRIPTION	DATE
0.1	Initial release	2014-05-20