Bluetooth® Secure Simple Pairing Using NFC

Application Document

NFC Forum™

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NFC Forum, Inc.
401 Edgewater Place, Suite 600
Wakefield, MA, USA 01880

Bluetooth SIG, Inc.
5209 Lake Washington Blvd NE, Suite 350
Kirkland, Washington 98033

Updated May 1, 2014

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1 Introduction

This Application Document is intended to provide examples for implementation of Bluetooth BR/EDR Secure Simple Pairing (SSP) and Bluetooth Low Energy (LE) Out-of-Band (OOB) pairing using NFC.

It is recommended that all NFC Forum members and Bluetooth SIG members refer to this Application Document when implementing Bluetooth OOB pairing using NFC.

Bluetooth SSP has been introduced in Bluetooth Core Specification Version 2.1 + EDR and Bluetooth LE pairing has been introduced in Bluetooth Core Specification Version 4.0. Specific data format may change in subsequent versions of the standard. Thus, this Application Document refers explicitly to Bluetooth Core Specification version 4.0.

The format used for SSP related data exchange is the Extended Inquiry Response (EIR) format, which is described in Section 3.1 and 3.2. The format used for Bluetooth LE OOB data exchange is the Advertising and Scan Response Data (AD) format, which is described in Section 3.3 and 3.4. However, both the EIR and AD formats are specified by the Bluetooth Special Interest Group (SIG), which may be updated or changed independently of this document. Any conflict between the data format presentations made in this document and those defined by the Bluetooth SIG is resolved in favor of the Bluetooth SIG (as the originator of the formats).

1.1 Audience

The audience of this document is all the NFC Forum members and Bluetooth SIG members interested in implementing the Bluetooth SSP or the Bluetooth LE pairing using NFC.

1.2 Applicable Documents or References

[BLUETOOTH_CORE]

Bluetooth Core Specification version 4.0 and later, Bluetooth SIG, June 30, 2010.

https://www.bluetooth.org/Technical/Specifications/adopted.htm

In this document, references to sections or pages of Bluetooth Core Specification refer to Version 4.0. Different paragraph numbers or page numbers may apply for different revisions of Bluetooth Core Specifications.

[BLUETOOTH_CSS]

Bluetooth Core Specification supplement version 4 or later, Bluetooth SIG, December 3, 2013.

https://www.bluetooth.org/Technical/Specifications/adopted.htm

In this document, references to sections or pages of Bluetooth Core Specification supplement refer to Version 4. Different paragraph numbers or page numbers may apply for different revisions of Bluetooth Core Specification supplement.

[BLUETOOTH_CSA3]

Bluetooth Core Specification Addendum 3 or later versions of the [BLUETOOTH_CORE] which have the Addendum integrated, Bluetooth SIG, July 24, 2012.

https://www.bluetooth.org/Technical/Specifications/adopted.htm

In this document, references to sections or pages refer to Bluetooth Core Specification Addendum 3. Different paragraph numbers or page numbers may apply for later versions of the [BLUETOOTH_CORE] which have the Addendum integrated.

[BLUETOOTH_CSA4]

Bluetooth Core Specification Addendum 4 or later versions of the [BLUETOOTH_CORE] which have the Addendum integrated, Bluetooth SIG, February 12, 2013.

https://www.bluetooth.org/Technical/Specifications/adopted.htm

In this document, references to sections or pages refer to Bluetooth Core Specification Addendum 4. Different paragraph numbers or page numbers may apply for later versions of the [BLUETOOTH_CORE] which have the Addendum integrated.

[BLUETOOTH_NUMBERS]

Bluetooth Assigned Numbers, Bluetooth SIG, https://www.bluetooth.org/Technical/AssignedNumbers/home.htm

[CH] NFC Forum Connection Handover Technical Specification, Version 1.2, NFC Forum

[NDEF] NFC Data Exchange Format, Version 1.0, NFC Forum

[RFC2046] Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types, RFC 2046 N. Freed, N. Borenstein, November 1996 Internet Engineering Task Force

[RTD] NFC Record Type Definition (RTD), Version 1.0, NFC Forum

[URI_RTD] NFC URI Record Type Definition Technical Specification, Version 1.0, NFC Forum

[RFC2119] Key words for use in RFCs to Indicate Requirement Levels, RFC 2119, S. Bradner, March 1997, Internet Engineering Task Force

1.3 Administration

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401 Edgewater Place, Suite 600
Wakefield, MA, 01880

Tel.: +1 781-876-8955
Fax: +1 781-610-9864

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1.6 Special Word Usage

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 [RFC2119].

1.7 Abbreviations

Table 1: Abbreviations

Abbreviation	Context	Description
A2DP	Bluetooth SIG	Advanced Audio Distribution Profile
ac	NFC Forum	Alternative Carrier
AD	Bluetooth SIG	Advertising and Scan Response Data
BD_ADDR	Bluetooth SIG	Bluetooth Device Address
BR	Bluetooth SIG	Basic Rate
CF	NFC Forum	Chunk Flag
CoD	Bluetooth SIG	Class of Device
CPS	NFC Forum	Carrier Power State
EDR	Bluetooth SIG	Enhanced Data Rate
EIR	Bluetooth SIG	Extended Inquiry Response
Hr	NFC Forum	Handover Request Message
Hs	NFC Forum	Handover Select Message
HF	Bluetooth SIG	Hands-Free Unit
HFP	Bluetooth SIG	Hands-Free Profile
IL	NFC Forum	ID Length
LE	Bluetooth SIG	Low Energy
M	Bluetooth SIG	Mandatory

Abbreviation	Context	Description
MB	NFC Forum	Message Begin
ME	NFC Forum	Message End
MITM	N/A	Man In The Middle
NDEF	NFC Forum	NFC Data Exchange Format
NFC	NFC Forum	Near Field Communication
O	Bluetooth SIG	Optional
OBEX	Bluetooth SIG	Object Exchange
OOB	Bluetooth SIG	Out-of-Band
PIN	N/A	Personal Identification Number
RFC	N/A	Request For Comments
SDP	Bluetooth SIG	Service Discovery Protocol
SIG	Bluetooth SIG	Special Interest Group
SNK	Bluetooth SIG	Sink
SR	NFC Forum	Short Record
SSP	Bluetooth SIG	Secure Simple Pairing
TNF	NFC Forum	Type Name Format
UI	N/A	User Interface
UID	Bluetooth SIG	Unique Identifier
UUID	Bluetooth SIG	Universal Unique Identifier

1.8 Glossary

Advertising and Scan Response Data / Bluetooth *SIG*

A message providing information about the local Bluetooth device sent in an Advertising or Scan Response event from Bluetooth LE devices. Defined in [BLUETOOTH_CORE].

Alternative Carrier / NFC Forum

A (wireless) communication technology that can be used for data transfers between a Handover Requester and a Handover Selector.

Bluetooth Device

A device that implements [BLUETOOTH_CORE].

Carrier Configuration Data / NFC Forum

The information needed to connect to an alternative carrier. The exact information depends on the carrier technology.

Extended Inquiry Response / Bluetooth SIG

A response message providing information about the local Bluetooth device sent in response to an Inquiry from remote Bluetooth devices. Defined in [BLUETOOTH_CORE].

Handover Requester / NFC Forum

An NFC Forum Device that begins the Handover Protocol by issuing a Handover Request Message to another NFC Forum Device.

Handover Selector / NFC Forum

An NFC Forum Device that constructs and replies to a Handover Select Message as a result of a previously received Handover Request Message, or an NFC Forum Tag that provides a pre-set Handover Select Message for reading.

Negotiated Handover / NFC Forum

An exchange of NDEF messages that allows two NFC Forum Devices to agree on a set of alternative carrier(s) to be used for further data exchange.

NFC Forum Device

A device that is certified by NFC Forum.

Out-of-band / Bluetooth SIG

Communication that belongs to but occurs outside of an intended communication channel or method. In this document, “out-of-band” refers to data transmission over NFC for the purpose of pairing devices using Bluetooth SSP and discovering Bluetooth services.

Static Handover / NFC Forum

Provision of “Handover Select” message on an NFC Forum Tag that allows a reading NFC Forum Device to select and use alternative carriers for further data exchange.

2 Overview

The Bluetooth SIG publishes a set of specifications available to its Members for wireless personal area networks. These specifications cover interoperability requirements ranging from the behavior of the radio through core protocols, up to application level profiles and services that enable specific use cases. The specifications are controlled by the Bluetooth SIG that licenses the use of the specifications, provided that a product successfully completes all Bluetooth SIG qualification and listing requirements. The Bluetooth SIG also facilitates specification development by member companies.

The use of the NFC technology can enhance the user experience of applications that use the Bluetooth technology.

The enhancements can be any of the following areas:

1. Select a Bluetooth device
2. Securely connect to a Bluetooth device
3. Start an application on a Bluetooth device

2.1 Device Selection

Discovering a Bluetooth enabled device typically uses the Inquiry procedure for Bluetooth BR/EDR devices and the Discovery procedures for Bluetooth LE devices to discover other Bluetooth devices in the vicinity of the discovering device.

NFC can simplify the discovery process by eliminating the Inquiry or Discovery procedure by providing the Bluetooth address and other optional parameters related to a specific Bluetooth-enabled device. This removes the need for the user to select the appropriate device from a (potentially long) list. The result is a more seamless wireless user experience.

2.2 Fast and Securely Connect

NFC can simplify the process of authenticated pairing between two Bluetooth devices by exchanging authentication information over an NFC link.

Devices that comply with [BLUETOOTH_CORE] and subsequent versions use Secure Simple Pairing (SSP) to securely connect devices over BR/EDR transport. SSP provides a stronger level of security, yet makes it easier for the user to perform pairing. SSP explicitly introduces the notion of Out-of-Band (OOB) pairing. The information (Hash C and Randomizer R used for Bluetooth BR/EDR devices and TK-value used for Bluetooth LE devices, described in Sections 3.2 and 3.4) can be exchanged over an NFC link to be used as part of the OOB pairing process.

Devices that comply with [BLUETOOTH_CORE] may support Bluetooth Interlaced Page Scan to speed up the Bluetooth connection setup. After Bluetooth OOB Data (see Table 2) has been exchanged over NFC, a device may enable Bluetooth Interlaced Page Scan to faster scan for a remote Bluetooth paging device and therefore to reduce the Bluetooth connection setup time. To improve interoperability it is recommended to enable the Bluetooth Interlaced Page Scan duration for at least 60 seconds As Bluetooth Interlaced Page Scan consumes more power than normal Bluetooth Page Scan, it is also recommended to limit the maximum duration of Bluetooth Interlaced Page Scan to 120 seconds.

After Bluetooth OOB data indicating LE transport has been exchanged over NFC it is recommended that the Central device and the Peripheral device use the fast connection establishment parameters as recommended by the Bluetooth SIG ([BLUETOOTH_CSA3], GAP Connection Parameters Changes, Sections 1.11 and 1.12, and [BLUETOOTH_CSA4], Part D, Section 1.3) to reduce the Bluetooth LE connection setup time.

2.3 Start an Application

NFC can be used to start an application to provide good user experience. For example, the user touches their NFC Forum device to another NFC Forum device to exchange contact information. Starting an application upon NFC ‘touch’ action is implementation specific. In some cases, the ‘touch’ could even allow the user to select the application to execute.

3 Handover to a Bluetooth Carrier

The Bluetooth SIG defined a mechanism called “Secure Simple Pairing” ([BLUETOOTH_CORE], Volume 2, Part H, Section 7) to simplify the process of pairing two Bluetooth BR/EDR devices. Pairing between Bluetooth LE devices is defined in [BLUETOOTH_CORE], Volume 3, Part H.

Secure Simple Pairing defines four different association models, one of them using an Out-of-Band channel such as NFC. Three different association models are defined for Bluetooth LE, one of them is the Out-Of-Band association model.

The NFC Forum Connection Handover technical specification ([CH]) defines the mechanism and format of the messages to exchange Alternative Carrier information between NFC Forum Devices or between an NFC Forum Tag and NFC Forum Device. Specifically, Bluetooth OOB data can be exchanged in Connection Handover Request and/or Select messages as Alternative Carrier information.

The Bluetooth SIG has defined one Media-type per [RFC2046] for Bluetooth BR/EDR ‘Secure Simple Pairing OOB’ and one media-type for Bluetooth LE OOB communication.

For Bluetooth BR/EDR devices, Secure Simple Pairing OOB “application/vnd.bluetooth.ep.oob” should be used as the [NDEF] record type name. The payload for this type of record is then defined by the Extended Inquiry Response (EIR) format specified in the Bluetooth Core Specification ([BLUETOOTH_CORE], Volume 3, Part C, Section 8).

For Bluetooth LE OOB “application/vnd.bluetooth.le.oob” should be used as the [NDEF] record type name. The payload of this type of record is then defined by the Advertising and Scan Response Data (AD) format specified in the Bluetooth Core Specification ([BLUETOOTH_CORE], Volume 3, Part C, Section 11).

3.1 Secure Simple Pairing OOB Data

For Bluetooth BR/EDR devices, the Secure Simple Pairing Out-of-Band data format is used for OOB pairing ([BLUETOOTH_CORE], Volume 3, Part C, Section 5.2.2.7). The format is provided in Table 2. The format consists of a length field, the Bluetooth Device Address and an optional set of additional EIR data types.

Table 2: Bluetooth BR/EDR Secure Simple Pairing OOB Data

Name	Offset (Octets)	Size	Mandatory / Optional	Description
OOB Data Length	0	2 octets	M	The total length including the OOB Data Length, the Bluetooth Device Address, and the OOB Optional Data fields (see Section 3.1.1)
Bluetooth Device Address	2	6 octets	M	Bluetooth Device Address of the device (see Section 3.1.2)
OOB Optional Data	8	N octets	O	The remaining optional OOB data, in EIR format (see Section 3.2)

3.1.1 Secure Simple Pairing OOB Data Length

This length value provides the absolute length of total OOB data block[1] used for Bluetooth BR/EDR OOB communication, which includes the length field itself and the Bluetooth Device Address. The minimum length that may be represented in this field is 8.

The value in this field is (N + 8) where N is the length of the OOB Optional Data field as shown in Table 2. This field is encoded in Little Endian order.

3.1.2 Bluetooth Device Address

The Bluetooth Device Address is uniquely assigned and is used to connect to another Bluetooth device. For more details, see [BLUETOOTH_CORE] Volume 2, Part B, Section 1.2, on page 62. As indicated in [BLUETOOTH_CORE] Volume 3, Part C, Section 8.1, this value is encoded in Little Endian order. For example, the Bluetooth Address 00:0c:78:51:c4:06 would be encoded as 0x06 0xC4 0x51 0x78 0x0C 0x00.

[1] [BLUETOOTH_CORE] Versions 2.1 + EDR and v3.0 + HS contain an inconsistency in the definition of the field “OOB Optional Data Length”. The field is described in Section 8.1.6 and Section 5.2.2.7. It appears that these two descriptions contradict each other, because the first indicates that the length field does not include the mandatory fields (Length and BD_ADDR), and the second indicates that they should be included. The [BLUETOOTH_CORE] Version 4.0 has a consistent definition in both sections that states that the mandatory fields are included in the ‘Length’ field. This issue is addressed in erratum 3476 in the *Bluetooth* SIG errata system such that the length field conforms to the definition in Section 5.2.2.7 wherein the length field includes the mandatory fields.

3.2 Secure Simple Pairing OOB Optional Data

The OOB Optional Data format is defined in [BLUETOOTH_CORE] Volume 3, Part C, Figure 8.1. There are a number of EIR data types defined by the Bluetooth SIG (for more details, see the Generic Access Profile (GAP) section of [BLUETOOTH_NUMBERS] and the [BLUETOOTH_CSS]). The OOB Optional Data section highlights the use of the data types appropriate for the Connection Handover scenario. This coverage will not be exhaustive, and implementations may include other EIR data types.

As such, an NFC handover implementation receiving OOB EIR formatted data should be prepared to receive all possible EIR data type values, including values that are currently reserved for future use, in any order. Any EIR data type that is not supported by an implementation is ignored without inspecting the associated EIR data.

Table 3: Bluetooth EIR Data Types

Value (1 Octet)	Description
`0x09 or 0x08`	Bluetooth Local Name (Section 3.2.1)
`0x0E`	Simple Pairing Hash C (Section 3.2.2)
`0x0F`	Simple Pairing Randomizer R (Section 3.2.3)
`0x02, 0x03, 0x04, 0x05, 0x06, or 0x07`	Service Class UUID (different lengths based on Bluetooth SIG allocated base UUID) (Section 3.2.4)
`0x0D`	Class of Device (Section 3.2.5)

Additional EIR data types (not shown in [Table 3]) are defined by the Bluetooth SIG for other types of information, including a manufacturer-specific type for proprietary information to be included within the standard format[2] (see [BLUETOOTH_CORE] Volume 3, Part C, Section 8.1.4).

3.2.1 Bluetooth Local Name Information

The Bluetooth Local Name, if configured on the Bluetooth device, is the user-friendly name presented over Bluetooth technology, as defined in [BLUETOOTH_CORE] Volume 3, Part C, Section 3.2.2. This is the name that may be displayed to the device user as part of the UI involving operations with Bluetooth devices.

[2] There are different EIR data types to indicate additional semantics such as “partial” and “complete”. For more details, please refer to [BLUETOOTH_CORE] Volume 3, Part C, Section 8.

3.2.2 Simple Pairing Hash C Information

The Simple Pairing Hash C is defined in [BLUETOOTH_CORE] Volume 2, Part H, Section 7.2.2, which also provides information regarding whether inclusion of Hash C in the OOB data is appropriate. It is recommended in [BLUETOOTH_CORE] that the Hash C is generated anew for each pairing. It should be noted that on passive NFC Forum tags provision of the freshly generated Hash C is not possible due to the fact that data is static and not modifiable[3].

3.2.3 Simple Pairing Randomizer R Information

The Simple Pairing Randomizer R is defined in [BLUETOOTH_CORE] Volume 2, Part H, Section 7.2.2, which provides details for scenarios where inclusion of Randomizer R value is appropriate[3]. It is worth noting that the Randomizer R is optional, and if not present a value of 0 is assumed.

3.2.4 Service Class UUID Information

Service class information is used to identify the supported Bluetooth services of the device. A Service Class is represented by a UUID, which may be truncated from the full 128-bit UUID to a 16-bit or 32-bit abbreviated version based on the Bluetooth SIG BASE_UUID (for more details, see [BLUETOOTH_NUMBERS] Service Discovery).

The Service Class UUID element in the EIR format represents a list of UUIDs that are grouped together based on two properties of the list:

- The size of the UUID (16-bit, 32-bit, or 128-bit)
- Whether the UUID list is complete or partial

A Service Class UUID list is defined as being complete when all service classes represented as service are recorded in the Bluetooth Service Discovery (SDP) database. A receiving device will use the complete/partial status of a UUID list to determine whether it performs an SDP query (once a Bluetooth link has been established) if the service class it requires is not listed.

The list of UUIDs is structured such that the payload has contiguous UUIDs (the size of each UUID is determined by the EIR type associated with that payload). For example, if an EIR tag 0x03 has the length 11, then the payload will contain 5 UUIDs in their 16-bit representation. For more details, see [BLUETOOTH_CORE] Volume 3, Part C, Section 8.1.1, [BLUETOOTH_CORE] Volume 3, Part B, and [BLUETOOTH_NUMBERS] Service Discovery.

[3] Note the special case of an NFC Forum Tag that is able to dynamically modify its Data (active NFC Device performing Tag emulation or similar). This allows including freshly generated Simple Pairing Hash C and Randomizer R to establish a secure Bluetooth connection without user further interaction beyond the “NFC touch”.

3.2.5 Class of Device Information

The Class of Device information is to be used to provide a graphical representation to the user as part of UI involving operations with Bluetooth devices. For example, it may provide a particular icon to present the device.

This field is not supposed to be directly used for determining whether or not a particular service can be used because it is aimed at providing information to the user about the type of device they are engaging with. An illustrative example is that a device may be a “Desktop workstation” and provide a number of features (such as printing because it is connected to a printer). However, the service class field of the Class of Device information may indicate the general categories of services that the device may provide.

Determining the support for services is based on the supported Service Class UUIDs (see Section 3.2.4).

Details about Class of Device values can be found in [BLUETOOTH_CORE] Volume 3, Part C, Section 3.2.4. The actual Class of Device values are defined in [BLUETOOTH_NUMBERS] Baseband.

3.3 Security Manager OOB Required Data Types

The format used for Bluetooth LE OOB data exchange is the Advertising and Scan Response Data (AD) format ([BLUETOOTH_CORE], Volume 3, Part C, Section 11). Each AD structure consists of an AD Length field of 1 octet, an AD Type field and an AD Data field. The Length value is the total number of octets in the AD Type and the AD Data field. The total OOB data length is defined by the [NDEF] record payload length.

The LE Role data type described in Section 3.3.2 should be sent for Bluetooth LE OOB pairing over NFC.

The LE Bluetooth Device Address data type described in Section 3.3.1 should be sent for Bluetooth OOB pairing over NFC with one exception for NFC Forum Tags. If a device uses a Public or Static Device Address it should be present on the NFC Forum Tag. If a device uses a Private Device Address and it is not possible to dynamically program the NFC Forum Tag, the LE Bluetooth Device Address field may not be present on the tag. In any case if LE Bluetooth Device Address field is present on the Tag it shall match the current Bluetooth Device Address of the Bluetooth device.

Bluetooth LE OOB data exchanged over NFC may contain other AD types.

Table 4: Bluetooth AD Types Required for OOB Pairing over NFC

Value (1 Octet)	Description
0x1B	*LE* Bluetooth *Device Address* (Section 3.3.1)[4]
0x1C	*LE Role* (Section 3.3.2)

3.3.1 LE Bluetooth Device Address

The LE Bluetooth Device Address data type is defined in [BLUETOOTH_CSS] Section 1.16. The LE Bluetooth Device Address data value consists of 7 octets. The 6 least significant octets contain the 48 bit address that is used for the Bluetooth pairing over the LE transport and will identify the peer device to establish a connection with. The least significant bit in the most significant octet defines the address type. The address may be a Public Device Address or a Random Device Address. Random Device Address is described in [BLUETOOTH_CORE], Volume 3, Part C, Section 10.8. Public Address is defined in [BLUETOOTH_CORE], Volume 2, Part B, Section 1.2. The Address sent in the LE Bluetooth Device Address data type should be used on the LE transport for at least ten minutes after the NFC data exchange.

LE Bluetooth Device Address is encoded in Little Endian order. For example, the Bluetooth Device Address 00:0c:78:51:c4:06 would be encoded as 0x06 0xC4 0x51 0x78 0x0C 0x00.

3.3.2 LE Role

The Generic Access Profile defines four specific roles. These roles are described in [BLUETOOTH_CORE] Volume 3, part C, Section 2.2.2. During Bluetooth LE connection establishment, one device must be in the Peripheral role and the other in the Central role to be able to perform connection establishment. The LE Role data type, defined in [BLUETOOTH_CSS] Section 1.17, indicates role capabilities and role preference.

3.4 Security Manager OOB Pairing Optional Data Types

The following four AD types are defined by the Bluetooth SIG; Security Manager TK Value, Appearance, Flags, and Local Name. The following sub sections give the definitions for these AD types that are appropriate for Security Manager OOB pairing. This coverage is not exhaustive and implementations may include other AD types. An NFC Handover implementation receiving OOB AD formatted data should be prepared to receive all possible AD type values, including values that are currently reserved for future use, in any order. Any AD type that is not supported by an implementation is ignored without inspecting the associated AD values.

[4] Exception for devices using a Private Device Address and a NFC Forum Tag that is not dynamically programmable.

Table 5: Bluetooth Optional AD Types

Value (1 Octet)	Description
0X10	*Security Manager TK Value* (Section 3.4.1)
0x19	*Appearance* (Section 3.4.2)
0x01	*Flags* (Section 3.4.3)
0x08 or 0x09	*Local Name* (Section 3.4.4)

3.4.1 Security Manager TK value

The Security Manager TK value is defined in [BLUETOOTH_CSS] Section 1.8 and is used by the LE Security Manager, which is described in [BLUETOOTH_CORE] Volume 3, Part H. If the OOB association model is used, the TK value may be exchanged over the OOB channel, in this case NFC. The TK value requirements for such exchange is described in [BLUETOOTH_CORE] Volume 3, Part H, Section 2.3.5.4.

3.4.2 Appearance

The Appearance data type is defined in [BLUETOOTH_CSS] Section 1.12. The appearance characteristic defines the representation of the external appearance of the device, for example, a mouse, generic remote control, or keyboard. The appearance characteristics may be used by the discovering device to represent an icon, string, or similar to the user. Attribute values for the appearance data type can be found in [BLUETOOTH_NUMBERS].

3.4.3 Flags

Flags data type described in [BLUETOOTH_CSS] Section 1.3 contain information on which discoverable mode to use and BR/EDR support and capability.

3.4.4 Local Name

The Local Name, if configured on the Bluetooth device, is the user-friendly name presented over Bluetooth technology, as defined in [BLUETOOTH_CORE] Volume 3, Part C, Section 3.2.2. This is the name that may be displayed to the device user as part of the UI involving operations with Bluetooth devices. The Local Name data type is defined [BLUETOOTH_CSS] Section 1.2.

4 Examples

4.1 Negotiated Handover

4.1.1 BR/EDR Example

Figure 1 shows a sample Handover Request Message from a device with only Bluetooth communication capability using the mime-type “application/vnd.bluetooth.ep.oob”.

Table 6 describes a sample Handover Request Message that could be sent by a camera device that has a Bluetooth radio available.

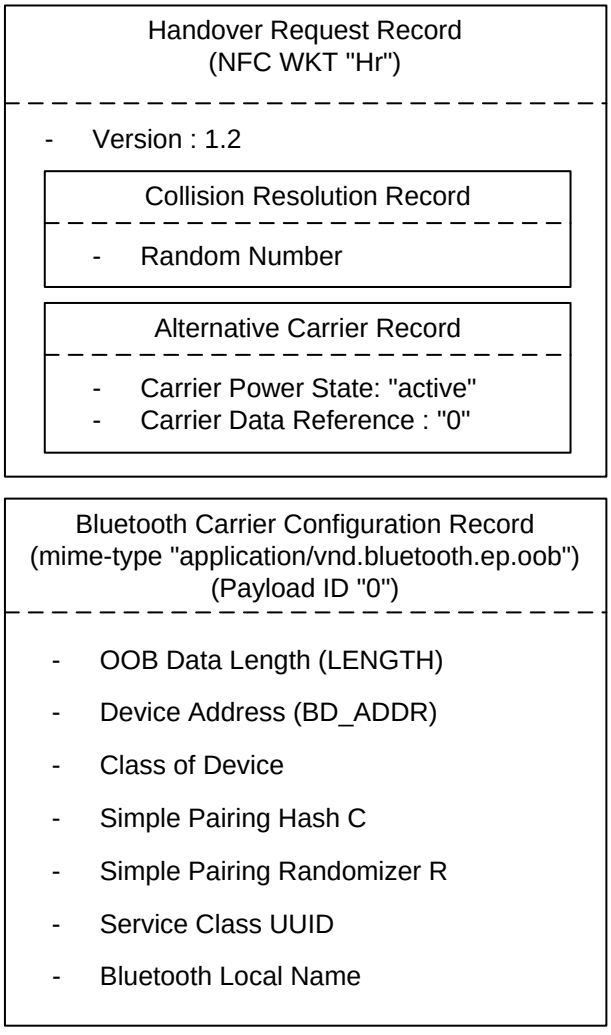

Figure 1: Bluetooth Handover Request Message

Note that the Bluetooth OOB data block might contain only the LENGTH and BD_ADDR fields.

Bluetooth Simple Pairing in NFC Forum Peer-to-Peer mode allows for mutual authentication based on commitments of public keys exchanged out-of-band. A device requesting handover to a Bluetooth carrier sends its public key commitment Hash C and Randomizer R with the Handover Request Message, and it receives the peer's commitment and randomizer with the Handover Select Message. The cryptographic details of the Bluetooth out-of-band pairing are described in [BLUETOOTH_CORE] Volume 2, Part H, Section 7.2.2.

Table 6: Binary Content of a Sample Bluetooth Handover Request Message

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
0	0x91	1	NDEF Record Header: MB=1b, ME=0b, CF=0b, SR=1b, IL=0b, TNF=001b
1	0x02	1	Record Type Length: 2 octets
2	0x11	1	Payload Length: 17 octets
3	0x48 0x72	2	Record Type: "Hr"
5	0x12	1	Version Number: Major = 1, Minor = 2
6	0x91	1	NDEF Record Header: MB=1b, ME=0b, CF=0b, SR=1b, IL=0b, TNF=001b
7	0x02	1	Record Type Length: 2 octets
8	0x02	1	Payload Length: 2 octets
9	0x63 0x72	2	Record Type: "cr"
11	0x01 0x02	2	Random Number: 0x01 0x02
13	0x51	1	NDEF Record Header: MB=0b, ME=1b, CF=0b, SR=1b, IL=0b, TNF=001b
14	0x02	1	Record Type Length: 2 octets
15	0x04	1	Payload Length: 4 octets
16	0x61 0x63	2	Record Type: "ac"
18	0x01	1	Carrier Flags: CPS=1, "active"
19	0x01	1	Carrier Data Reference Length: 1 octet
20	0x30	1	Carrier Data Reference: "0"
21	0x00	1	Auxiliary Data Reference Count: 0
22	0x5A	1	NDEF Record Header: MB=0b, ME=1b, CF=0b, SR=1b, IL=1b, TNF=010b
23	0x20	1	Record Type Length: 32 octets
24	0x43	1	Payload Length: 67 octets
25	0x01	1	Payload ID Length: 1 octet
26	0x61 0x70 0x70 0x6C 0x69 0x63 0x61 0x74 0x69 0x6F 0x6E 0x2F 0x76 0x6E 0x64 0x2E 0x62 0x6C 0x75 0x65 0x74 0x6F 0x6F 0x74 0x68 0x2E 0x65 0x70	32	Record Type Name: application/vnd.bluetooth.ep.oob

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
	0x2E 0x6F 0x6F 0x62		
58	0x30	1	Payload ID: “0”
59	0x43 0x00	2	Bluetooth OOB Data Length: 67 octets
61	0x01 0x07 0x80 0x80 0xBF 0xA1	6	Bluetooth Device Address: A1:BF:80:80:07:01
67	0x04	1	EIR Data Length: 4 octets
68	0x0D	1	EIR Data Type: Class of Device
69	0x20 0x06 0x08	3	Class of Device: • 0x08: Service Class = Capturing • 0x06: Major Device Class = Imaging • 0x20: Minor Device Class = Camera
72	0x11	1	EIR Data Length: 17 octets
73	0x0E	1	EIR Data Type: Simple Pairing Hash C
74	0x0F 0x0E 0x0D 0x0C 0x0B 0x0A 0x09 0x08 0x07 0x06 0x05 0x04 0x03 0x02 0x01 0x00	16	Simple Pairing Hash C: 0x000102030405060708090A0B0C0D0E0F
90	0x11	1	EIR Data Length: 17 octets
91	0x0F	1	EIR Data Type: Simple Pairing Randomizer R
92	0x0F 0x0E 0x0D 0x0C 0x0B 0x0A 0x09 0x08 0x07 0x06 0x05 0x04 0x03 0x02 0x01 0x00	16	Simple Pairing Randomizer R: 0x000102030405060708090A0B0C0D0E0F
108	0x05	1	EIR Data Length: 5 octets
109	0x03	1	EIR Data Type: 16-bit Service Class UUID list (complete)
110	0x06 0x11 0x20 0x11	4	16-bit Service Class UUID list (complete): 0x1106 – OBEX File Transfer 0x1120 – Direct Printing Reference Object Service
114	0x0B	1	EIR Data Length: 11 octets
115	0x09	1	EIR Data Type: Complete Local Name
116	0x44 0x65 0x76 0x69 0x63 0x65 0x4e 0x61 0x6d 0x65	10	Bluetooth Local Name: DeviceName

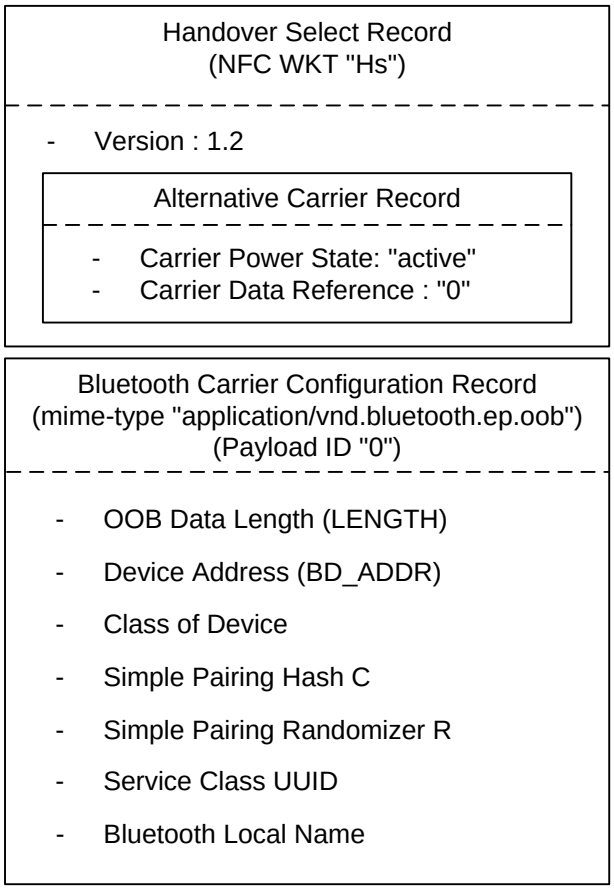

Figure 2: Bluetooth Handover Select Message

Figure 2 shows the structure of a Handover Select Message returned by a Handover Selector device that acknowledges a Bluetooth carrier.

Table 7 describes a sample Handover Select Message that could be returned by a printer device that has a Bluetooth radio available.

Note that [BLUETOOTH_CORE] requires all numerical multi-octet entities and values associated with the following data types use Little Endian order. Hence, in the examples presented in this document, the following fields are encoded using Little Endian order:

- ‘Bluetooth OOB Data Length’
- ‘Bluetooth Device Address’
- ‘Class of Device’
- ‘16-bit Service Class UUID list (complete)’
- Simple Pairing Hash C
- Simple Pairing Randomizer R

Table 7: Binary Content of a Sample Bluetooth Handover Select Message

Offset (Octets)	Content	Length (Octets)	Explanation
0	0x91	1	NDEF Record Header: MB=1b, ME=0b, CF=0b, SR=1b, IL=0b, TNF=001b
1	0x02	1	Record Type Length: 2 octets
2	0x0A	1	Record Type Length: 10 octets
3	0x48 0x73	2	Record Type: “Hs”
5	0x12	1	Version Number: Major = 1, Minor = 2
6	0xD1	1	NDEF Record Header: MB=1b, ME=1b, CF=0b, SR=1b, IL=0b, TNF=001b
7	0x02	1	Record Type Length: 2 octets
8	0x04	1	Payload Length: 4 octets
9	0x61 0x63	2	Record Type: “ac”
11	0x01	1	Carrier Flags: CPS=1, "active"
12	0x01	1	Carrier Data Reference Length: 1 octet
13	0x30	1	Carrier Data Reference: “0”
14	0x00	1	Auxiliary Data Reference Count: 0
15	0x5A	1	NDEF Record Header: MB=0b, ME=1b, CF=0b, SR=1b, IL=1b, TNF=010b
16	0x20	1	Record Type Length: 32 octets
17	0x43	1	Payload Length: 67 octets
18	0x01	1	Payload ID Length: 1 octet
19	0x61 0x70 0x70 0x6C 0x69 0x63 0x61 0x74 0x69 0x6F 0x6E 0x2F 0x76 0x6E 0x64 0x2E 0x62 0x6C 0x75 0x65 0x74 0x6F 0x6F 0x74 0x68 0x2E 0x65 0x70 0x2E 0x6F 0x6F 0x62	32	Record Type Name: application/vnd.bluetooth.ep.oob
51	0x30	1	Payload ID: “0”
52	0x43 0x00	2	Bluetooth OOB Data Length: 67 octets
54	0x03 0x07 0x80 0x88 0xbf 0x01	6	Bluetooth Device Address: 01:bf:88:80:07:03
60	0x04	1	EIR Data Length (4 octets)
61	0x0D	1	EIR Data Type: Class of Device
62	0x80 0x06 0x04	3	Class of device: 0x04: Service class = Rendering 0x06: Major Device class = Imaging 0x80: Minor Device class = Printer
65	0x11	1	EIR Data Length: 17 octets
66	0x0E	1	EIR Data Type: Simple Pairing Hash C
67	0x0F 0x0E 0x0D 0x0C 0x0B 0x0A 0x09 0x08 0x07 0x06 0x05 0x04 0x03 0x02 0x01 0x00	16	Simple Pairing Hash C: 0x000102030405060708090A0B0C0D0E0F

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
83	0x11	1	EIR Data Length: 17 octets
84	0x0F	1	EIR Data Type: Simple Pairing Randomizer R
85	0x0F 0x0E 0x0D 0x0C 0x0B 0x0A 0x09 0x08 0x07 0x06 0x05 0x04 0x03 0x02 0x01 0x00	16	Simple Pairing Randomizer R: 0x000102030405060708090A0B0C0D0E0F
101	0x05	1	EIR Data Length: 5 octets
102	0x03	1	EIR Data Type: 16-bit Service Class UUID list (complete)
103	0x18 0x11 0x23 0x11	4	16-bit Service Class UUID list (complete): 0x1118 – Direct Printing 0x1123 – Printing Status
107	0x0B	1	EIR Data Length: 11 octets
108	0x09	1	EIR Data Type: Complete Local Name
109	0x44 0x65 0x76 0x69 0x63 0x65 0x4e 0x61 0x6d 0x65	10	Bluetooth Local Name: DeviceName

4.1.2 LE Example

Figure 3 shows a Handover Request Message from a device with only Bluetooth LE communication capability using the mime-type “application/vnd.bluetooth.le.oob”.

Table 8 describes a Handover Request Message from a generic computer. In this example the Public Address is used in the LE Bluetooth Device Address data type. The LE Role data type states both peripheral and central role capabilities with the central role as the preferred one.

In a Negotiated Handover scenario, conflicting roles may be resolved by retransmitting the Handover Request message with new LE Role preference. If two devices have the same role preferences and both have peripheral and central role capabilities, the Handover Requester should change its role.

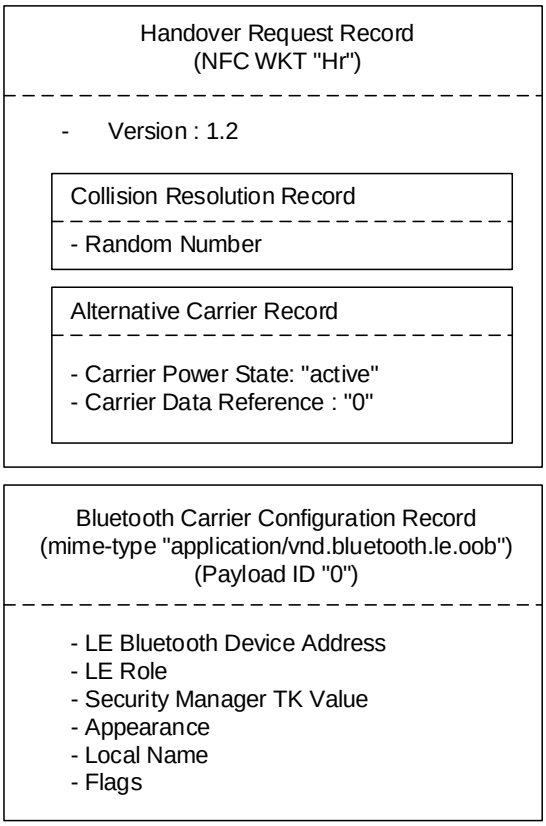

Figure 3: Bluetooth LE Handover Request Message

Note that the Bluetooth Carrier Configuration Record might contain only the LE Bluetooth Device Address data type and the LE Role data type.

Table 8: Binary Content of a Bluetooth LE Handover Request Message

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
0	0x91	1	NDEF record header: MB=1b ME=0b CF=0b SR=1b IL=0b TNF=001b
1	0x02	1	NDEF record type length = 2 octets
2	0x11	1	NDEF payload length = 17 octets
3	0x48 0x72	2	Record type = ‘Hr’
5	0x12	1	Connection Handover specification version 1.2
6	0x91	1	NDEF Record Header: MB=1b, ME=0b, CF=0b, SR=1b, IL=0b, TNF=001b
7	0x02	1	Record Type Length: 2 octets
8	0x02	1	Payload Length: 2 octets
9	0x63 0x72	2	Record Type: “cr”
11	0x01 0x02	2	Random Number: 0x01 0x02
13	0x51	1	NDEF record header: MB=0b ME=1b CF=0b SR=1b IL=0b TNF=001b

Offset (Octets)	Content	Length (Octets)	Explanation
14	0x02	1	NDEF record type length = 2 octets
15	0x04	1	NDEF payload length = 4 octets
16	0x61 0x63	2	Record Type ‘ac’ alternative carrier
18	0x01	1	Carrier Flags: CPS=1 “active”
19	0x01	1	Carrier Date Reference Length: 1 octet
20	0x30	1	Carrier data reference = “0”
21	0x00	1	Auxiliary Data Reference Count: 0
22	0x5A	1	NDEF record header: MB=0b ME=1b CF=0b SR=1b IL=1b TNF=010b
23	0x20	1	NDEF Record Type length 32 octets
24	0x31	1	NDEF Payload length = 49 octets
25	0x01	1	ID length
26	0x61 0x70 0x70 0x6C 0x69 0x63 0x61 0x74 0x69 0x6F 0x6E 0x2F 0x76 0x6E 0x64 0x2E 0x62 0x6C 0x75 0x65 0x74 0x6F 0x6F 0x74 0x68 0x2E 0x6c 0x65 0x2E 0x6F 0x6F 0x62	32	Record Type Name: application/vnd.bluetooth.le.oob
58	0x30	1	Payload ID = 0
59	0x08	1	LE Bluetooth Device Address length: 8 octets
60	0x1B	1	LE Bluetooth Device Address data type
61	0x01 0x07 0x80 0x80 0xBF 0xA1 0x00	7	Bluetooth Device Address: Public Address A1:BF:80:80:07:01
68	0x02	1	LE Role Length: 2 octets
69	0x1C	1	LE Role data type
70	0x03	1	LE Role: Central and peripheral capabilities with the central role preferred.
71	0x11	1	Security Manager TK value length: 17 octets
72	0x10	1	Security Manager TK value data type
73	0x00 0x00 0x00 0x11 0x00 0x00 0x00 0x11 0x00 0x00 0x00 0x11 0x00 0x00 0x00 0x11	16	Security Manager TK value
89	0x03	1	Appearance length: 3 octets
90	0x19	1	Appearance data type
91	0x00 0x80	2	Appearance: Generic Computer
93	0x0B	1	Local name length: 11 octets
94	0x09	1	Local name data type
95	0x44 0x65 0x76 0x69 0x63 0x65 0x4e 0x61 0x6d 0x65	10	Local name Ascii: “DeviceName”
105	0x02	1	Flags length: 2 octets
106	0x01	1	Flags data type
107	0x06	1	Flags: LE General Discoverable Mode, BR/EDR not supported

Figure 4 shows a Handover Select Message returned by a Handover Selector that acknowledges a Bluetooth Low energy carrier.

Table 9 describes a Handover Select Message that can be returned by a keyboard supporting Bluetooth LE. In this example a resolvable private address is used in the LE Bluetooth Device Address data type. The LE Role states only peripheral capabilities. User friendly device name is set to “DeviceName” in the Local Name data type.

In a Negotiated Handover scenario, conflicting roles may be resolved if the Selector change its role. If two devices have the same role preferences and both have peripheral and central role capabilities the Handover Selector should keep its preferred role.

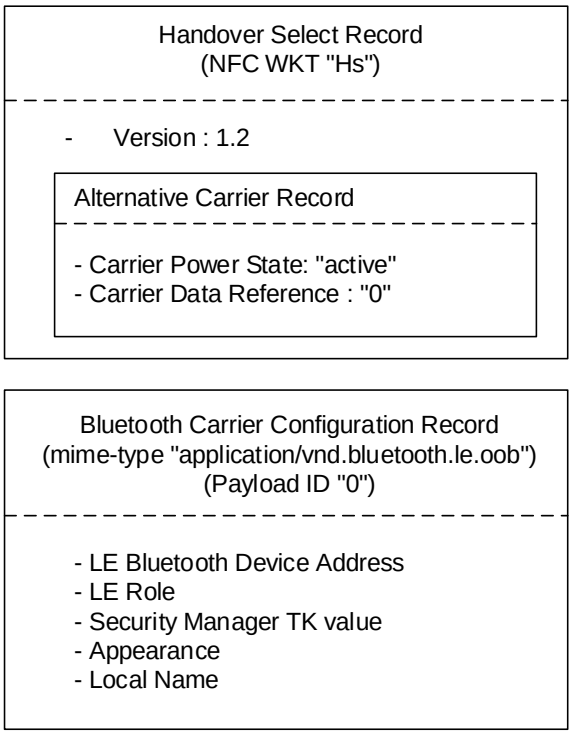

Figure 4: Bluetooth LE Handover Select Message

Table 9: Binary Content of a Bluetooth LE Handover Select Message

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
0	0x91	1	NDEF record header: MB=1b ME=0b CF=0b SR=1b IL=0b TNF=001b
1	0x02	1	NDEF record type length = 2 octets
2	0x0A	1	NDEF payload length = 10 octets
3	0x48 0x73	2	Record type = ‘Hs’
5	0x12	1	Connection Handover specification version 1.2
6	0xD1	1	NDEF record header: MB=1b ME=1b CF=0b SR=1b IL=0b TNF=001b

Offset (Octets)	Content	Length (Octets)	Explanation
7	0x02	1	NDEF record type length = 2 byte
8	0x04	1	NDEF payload length = 4 octets
9	0x61 0x63	2	Record Type “ac” alternative carrier
11	0x01	1	Carrier Flags CPS = 1 “active”
12	0x01	1	Carrier Data Reference Length: 1 octet
13	0x30	1	Carrier Data Reference: “0”
14	0x00	1	Auxiliary Data Reference Count: 0
15	0x5A	1	NDEF record header: MB=0b ME=1b CF=0b SR=1b IL=1b TNF=010b
16	0x20	1	Record Type Length 32 octets
17	0x2E	1	Payload Length = 46 octets
18	0x01	1	Payload ID Length: 1 octet
19	0x61 0x70 0x70 0x6C 0x69 0x63 0x61 0x74 0x69 0x6F 0x6E 0x2F 0x76 0x6E 0x64 0x2E 0x62 0x6C 0x75 0x65 0x74 0x6F 0x6F 0x74 0x68 0x2E 0x6c 0x65 0x2E 0x6F 0x6F 0x62	32	Record Type Name: application/vnd.bluetooth.le.oob
51	0x30	1	Payload ID = 0
53	0x08	1	LE Bluetooth Device Address length: 8 octets
53	0x1B	1	LE Bluetooth Device Address data type
54	0xC8 0xDC 0xF4 0x55 0x2A 0x77 0x01	7	Bluetooth Device Address: Resolvable Private Address: 77:2A:55:F4:DC:C8
61	0x02	1	LE Role Length: 2 octets
63	0x1C	1	LE Role data type
63	0x00	1	LE Role: Only peripheral capabilities
64	0x11	1	Security Manager TK value length: 17 octets
65	0x10	1	Security Manager TK value data type
66	0x00 0x00 0x00 0x11 0x00 0x00 0x00 0x11 0x00 0x00 0x00 0x11 0x00 0x00 0x00 0x11	16	Security Manager TK value
82	0x03	1	Appearance Length: 3 octets
83	0x19	1	Appearance data type
84	0x03 0xC1	2	Appearance: Keyboard
86	0x0B	1	Local name length: 11 octets
87	0x09	1	Local name data type
88	0x44 0x65 0x76 0x69 0x63 0x65 0x4e 0x61 0x6d 0x65	10	Local name Ascii: “DeviceName”

4.2 Static Handover

A Static Handover can be used in cases where the Handover Selector device is equipped with an NFC Forum Tag only. Therefore, it cannot actively reply to a Handover Request Message. A Handover Requester device detects this message during the NFC discovery phase and will then be able to read data from the NFC Forum Tag. If the data that is read embodies a Handover Select Message, the Handover Requester can use this information to choose one of the indicated alternative carriers and try to establish a secondary connection.

In principle, the Handover Select Message stored on a NFC Forum Tag is identical to a Handover Select Message returned by an active NFC Forum Device. However, due to the static nature of data on a tag, a pre-stored Handover Select Message will always have to indicate all available carriers because carriers cannot automatically be powered as a result of the NFC touch.

If alternative carriers cannot be ensured to be active, the carrier power state should be set to either “inactive” or “unknown”, which results in the behavior of the Handover requester as undefined. A possible strategy for the Handover requester could be to request the user to perform a manual activation for a carrier signaled as “inactive” and to first try and then possibly request manual activation for a carrier with “unknown” power state.

Dynamic carrier-specific protocol information, such as non-static IP addresses, cannot be provided.

4.2.1 BR/EDR Example

Figure 5 shows an example where Bluetooth configuration data is included into an Handover Select Message stored on an NFC Forum Tag.

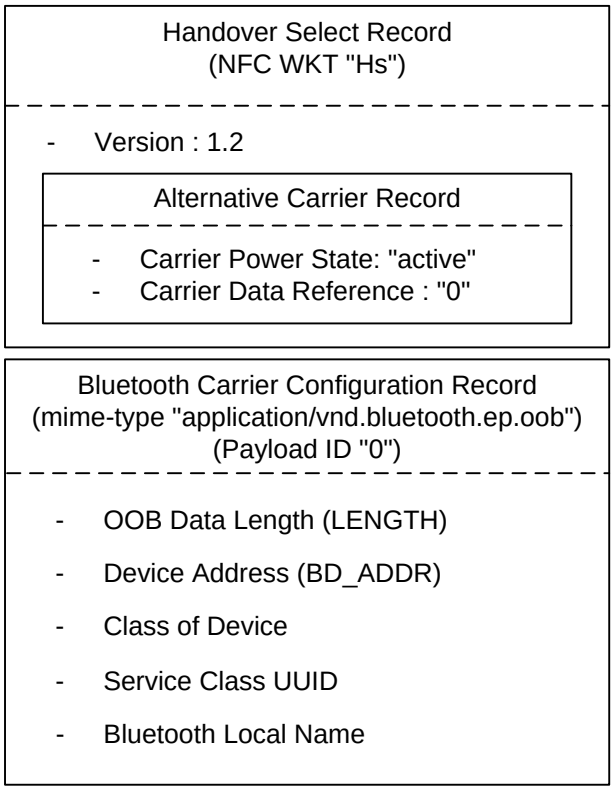

Figure 5: Bluetooth Configuration Data on NFC Forum Tag

In the example, the power state of Bluetooth carrier is indicated as “active” (that is, the Handover Requester device would expect both carriers to be operational and on-air).

The binary layout of a Handover Select Message for a Bluetooth carrier stored on an NFC Forum Tag is shown in Table 10, which presents the Bluetooth Configuration Data that can be advertised by a printer device that supports the Basic Printing Profile. It is worth noting that the Simple Pairing Hash C and Randomizer R are not present because of the inability to refresh the C and R values after each pairing attempt. More details about where C and R values are appropriate can be found in [BLUETOOTH_CORE], Volume 2, Part H, Section 7.2.2.

Table 10: Binary Content of a Sample Bluetooth Handover Select Message on an NFC Forum Tag

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
0	0x91	1	NDEF Record Header: MB=1b, ME=0b, CF=0b, SR=1b, IL=0b, TNF=001b
1	0x02	1	Record Type Length: 2 octets
2	0x0A	1	Record Type Length: 10 octets
3	0x48 0x73	2	Record Type: “Hs”
5	0x12	1	Version Number: Major = 1, Minor = 2
6	0xD1	1	NDEF Record Header: MB=1b, ME=1b, CF=0b, SR=1b, IL=0b, TNF=001b

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
7	0x02	1	Record Type Length: 2 octets
8	0x04	1	Payload Length: 4 octets
9	0x61 0x63	2	Record Type: “ac”
11	0x03	1	Carrier Flags: CPS=3, "unknown"
12	0x01	1	Carrier Data Reference Length: 1 octet
13	0x30	1	Carrier Data Reference: “0”
14	0x00	1	Auxiliary Data Reference Count: 0
15	0x5A	1	NDEF Record Header: MB=0b, ME=1b, CF=0b, SR=1b, IL=1b, TNF=010b
16	0x20	1	Record Type Length: 32 octets
17	0x1F	1	Payload Length: 31 octets
18	0x01	1	Payload ID Length: 1 octet
19	0x61 0x70 0x70 0x6C 0x69 0x63 0x61 0x74 0x69 0x6F 0x6E 0x2F 0x76 0x6E 0x64 0x2E 0x62 0x6C 0x75 0x65 0x74 0x6F 0x6F 0x74 0x68 0x2E 0x65 0x70 0x2E 0x6F 0x6F 0x62	32	Record Type Name: application/vnd.bluetooth.ep.oob
51	0x30	1	Payload ID: “0”
52	0x1F 0x00	2	Bluetooth OOB Data Length: 31 octets
54	0x03 0x07 0x80 0x88 0xbf 0x01	6	Bluetooth Device Address: 01:bf:88:80:07:03
60	0x04	1	EIR Data Length: 4 octets
61	0x0D	1	EIR Data Type: Class of Device
62	0x80 0x06 0x04	3	Class of Device: 0x04: Service class = Rendering 0x06: Major Device class = Imaging 0x80: Minor Device class = Printer
65	0x05	1	EIR Data Length: 5 octets
66	0x03	1	EIR Data Type: 16-bit Service Class UUID list (complete)
67	0x18 0x11 0x23 0x11	4	16-bit Service Class UUID list (complete): 0x1118 – Direct Printing 0x1123 – Printing Status
71	0x0B	1	EIR Data Length: 11 octets
72	0x09	1	EIR Data Type: Complete Local Name
73	0x44 0x65 0x76 0x69 0x63 0x65 0x4e 0x61 0x6d 0x65	10	Bluetooth Local Name: DeviceName

4.2.2 LE Example

Figure 6 shows an example of a Bluetooth LE configuration stored into a Handover Select Message stored on a NFC Forum Tag.

Table 11 describes a Handover Select Message stored on a NFC Forum Tag. In principle this message is identical to a Handover Select message returned by an active NFC Forum device in the negotiated handover scenario. However, the TK value is removed and a static private address is used due to the static behavior of a Tag.

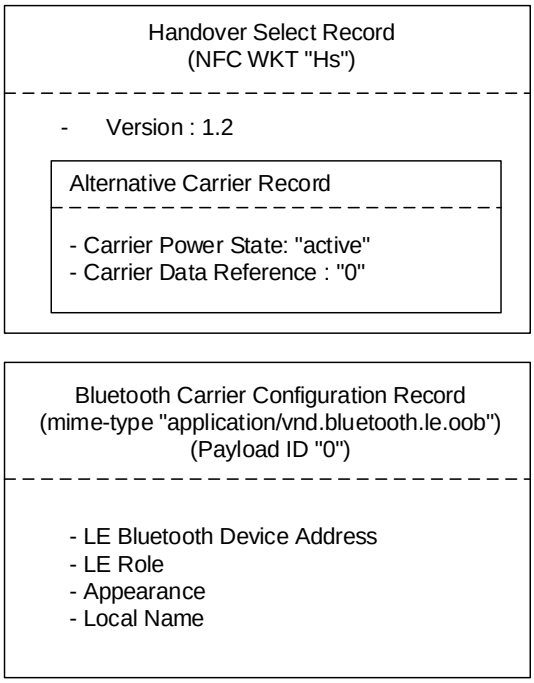

Figure 6: Bluetooth LE Configuration Data on NFC Forum Tag

Table 11: Binary Content of a Bluetooth LE Handover Select Message on an NFC Forum Tag

Offset (Octets)	Content	Length (Octets)	Explanation
0	0x91	1	NDEF record header: MB=1b ME=0b CF=0b SR=1b IL=0b TNF=001b
1	0x02	1	NDEF record type length = 2 octets
2	0x0A	1	NDEF payload length = 10 octets
3	0x48 0x73	2	Record type = ‘Hs’
5	0x12	1	Connection Handover specification version 1.2
6	0xD1	1	NDEF record header: MB=1b ME=1b CF=0b SR=1b IL=0b TNF=001b
7	0x02	1	NDEF record type length = 2 byte
8	0x04	1	NDEF payload length = 4 octets
9	0x61 0x63	2	Record Type “ac” alternative carrier
11	0x01	1	Carrier Flags CPS = 1 “active”

Offset (Octets)	Content	Length (Octets)	Explanation
12	0x01	1	Carrier Data Reference Length: 1 octet
13	0x30	1	Carrier Data Reference: “0”
14	0x00	1	Auxiliary Data Reference Count: 0
15	0x5A	1	NDEF record header: MB=0b ME=1b CF=0b SR=1b IL=1b TNF=010b
16	0x20	1	Record Type Length 32 octets
17	0x1C	1	Payload Length = 28 octets
18	0x01	1	Payload ID Length: 1 octet
19	0x61 0x70 0x70 0x6C 0x69 0x63 0x61 0x74 0x69 0x6F 0x6E 0x2F 0x76 0x6E 0x64 0x2E 0x62 0x6C 0x75 0x65 0x74 0x6F 0x6F 0x74 0x68 0x2E 0x6c 0x65 0x2E 0x6F 0x6F 0x62	32	Record Type Name: application/vnd.bluetooth.le.oob
51	0x30	1	Payload ID = 0
52	0x08	1	LE Bluetooth Device Address length: 8 octets
53	0x1B	1	LE Bluetooth Device Address data type
54	0x18 0x3B 0x4B 0x1C 0x3B 0xCA 0x01	7	Bluetooth Device Address: Static Address: CA:3B:1C:4B:3B:18
61	0x02	1	LE Role Length: 2 octets
62	0x1C	1	LE Role data type
63	0x00	1	LE Role: Only peripheral role capabilities
64	0x03	1	Appearance length: 3 octets
65	0x19	1	Appearance data type
66	0x03 0xC1	2	Appearance: Keyboard
68	0x0B	1	Local name length: 11 octets
69	0x09	1	Local name data type
70	0x44 0x65 0x76 0x69 0x63 0x65 0x4e 0x61 0x6d 0x65	10	Local name Data Ascii: “DeviceName”

4.3 Simplified Tag Format for a Single Bluetooth Carrier

In case a Handover Selector device would advertise only one alternative carrier (i.e., a Bluetooth carrier), a simplified format without the Handover Select record may be used. In this case, the NFC Forum Tag contains an NDEF message with only the Bluetooth OOB information.

4.3.1 BR/EDR Example

Figure 7 illustrates how Bluetooth configuration data is included in an NDEF message.

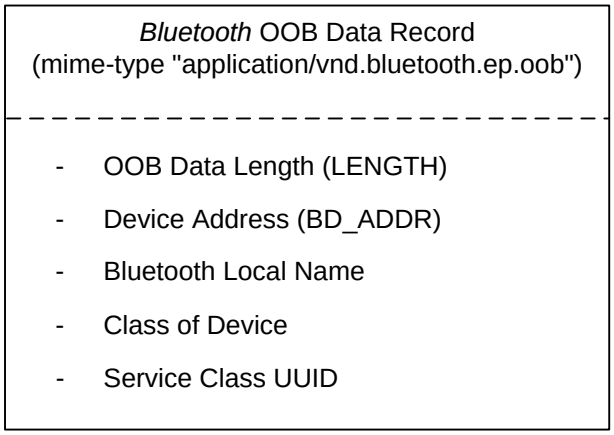

Figure 7: Bluetooth OOB Data on NFC Forum Tag

The binary layout of an NDEF message without the Handover Select Record for a Bluetooth carrier stored on an NFC Forum Tag is shown in Table 12. The Bluetooth Configuration Data is an example of a device indicating a type of headset, and it includes the following optional OOB data fields: the Class of Device, Complete Local Name, and Service Class UUID.

Table 12: Binary Content of a Sample Bluetooth OOB Data on an NFC Forum Tag

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
0	0xD2	1	NDEF Record Header: MB=1b, ME=1b, CF=0b, SR=1b, IL=0b, TNF=010b
1	0x20	1	Record Type Length: 32 octets
2	0x21	1	Payload Length: 33 octets
3	0x61 0x70 0x70 0x6C 0x69 0x63 0x61 0x74 0x69 0x6F 0x6E 0x2F 0x76 0x6E 0x64 0x2E 0x62 0x6C 0x75 0x65 0x74 0x6F 0x6F 0x74 0x68 0x2E 0x65 0x70 0x2E 0x6F 0x6F 0x62	32	Record Type Name: application/vnd.bluetooth.ep.oob
35	0x21 0x00	2	OOB Optional Data Length (33 octets)
37	0x06 0x05 0x04 0x03 0x02 0x01	6	Bluetooth Device Address: 01:02:03:04:05:06
43	0x0D	1	EIR Data Length: 13 octets

Offset (Octets)	Content	Length (Octets)	Explanation
44	0x09	1	EIR Data Type: Complete Local Name
45	0x48 0x65 0x61 0x64 0x53 0x65 0x74 0x20 0x4E 0x61,0x6D 0x65	12	Bluetooth Local Name HeadSet Name
57	0x04	1	EIR Data Length: 4 octets
58	0x0D	1	EIR Data Type: Class of Device
59	0x04 0x04 0x20	3	Class of Device: • 0x20: Service class = Audio • 0x04: Major Device class = Audio/Video • 0x04: Minor Device class = Wearable Headset Device
62	0x05	1	EIR Data Length: 5 octets
63	0x03	1	EIR Data Type: 16-bit Service Class UUID list (complete)
64	0x1E 0x11 0x0B 0x11	4	16-bit Service Class UUID list (complete): 0x111E – HFP-HF 0x110B - A2DP-SNK

4.3.2 LE Example

Figure 8 illustrates how Bluetooth LE configuration data is included in an NDEF message for the simplified Tag format.

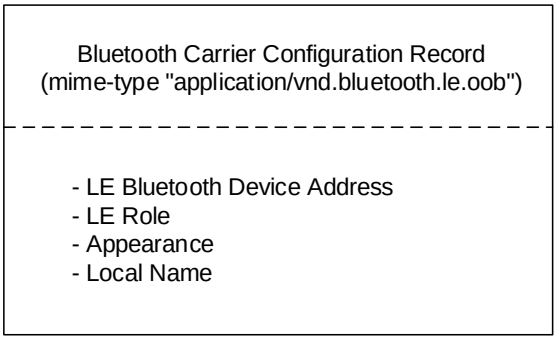

Figure 8: Bluetooth LE OOB Data on NFC Forum Tag

The binary layout of the simplified Tag format is shown in Table 13. The example is a Bluetooth LE configured mouse with local name set as “DeviceName” with only peripheral role capabilities. Static private address is used.

Table 13: Binary Content of a Bluetooth *LE* OOB Data on an NFC Forum Tag

Offset (Octets)	Content	Length (Octets)	Explanation
0	0xD2	1	NDEF record header: MB=1b ME=1b CF=0b SR=1b IL=0b TNF=010b
1	0x32	1	Record Type Length 32 octets

Offset (Octets)	**Content**	**Length** (Octets)	**Explanation**
2	0x1C	1	Payload Length = 28 octets
3	0x61 0x70 0x70 0x6C 0x69 0x63 0x61 0x74 0x69 0x6F 0x6E 0x2F 0x76 0x6E 0x64 0x2E 0x62 0x6C 0x75 0x65 0x74 0x6F 0x6F 0x74 0x68 0x2E 0x6c 0x65 0x2E 0x6F 0x6F 0x62	32	Record Type Name: application/vnd.bluetooth.le.oob
35	0x08	1	LE Bluetooth Device Address length: 8 octets
36	0x1B	1	LE Bluetooth Device Address data type
37	0x18 0x3B 0x4B 0x1C 0x3B 0xCA 0x01	7	Bluetooth Device Address: Static Address: CA:3B:1C:4B:3B:18
44	0x02	1	LE Role Length: 2 octets
45	0x1C	1	LE Role data type
46	0x00	1	LE Role: Only peripheral role capabilities
47	0x03	1	Appearance Length: 3 octets
48	0x19	1	Appearance data type
49	0x03 0xC2	2	Appearance Data: Mouse
51	0x0B	1	Local Name length: 11 octets
52	0x09	1	Local Name data type
53	0x44 0x65 0x76 0x69 0x63 0x65 0x4e 0x61 0x6d 0x65	10	Local Name Ascii: “DeviceName”

A. Revision History

The following table outlines the revision history of Bluetooth® Secure Simple Pairing Using NFC.

Table 14: Revision History

Document Name	Revision and Release Date	Status	Change Notice	Supersedes
Bluetooth® Secure Simple Pairing Using NFC Application Note	Version 1.0, October 2011	Final	None	
Bluetooth® Secure Simple Pairing Using NFC Application Note	Version 1.0.1, October 2012	Final	Removes license restrictions; small editorial changes	Version 1.0
Bluetooth® Secure Simple Pairing Using NFC Application Note	Version 1.1, January 2014	Final		Version 1.1