

iBeacon for Printers Specification
Version 1.0

Abstract

This document describes the iBeacon format for advertising a printer using a Bluetooth Low Energy beacon. This beacon can be broadcast by the printer itself or via an external device acting as a proxy. This beacon is used by Clients to easily locate and connect to a printer or print server.

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1. Introduction

This document describes the Bluetooth Low Energy beacon format for use with printers and presents requirements and recommendations for using this beacon format. As Apple platforms print using AirPrint technology, this specification pertains to creating beacons for AirPrint devices exclusively. Usage with other printing protocols is unsupported.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

“AirPrint Printer” refers to any device implementing the AirPrint specifications, such as a multifunction printer, a print server, or any other service compliant and certified by Apple.

“Apple Device” or “Client” refers to any device manufactured by Apple and capable of printing such as an iPhone, iPad, iPod Touch, Mac, etc.

3. How an iBeacon for Printers Is Used

Apple Devices use the beacon to discover and make use of AirPrint Printers that are physically nearby. The beacon includes the AirPrint Printer’s IP address as well as other connection information that the Client uses to establish a connection. If the AirPrint Printer is reachable by the Client using the IP address in the beacon, the Client shows the AirPrint Printer as an available printer in the user interface. This could make an AirPrint Printer available to Clients that would not otherwise see the printer. For example, if Bonjour isn’t available, or if the Client is not receiving multicast advertising packets from the subdomain of the AirPrint device, the AirPrint Beacon enables the AirPrint Printer to be visible to Clients.

Even if the AirPrint Printer has already been discovered by the Client (by Bonjour, for example), the beacon still provides additional information to the Client, such as the proximity of the AirPrint device.

4. iBeacon for Printers Packet

All accessories that support this beacon (either the AirPrint Printer itself or a standalone beacon proxying for an AirPrint Printer) MUST incorporate a Bluetooth Low Energy (BLE) radio and implement the Broadcaster role as defined in the Bluetooth 4.0 specification Volume 3, Part C, Section 2.2.2.1. In addition, the accessory MUST be Bluetooth specification compliant by passing all the relevant

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tests in Section 5.2.1 of Test Suite Structure (TSS) and Test Purposes (TP) in Bluetooth Link Layer (LL) Specification 4.0.

This beacon MUST use a non-connectable undirected Advertising PDU, ADV_NONCONN_IND or MAY use a connectable Advertising PDU, ADV_IND only if the bluetooth device is capable of advertising while in a connection, and implement an Apple-specific advertising payload. This beacon MUST broadcast the entire 31 byte advertising packet in all Advertising frequencies using a fixed 100 ms advertising interval. The iBeacon for Printers advertisement packet MUST be the only advertisement from a given Bluetooth address.

Table 4-1 iBeacon for Printers Advertising Packet

Byte(s)	Name	Value	Notes
0	Flags[0]	0x02	See Bluetooth 4.0 Core Specification, Volume 3, Appendix C, 18.1
1	Flags[1]	0x01	See Bluetooth 4.0 Core Specification, Volume 3, Appendix C, 18.1
2	Flags[2]	0x06	See Bluetooth 4.0 Core Specification, Volume 3, Appendix C, 18.1
3	Length	0x1B	See Bluetooth 4.0 Core Specification, Volume 3, Appendix C, 18.1
4	Type	0xFF	See Bluetooth 4.0 Core Specification, Volume 3, Appendix C, 18.1
5	Company ID[0]	0x4C	MUST NOT be used for any purposes not specified by Apple
6	Company ID[1]	0x00	MUST NOT be used for any purposes not specified by Apple
7	Beacon Type[0]	0x03	MUST be set to 0x03
8	Beacon Type[1]	0x16	MUST be set to 0x16
9	Connection Info	See Table 4-2	Connection bits are defined in Table 4-2
10-11	Printer ID or RP Index Value	0xnnnn	If connection info byte RTYPE is set to use Printer ID, this value is the 16-bit unsigned integer value in network order for the Printer ID (see section 5). If RTYPE is set to use RP index, then this value is the 16-bit unsigned integer value representing the RP value found in table 4-3.
12-13	Port[0]	0xnnnn	The 16-bit unsigned integer port value in network order

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Byte(s)	Name	Value	Notes
14-17	IPv4/IPv6 Address	0xnnnnnnnn	If the connection info byte ATYPE value is set to IPv4 address, these bytes contain the network order IPv4 address. If the connection info byte ATYPE value is set to IPv6 address, these bytes contain the first 4 bytes of the network order IPv6 address.
18-29	IPv6 Address	0xnn..nn or 0x00..00	If the connection info byte ATYPE value is set to IPv6 address, these bytes contain the last 12 bytes of the network order IPv6 address. Otherwise, these bytes are all zeros.
30	Measured Power	0xnn	See Measured Power section 6.

Table 4-2 Connection Info Byte

Bit	Name	Value
0-3	ATYPE	Address type: 1 (0001) IPv4 2 (0010) IPv6
4-5	RTYPE	Resource path type: 0 (00) Resource path is represented by index, see table 4-3 1 (01) Use printer ID as resource path. IPP Servers MUST support the printer-id attribute detailed in section 5 of this specification to be used.
6-7	SEC	Security type: 0 (00) None 1 (01) TLS

Table 4-3 RP Values

RP Index Value	Resource	Note
0	“/ipp/print”	Standard path used by AirPrint Printers conforming to AirPrint 1.2.1 and above.
1	“/ipp/printer”	Some printers manufactured by Canon, Brother, Samsung, and others use this RP value.
2	“/printers/Laserjet”	Some laser printers manufactured by HP use this RP value.
3	“/ipp/port1”	Some printers manufactured by Brother use this RP value.

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RP Index Value	Resource	Note
4	“/Epson_IPP_Printer”	Some printers manufactured by Epson use this RP value.
5	“/ipp/ap”	Some printers manufactured by Fuji Xerox use this RP value.
6	“/printer"	Some printers manufactured by Gestetner, infotec, LANIER, NRG, RICOH, and SAVIN use this RP value.

5. IPP Server Requirements

To support the iBeacon for Printers, an IPP server MUST support the following IPP attributes and operations:

5.1 printer-id (integer(1:65535))

This REQUIRED Printer Status attribute is returned by a Get-Printer-Attributes and CUPS-Get-Printers operation in the printer group and MUST contain a unique value for every queue supported by a given server. The “printer-id” attribute is READ-ONLY and MUST remain constant for a given print queue as long as it exists on the server. The server assigns a unique “printer-id” value when the queue is created.

5.2 CUPS-Get-Printers

5.2.1 CUPS-Get-Printers

The CUPS-Get-Printers operation (0x4002) returns the Printer attributes for every IPP print service managed by the IPP Server.

5.2.1.1 CUPS-Get-Printers Request

The following groups of attributes are supplied as part of the CUPS-Get-Printers request:

Group 1: Operation Attributes

Natural Language and Character Set:

The “attributes-charset” and “attributes-natural-language” attributes as described in section 3.1.4.1 of the IPP Model and Semantics [RFC2911].

“limit” (integer (1:MAX)):

The Client OPTIONALLY supplies this attribute limiting the number of Printers that are returned.

“printer-id” (1setOf integer(1:65535)) :

The Client OPTIONALLY supplies this attribute, and the server returns only print services matching a “printer-id” value supplied in this attribute.

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“requested-attributes” (1setOf keyword) :

The Client OPTIONALLY supplies a set of attribute names and/or attribute group names in whose values the requester is interested. If the Client omits this attribute, the Server responds as if this attribute had been supplied with a value of 'printer-uri-supported'.

“requested-user-name” (name(127)) :

The Client OPTIONALLY supplies a user name that is used to filter the returned Printers.

5.2.1.2 CUPS-Get-Printers Response

The following groups of attributes are sent as part of the CUPS-Get-Printers Response:

Group 1: Operation Attributes

Natural Language and Character Set:

The “attributes-charset” and “attributes-natural-language” attributes as described in section 3.1.4.2 of the IPP Model and Semantics [RFC2911].

Status Message:

The standard response status message.

Groups 2-N: Printer Object Attributes

The set of requested attributes and their current values for each Printer.

6. Measured Power

Apple Devices use the measured power value of an iBeacon to help with ranging accuracy.

This measured power value MUST be obtained for each particular hardware configuration (Bluetooth radio, antenna hardware, or other printer hardware configuration). It is constant for each particular hardware configuration. For example, a printer model with a scanner on top is a different hardware configuration than a model without a scanner, and each hardware configuration MUST have a unique measured power value obtained. Likewise, two devices made with different materials, even if the design is identical, MUST each have a unique measured power value obtained.

The measured power MUST be set using the following procedure with an iPhone 6S:

- Hold the iPhone 6S in a portrait orientation with the top half uncovered (this includes cases).
- While the beacon is advertising, repeatedly sample the RSSI at a 1 meter distance for a minimum of 10 seconds.
- Discard the highest 10% of the RSSI samples.

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- Discard the lowest 20% of the RSSI samples.
- Average the remaining samples to obtain the measured power value.

7. Manufacturing Requirements

Table 6-1 iBeacon for Printers Manufacturing Requirements

Description	Requirements
Tx output power from beacon to beacon	SHOULD retain a Tx power variation within +/-5dB average relative to "golden device"
Tx output power stability over temperature	MUST be within +/-2dB over an operating temperature range of 0-40 deg Centigrade
Tx output power stability over frequency	MUST be within +/-2dB average over BTLE advertising channels
Tx output power stability over time	standard deviation over extended periods of time SHOULD NOT exceed 2dB stdev

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