



Supplement to the Bluetooth Core Specification

Bluetooth® Specification

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- **Group Prepared By:** Core Specification Working Group

Abstract:

This supplement contains information related to data types, common Profile and Service error codes, and enumerates the services permitted to use Security Mode 4 Level 0.





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Language and Other Conventions

The conventions in [Vol 1] Part E apply to the Supplement to the Bluetooth Core Specification.

Version History

Revision	Date	Comment
v1	2011-12-27	Initial version.
v2	2012-07-24	Add Common Profile and Service Error Codes.
v3	2013-02-12	Add Advertising Interval data type. Add Services Permitted to Use Security Mode 4 Level 0.
v4	2013-12-03	Add LE Bluetooth Device Address data type. Add LE Role data type. Add BR/EDR Secure Connections support. Adopted along with Core v4.1.
v5	2014-12-02	Add LE Secure Connections support. Adopted along with Core v4.2.
v6	2015-07-14	Add Uniform Resource Identifier (URI) data type.
v7	2016-12-06	Add Write Request Rejected Common Profile and Service Error Code. Add LE Supported Features data type. Add Channel Map Update Indication data type. Add Table 1.1 that contains requirements on where the different data types can appear. Errata integrated: 6528, 6610, 6695, 7008, 7019, 7117, 7377, 7510, 8057 Adopted along with Core v5.0.
v8	2019-01-21	Errata integrated: 8634, 8635 Issues integrated: 9540, 9988, 10280, 10910, 11020 Adopted along with Core v5.1.
v9	2019-12-31	Add BIGInfo data type. Add Broadcast_Code data type. Erratum integrated: 11533 Issue integrated: 11019 Adopted along with Core v5.2.



Revision	Date	Comment
v10	2021-07-13	Errata integrated: 12064, 13416, 15039, 15064, 15498, 15583 Issues integrated: 12596, 13592, 15851, 16671 Updated terminology to remove inappropriate language. ¹ Adopted along with Core v5.3.
v11	2023-01-31	Errata integrated: 17332, 17430, 17888, 17926, 18737, 20357 Issues integrated: 18566, 18567, 18835, 18989, 19026, 19043, 19070, 22281, 22374, 22445 Add Encrypted Data data type. Add Periodic Advertising with Responses. Adopted along with Core v5.4.

1. Certain terms that were identified as inappropriate have been replaced. As a consequence, some other terms have also been changed to retain consistency and some HCI command and event names had consequential changes. For a list of the original terms and names and their replacements, see the Appropriate Language Mapping Tables, <https://www.bluetooth.com/language-mapping/Appropriate-Language-Mapping-Table>.



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1 DATA TYPES DEFINITIONS AND FORMATS

This part defines the basic data types used for Extended Inquiry Response (EIR), Advertising Data (AD), Scan Response Data (SRD), Additional Controller Advertising Data (ACAD), and OOB data blocks. Additional data types may be defined in profile specifications.

Each data type shall only be used in accordance with the requirements specified in [Table 1.1](#).

Data type	Context				
	EIR	AD	SRD	ACAD	OOB
Service UUID	O	O	O	O	O
Local Name	C.1	C.1	C.1	X	C.1
Flags	C.1	C.1	X	X	C.1
Manufacturer Specific Data	O	O	O	O	O
TX Power Level	O	O	O	X	O
Secure Simple Pairing OOB	X	X	X	X	O
Security Manager OOB	X	X	X	X	O
Security Manager TK Value	X	X	X	X	O
Peripheral Connection Interval Range	X	O	O	X	O
Service Solicitation	X	O	O	X	O
Service Data	X	O	O	O	O
Appearance	X	C.2	C.2	X	C.1
Public Target Address	X	C.2	C.2	X	C.1
Random Target Address	X	C.2	C.2	X	C.1
Advertising Interval	X	C.1	C.1	X	C.1
LE Bluetooth Device Address	X	X	X	X	C.1
LE Role	X	X	X	X	C.1
Uniform Resource Identifier	O	O	O	X	O
LE Supported Features	X	C.1	C.1	X	C.1
Channel Map Update Indication	X	X	X	C.1	X
BIGInfo	X	X	X	C.1	X
Broadcast_Code	X	X	X	X	O

Table 1.1: Permitted usages for data types



Data type	Context				
	EIR	AD	SRD	ACAD	OOB
Encrypted Data	O	O	O	X	O
Periodic Advertising Response Timing Information	X	X	X	O	X

Table 1.1: Permitted usages for data types

- O: Optional in this context (may appear more than once in a block).
- C.1: Optional in this context; shall not appear more than once in a block.
- C.2: Optional in this context; shall not appear more than once in a block and shall not appear in both the AD and SRD of the same extended advertising interval.
- X: Reserved for future use.

The values for the data types are listed in [Assigned Numbers](#). In the format descriptions, the name of the data type (e.g., «Flags») is followed by the type of the value as defined in [Vol 1] Part E, Section 2.9.

1.1 SERVICE UUID

GAP and GATT service UUIDs should not be included in a Service UUIDs AD type, for either a complete or incomplete list.

1.1.1 Description

The Service UUID data type is used to include a list of Service or Service Class UUIDs.

There are six data types defined for the three sizes of Service UUIDs that may be returned:

- 16-bit Bluetooth Service UUIDs
- 32-bit Bluetooth Service UUIDs
- Global 128-bit Service UUIDs

Two Service UUID data types are assigned to each size of Service UUID. One Service UUID data type indicates that the Service UUID list is incomplete and the other indicates the Service UUID list is complete.

A packet or data block shall not contain more than one instance for each Service UUID data size. If a device has no Service UUIDs of a certain size, 16-, 32-, or 128-bit, the corresponding field in the extended inquiry response or advertising data packet shall be marked as complete with no Service UUIDs. An omitted Service UUID data type shall be interpreted as an empty incomplete-list.



16-bit and 32-bit UUIDs shall only be used if they are assigned by the Bluetooth SIG. The Bluetooth SIG may assign 16-bit and 32-bit UUIDs to member companies or organizations.

1.1.2 Format

Data Type	Description
«Incomplete List of 16-bit Service UUIDs» <i>UUID16[]</i>	More 16-bit Service UUIDs available
«Complete List of 16-bit Service UUIDs» <i>UUID16[]</i>	Complete list of 16-bit Service UUIDs
«Incomplete List of 32-bit Service UUIDs» <i>UUID32[]</i>	More 32-bit Service UUIDs available
«Complete List of 32-bit Service UUIDs» <i>UUID32[]</i>	Complete list of 32-bit Service UUIDs
«Incomplete List of 128-bit Service UUIDs» <i>UUID128[]</i>	More 128-bit Service UUIDs available
«Complete List of 128-bit Service UUIDs» <i>UUID128[]</i>	Complete list of 128-bit Service UUIDs

Table 1.2: Service UUID data types

1.2 LOCAL NAME

1.2.1 Description

The Local Name data type shall be the same as, or a shortened version of, the local name assigned to the device. The Local Name data type value indicates if the name is complete or shortened. If the name is shortened, the complete name can be read using the remote name request procedure over BR/EDR or by reading the device name characteristic after the connection has been established using GATT.

A shortened name shall only contain contiguous characters from the beginning of the full name. For example, if the device name is 'BT_Device_Name' then the shortened name could be 'BT_Device' or 'BT_Dev'.

1.2.2 Format

Data Type	Description
«Shortened Local Name» <i>utf8s</i>	Shortened local name
«Complete Local Name» <i>utf8s</i>	Complete local name

Table 1.3: Local Name data types



1.3 FLAGS

1.3.1 Description

The Flags data type contains one bit Boolean flags. The Flags data type shall be included when any of the Flag bits are non-zero and the advertising packet is connectable, otherwise the Flags data type may be omitted. All 0x00 octets after the last non-zero octet shall be omitted from the value transmitted.

Note: If the Flags AD type is not present in a non-connectable advertisement, the Flags should be considered as unknown and no assumptions should be made by the scanner.

Flags used over the LE physical channel are:

- Limited Discoverable Mode
- General Discoverable Mode
- BR/EDR Not Supported
- Simultaneous LE and BR/EDR to Same Device Capable (Controller)

The LE Limited Discoverable Mode and LE General Discoverable Mode flags shall be ignored when received over the BR/EDR physical channel. The 'BR/EDR Not Supported' flag shall be set to 0 when sent over the BR/EDR physical channel.

1.3.2 Format

The Flags field may be zero or more octets long. This allows the Flags field to be extended while using the minimum number of octets within the data packet.

Data Type	Bit	Description
«Flags» <i>boolean[]</i>	0	LE Limited Discoverable Mode
	1	LE General Discoverable Mode
	2	BR/EDR Not Supported. Bit 37 of LMP Feature Mask Definitions (Page 0)
	3	Simultaneous LE and BR/EDR to Same Device Capable (Controller). Bit 49 of LMP Feature Mask Definitions (Page 0)
	4	Previously Used

Table 1.4: Flags data types



1.4 MANUFACTURER SPECIFIC DATA

1.4.1 Description

The Manufacturer Specific data type is used for manufacturer specific data. The first two data octets shall contain a company identifier from [Assigned Numbers](#). The interpretation of any other octets within the data shall be defined by the manufacturer specified by the company identifier.

1.4.2 Format

Data Type	Description
«Manufacturer Specific Data» <i>uint16</i> , which may be followed by <i>struct</i>	The first value contains the Company Identifier Code. Any remainder contains manufacturer specific data.

Table 1.5: Manufacturer Specific data type

1.5 TX POWER LEVEL

1.5.1 Description

The TX Power Level data type indicates the transmitted power level of the packet containing the data type. The TX Power Level should be the radiated power level. If the power level is included in a TxPower field (see [Vol 6] Part B, Section 2.3.4.7), then the Controller should set the value to be as accurate as possible. If the Controller is aware that the power level varies across frequencies, then it should update the value depending on the frequency that the packet is being sent on. If the power level is included in a «TX Power Level» AD Structure (see [Vol 3] Part C, Section 11) created by the Host, then the Host should set the value to be as accurate as possible.

The TX Power Level data type may be used to calculate path loss on a received packet using the following equation:

$$\text{pathloss} = \text{Tx Power Level} - \text{RSSI}$$

where “RSSI” is the received signal strength, in dBm, of the packet received.

For example, if Tx Power Level = +4 (dBm) and the RSSI on the received packet is -60 (dBm) then the total path loss is +4 – (-60) = +64 dB. If a second packet were received at -40 dBm with a Tx Power Level data type = +15 dBm the resulting pathloss would be +55 dB. An application could use these pathloss values to choose which device it thinks might be closer (the one with the lower pathloss value).

Unfortunately, due to fading and varying antenna, circuit, and chip characteristics, these resulting pathloss values will have uncertainty. Some of



the uncertainty (for example, due to fading) may be able to be removed if multiple packets are received from the same device.

Note: When the TX Power Level data type is not present, the TX power level of the packet is unknown.

1.5.2 Format

Data Type	Description
«TX Power Level» <i>sint8</i>	0xXX: -127 to +127 dBm

Table 1.6: TX Power Level data type

1.6 SECURE SIMPLE PAIRING OUT OF BAND (OOB)

1.6.1 Description

The Secure Simple Pairing Out of Band data types enable an out of band mechanism to communicate discovery information as well as other information related to the pairing process.

1.6.2 Format

The Secure Simple Pairing Out of Band data types shall be encapsulated in a OOB data block as defined in [Vol 3] Part C, Section 5.2.2.7. The optional data types in the OOB block are described in [Table 1.7](#).

Data Type	Description
«Class of Device» <i>uint24</i>	Format defined in Assigned Numbers
«Secure Simple Pairing Hash C-192» <i>uint128</i>	Commitment value specified in [Vol 2] Part H, Section 7.2.2.
«Secure Simple Pairing Randomizer R-192» <i>uint128</i>	Random number used in [Vol 2] Part H, Section 7.2.2.
«Secure Simple Pairing Hash C-256» <i>uint128</i>	Commitment value specified in [Vol 2] Part H, Section 7.2.2.
«Secure Simple Pairing Randomizer R-256» <i>uint128</i>	Random number used in [Vol 2] Part H, Section 7.2.2.
«LE Secure Connections Confirmation Value» <i>uint128</i>	Confirm value specified in [Vol 3] Part H, Section 2.3.5.6.4.
«LE Secure Connections Random Value» <i>uint128</i>	Random number used in [Vol 3] Part H, Section 2.3.5.6.4.

Table 1.7: Data types for OOB data block optional parts



1.7 SECURITY MANAGER OUT OF BAND (OOB)

1.7.1 Description

The Security Manager Out of Band data type allows an out of band mechanism to be used by the Security Manager to communicate discovery information as well as other information related to the pairing process.

1.7.2 Format

Data Type	Bit	Description
«Security Manager Out of Band Flag» <i>boolean[8]</i>	0	OOB Flags Field (0 = OOB data not present, 1 = OOB data present)
	1	LE supported (Host) (i.e. bit 65 of LMP Extended Feature bits Page 1)
	2	Previously Used
	3	Address type (0 = Public Address, 1 = Random Address)

Table 1.8: Security Manager OOB Flags data type

1.8 SECURITY MANAGER TK VALUE

1.8.1 Description

The Security Manager TK Value data type allows an out of band mechanism to be used by the Security Manager to communicate the TK value.

1.8.2 Format

Data Type	Description
«Security Manager TK Value» <i>uint128</i>	Temporary key used in pairing over LE Physical channel; see [Vol 3] Part H, Section 2.3.

Table 1.9: Security Manager TK Value data type

1.9 PERIPHERAL CONNECTION INTERVAL RANGE

1.9.1 Description

The Peripheral Connection Interval Range data type contains the Peripheral's preferred connection interval range, for all logical connections. See [Vol 3] Part C, Section 12.3.



Note: The minimum value depends on the battery considerations of the Peripheral and the maximum connection interval depends on the buffers available on the Peripheral.

The Central should use the information from the Peripheral Connection Interval Range data provided by the Peripheral when establishing a connection.

Note: Central and Peripheral are GAP roles as defined in [Vol 3] Part C, Section 2.2.2.

1.9.2 Format

Data Type	Description
«Peripheral Connection Interval Range» <i>uint16[2]</i>	<p>The first value defines the minimum value for the connection interval in the following manner:</p> $\text{connInterval}_{min} = \text{Conn_Interval_Min} \times 1.25 \text{ ms}$ <p>Conn_Interval_Min range: 0x0006 to 0x0C80 Value of 0xFFFF indicates no specific minimum. Values not defined above are reserved for future use.</p> <p>The second value defines the maximum value for the connection interval in the following manner:</p> $\text{connInterval}_{max} = \text{Conn_Interval_Max} \times 1.25 \text{ ms}$ <p>Conn_Interval_Max range: 0x0006 to 0x0C80 Conn_Interval_Max shall be equal to or greater than the Conn_Interval_Min. Value of 0xFFFF indicates no specific maximum. Values not defined above are reserved for future use.</p>

Table 1.10: Peripheral Connection Interval Range data type

1.10 SERVICE SOLICITATION

1.10.1 Description

A Peripheral may send the Service Solicitation data type to invite Centrals that expose one or more of the services specified in the Service Solicitation data to connect. The Peripheral should be in the undirected connectable mode and in one of the discoverable modes. This enables a Central providing one or more of these services to connect to the Peripheral, so that the Peripheral can use the services on the Central.

Note: Central and Peripheral are GAP roles as defined in [Vol 3] Part C, Section 2.2.2.



1.10.2 Format

Data Type	Description
«List of 16 bit Service Solicitation UUIDs» <i>UUID16[]</i>	List of 16 bit Service Solicitation UUIDs
«List of 32 bit Service Solicitation UUIDs» <i>UUID32[]</i>	List of 32 bit Service Solicitation UUIDs
«List of 128 bit Service Solicitation UUIDs» <i>UUID128[]</i>	List of 128 bit Service Solicitation UUIDs

Table 1.11: Service Solicitation UUID data types

1.11 SERVICE DATA

1.11.1 Description

The Service Data data type consists of a service UUID with the data associated with that service.

1.11.2 Format

Data Type	Description
«Service Data - 16 bit UUID» <i>UUID16</i> , which may be followed by <i>struct</i>	The first value contains the 16 bit Service UUID. Any remainder contains additional service data.
«Service Data - 32 bit UUID» <i>UUID32</i> , which may be followed by <i>struct</i>	The first value contains the 32 bit Service UUID. Any remainder contains additional service data.
«Service Data - 128 bit UUID» <i>UUID128</i> , which may be followed by <i>struct</i>	The first value contains the 128 bit Service UUID. Any remainder contains additional service data.

Table 1.12: Service Data data types

1.12 APPEARANCE

1.12.1 Description

The Appearance data type defines the external appearance of the device.

This value shall be the same as the Appearance characteristic, as defined in [Vol 3] Part C, Section 12.2.



1.12.2 Format

Data Type	Description
«Appearance» <i>uint16</i>	The Appearance value shall be the enumerated value as defined by Assigned Numbers .

Table 1.13: Appearance data type

1.13 PUBLIC TARGET ADDRESS

1.13.1 Description

The Public Target Address data type defines the address of one or more intended recipients of an advertisement when one or more devices were bonded using a public address. This data type is intended to be used to avoid a situation where a bonded device unnecessarily responds to an advertisement intended for another bonded device.

1.13.2 Format

Data Type	Description
«Public Target Address» <i>uint48[]</i>	The format of each address is the same as the Public Device Address defined in [Vol 6] Part B, Section 1.3.

Table 1.14: Public Target Address data type

1.14 RANDOM TARGET ADDRESS

1.14.1 Description

The Random Target Address data type defines the address of one or more intended recipients of an advertisement when one or more devices were bonded using a random address. This data type is intended to be used to avoid a situation where a bonded device unnecessarily responds to an advertisement intended for another bonded device.

1.14.2 Format

Data Type	Description
«Random Target Address» <i>uint48[]</i>	The format of each address is the same as the Random Device Address defined in [Vol 6] Part B, Section 1.3.

Table 1.15: Random Target Address data type



1.15 ADVERTISING INTERVAL

1.15.1 Description

The Advertising Interval data type contains the *advInterval* value as defined in [Vol 6] Part B, Section 4.4.2.2.

If *advInterval* is less than 40.96 s, the «Advertising Interval - long» data type shall not be used. If *advInterval* is 40.96 s or greater, the «Advertising Interval - long» data type shall be used.

1.15.2 Format

Data Type	Description
«Advertising Interval» <i>uint16</i>	Units: 0.625 ms <i>advInterval</i> value
«Advertising Interval - long» <i>uint24</i> or <i>uint32</i>	Units: 0.625 ms <i>advInterval</i> value

Table 1.16: Advertising Interval data type

1.16 LE BLUETOOTH DEVICE ADDRESS

1.16.1 Description

The LE Bluetooth Device Address data type defines the device address of the local device and the address type on the LE transport.

1.16.2 Format

Data Type	Description
«LE Bluetooth Device Address» <i>uint48</i> followed by <i>boolean</i>	The first value is the Device Address defined in [Vol 6] Part B, Section 1.3. The second value indicates whether the Device Address is a Public Address or a Random Address: 0 = Public Device Address 1 = Random Device Address.

Table 1.17: Bluetooth Device Address data type

1.17 LE ROLE

1.17.1 Description

The LE Role data type defines the LE role capabilities of the device.



1.17.2 Format

Data Type	Value	Description
«LE Role» <i>uint8</i>	0x00	Only Peripheral Role supported
	0x01	Only Central Role supported
	0x02	Peripheral and Central Role supported, Peripheral Role preferred for connection establishment
	0x03	Peripheral and Central Role supported, Central Role preferred for connection establishment
	0x04 to 0xFF	Reserved for future use

Table 1.18: LE Role data type

1.18 UNIFORM RESOURCE IDENTIFIER (URI)

1.18.1 Description

The URI data type allows the representation of a URI, as defined in [IETF STD 66](#). The URI data type is encoded using UTF-8. To help with compression, the first UTF-8 code point in the URI data type value represents a scheme name string, as defined below. All other UTF-8 code points in the URI data type shall be appended to the decompressed scheme name string and the result forms the URI.

The mapping of scheme name strings to UTF-8 code points is defined in [Assigned Numbers](#). Only permanent and provisional schemes, as defined by the IETF (see <http://www.iana.org/assignments/uri-schemes.html>), shall be assigned a scheme name and corresponding code point.

The code point of U+0001 shall be used when the scheme used is not defined as either a permanent or provisional scheme. This code point maps to the empty scheme name string.

When U+0001 is used, the actual scheme and ":" shall be included in the remaining UTF-8 code points. Except for the special case of U+0001, the decompressed scheme name string includes the ":" that separates the scheme from the remainder (the "hier-part") of the URI.

1.18.2 Format

Data Type	Description
«URI» <i>utf8s</i>	Scheme name string and URI as a UTF-8 string

Table 1.19: URI data type



1.19 LE SUPPORTED FEATURES

1.19.1 Description

The LE Supported Features data type defines the LE features supported by the device. All 0x00 octets after the last non-zero octet shall be omitted from the value transmitted. This allows the LE Supported Features to be represented while using the minimum number of octets within the data packet.

1.19.2 Format

Data Type	Description
«LE Supported Features» <i>boolean[]</i>	Each value corresponds to the bit with the same position in the FeatureSet defined in [Vol 6] Part B, Section 4.6.

Table 1.20: LE Supported Features data type

1.20 CHANNEL MAP UPDATE INDICATION

1.20.1 Description

The channel map (*channelMap*) used for periodic advertisements may be updated at any time by the advertiser. The advertiser can update the channel map by sending the Channel Map Update Indication data type in the extended header of the packet containing the AUX_SYNC_IND or AUX_SYNC_SUBEVENT_IND PDU. The advertiser's Host may provide an initial channel map using the HCI_LE_Set_Host_Channel_Classification command; however the advertiser's Controller can update the channels that were marked as unknown by the Host in the channel map based on channel assessments without being requested to by the Host. The Channel Map Update Indication data type shall only be present in the extended header of the packet containing the AUX_SYNC_IND or AUX_SYNC_SUBEVENT_IND PDU.

The channel map used before the instant is known as *channelMap_{OLD}*. The channel map contained in the Channel Map Update Indication data type and used at the instant and after, is known as *channelMap_{NEW}*.

The Instant field shall be used to indicate the *paEventCount* value when *channelMap_{NEW}* shall apply; this value is called the instant.

Upon first transmission of the data type the advertiser should allow a minimum of 6 periodic advertising intervals before the instant occurs.

When the value of *paEventCount* is equal to the Instant field, the *channelMap_{NEW}* shall become the current *channelMap*. The *lastUnmappedChannel* shall not be reset. If the *unmappedChannel* is an unused channel, then the *channelMap_{NEW}* will be used when remapping. The only parameter that changes is the *channelMap*.



The advertiser shall not send a new Channel Map Update Indication data type before the instant.

1.20.2 Format

Data Type	Octets	Description
«Channel Map Update Indication» <i>boolean</i> [37] followed by <i>uint16</i>	0-4	ChM
	5-6	Instant

Table 1.21: Channel Map Update Indication data type

The ChM field shall contain the channel map indicating *Used* and *Unused* data channels. The format of this field is identical to the ChM field in the CONNECT_IND PDU (see [Vol 6] Part B, Section 2.3.3.1).

The Instant field shall be set to indicate the instant as described in [Section 1.20.1](#).

1.21 BIGINFO

1.21.1 Description

The BIGInfo data type contains the necessary information for a Synchronized Receiver to synchronize to a BIG that is being broadcast by an Isochronous Broadcaster.

1.21.2 Format

The format for BIGInfo is described in [Vol 6] Part B, Section 4.4.6.11.

1.22 BROADCAST_CODE

1.22.1 Description

The Broadcast_Code data type contains the string format of the Broadcast_Code for an encrypted BIG.

1.22.2 Format

The format for Broadcast_Code is described in [Vol 3] Part C, Section 3.2.6. It should not include trailing zero octets.



1.23 ENCRYPTED DATA

1.23.1 Description

The Encrypted Data data type consists of an encrypted payload secured with a pre-shared session key, a pre-shared initialization vector, and randomizer. It is authenticated using a message integrity check (MIC). The session key and initialization vector can be shared as described in [Vol 3] Part C, Section 12.6.

1.23.2 Format

The Encrypted Data data type shall contain Randomizer, Payload, and MIC fields.

Data Type	Octets ¹	Description
«Encrypted Data»	0 to 4	Randomizer
	5 to L+4	Payload
	L+5 to L+8	MIC

Table 1.22: Encrypted Data data type

1. L is the length of the payload.

The Payload field shall contain a sequence of one or more AD structures (see [Vol 3] Part C, Section 11) that are encrypted as described in [Section 1.23.3](#).

1.23.3 Encryption algorithm

The Payload and MIC fields shall be encrypted using the CCM algorithm defined in [Vol 6] Part E, Section 1, with the following changes:

- The *packetCounter* of the CCM nonce shall be set to the Randomizer field of the AD Data. The directionBit of the CCM nonce shall be set to the most significant bit of the Randomizer field.
- The session key shall be set to a value determined by a higher layer specification or otherwise negotiated between the devices that are sending and receiving this AD type. Any session keys with at least 128 bits of entropy may be used.
- The initialization vector (IV) of the CCM nonce shall be set to values determined by a higher-level specification or otherwise negotiated between the devices that are sending and receiving this AD type.
- In the B₁ block, octet 2 shall equal 0xEA.

1.23.4 Security properties

The Randomizer field shall be changed each time the data in the Payload field is changed or the random device address is changed (see [Vol 3] Part C, Sec-



tion 10.7.1.1). The IV shall be changed each time the session key is changed. If the randomizer value is not generated using the requirements for random numbers defined in [Vol 2] Part H, Section 2, then the Host's privacy can be compromised; e.g., making it easier for an attacker to track a device over a period of time.



1.24 PERIODIC ADVERTISING RESPONSE TIMING INFORMATION

1.24.1 Description

The Periodic Advertising Response Timing Information data type contains additional synchronization information used for Periodic advertising with responses (PAwR) trains.

1.24.2 Format

Data Type	Description	Octets	Fields
«Periodic Advertising Response Timing Information»	Size: 7 octets Periodic advertising response timing information for the advertiser.	0 to 3	RspAA: 4 octets Access Address to be used by the device when it transmits a response packet to the periodic advertiser
		4	numSubevents: 1 octet The number of subevents. N = 0x01 to 0x80
		5	subeventInterval: 1 octet Time from the start of one subevent to the start of the next subevent N = 0x06 to 0xFF Time = N × 1.25 ms Time Range: 7.5 ms to 318.75 ms
		6	responseSlotDelay: 1 octet Time from the start of one subevent to the first response slot N = 0x01 to 0xFE Time = N × 1.25 ms Time Range: 1.25 ms to 317.5 ms
		7	responseSlotSpacing: 1 octet Time from the start of one response slot to the start of the next response slot N = 0x02 to 0xFF Time = N × 0.125 ms Time Range: 0.25 ms to 31.875 ms

Table 1.23: Periodic Advertising Response Timing Information data type

2 EXAMPLES

The following sections include examples of EIR and Advertising Data Types.

2.1 HOST EXAMPLES

2.1.1 Example extended inquiry response

This is an example extended inquiry response for a phone with PANU and Hands-free Audio Gateway:

Value	Notes
0x06	Length of this Data
0x09	«Complete Local Name»
0x50	'P'
0x68	'h'
0x6F	'o'
0x6E	'n'
0x65	'e'
0x05	Length of this Data
0x03	«Complete list of 16-bit Service UUIDs»
0x15	PANU service class UUID
0x11	
0x1F	
0x11	
0x01	Hands-free Audio Gateway service class UUID
0x05	
0x01	
0x07	
0x01	Length of this data
0x05	«Complete list of 32-bit Service UUIDs»
0x01	Length of this data
0x07	«Complete list of 128-bit Service UUIDs»
0x00	End of Data (Not transmitted over the air)

Table 2.1: Example extended inquiry response

2.1.2 Example advertising data – Complete Local Name

This is an example of advertising data with AD types:

Value	Notes
0x02	Length of this Data
0x01	«Flags»

Table 2.2: Example advertising data with AD types



Value	Notes
0x01	LE Limited Discoverable Flag set
0x0A	Length of this Data
0x09	«Complete local name»
0x50	'P'
0x65	'e'
0x64	'd'
0x6F	'o'
0x6D	'm'
0x65	'e'
0x74	't'
0x65	'e'
0x72	'r'

Table 2.2: Example advertising data with AD types

2.1.3 Example advertising data – URI

This example represents an advertisement of the URI “http://www.bluetooth.com”.

Value	Notes
0x15	Length of this data
0x24	«URI»
0x16	UTF-8 code point for “http:”
0x2F	'/'
0x2F	'/'
0x77	'w'
0x77	'w'
0x77	'w'
0x2E	'.'
0x62	'b'
0x6C	'l'
0x75	'u'
0x65	'e'
0x74	't'
0x6F	'o'
0x6F	'o'
0x74	't'

Table 2.3: Example advertising data with a URI data type for http://www.bluetooth.com



Value	Notes
0x68	'h'
0x2E	'.'
0x63	'c'
0x6F	'o'
0x6D	'm'

Table 2.3: Example advertising data with a URI data type for `http://www.bluetooth.com`

This example represents an advertisement of the URI “example://z.com/Ålborg”.

Value	Notes
0x12	Length of this data
0x24	«URI»
0xC2	First UTF-8 octet for 'example:'
0xB9	Last UTF-8 octet for 'example:'
0x2F	'/'
0x2F	'/'
0x7A	'z'
0x2E	'.'
0x63	'c'
0x6F	'o'
0x6D	'm'
0x2F	'/'
0xC3	First UTF-8 octet for 'Å'
0x85	Last UTF-8 octet for 'Å'
0x6C	'l'
0x62	'b'
0x6F	'o'
0x72	'r'
0x67	'g'

Table 2.4: Example advertising data with a URI data type for `example://z.com/Ålborg`



2.2 CONTROLLER EXAMPLES

2.2.1 Example ACAD – Channel Map Update Indication

Value	Notes
0x08	Length of this Data
0x28	«Channel Map Update Indication»
0xFF	ChM = 0x1FFFFFF7FF
0xF7	
0xFF	
0xFF	
0x1F	
0x64	Instant = 0x0064
0x00	

Table 2.5: Example ACAD – Channel Map Update Indication

2.3 ENCRYPTED ADVERTISING DATA SAMPLE DATA

2.3.1 Encrypted Advertising Data Set 1

This sample data contains an Encrypted Data data type with complete local name and AD_Appearance data types.

```
tag: Complete Local Name "Short Mini-Bus"
tag: AD_Appearance "Minibus"
```

Before Encryption

```
0F095368 6F727420 4D696E69 2D427573
03190A8C
```

Randomizer (MSO to LSO) : 0xDECA57E118

IV (MSO to LSO) : 0x46E77AB1EF007A9E

Session Key (MSO to LSO) : 0x57A9DA12D12E6E131E20612AD10A6A19

```
b0 = 4918E157 CADE9E7A 00EFB17A E7460014
b1 = 0001EA00 00000000 00000000 00000000
b2 = 0F095368 6F727420 4D696E69 2D427573
b3 = 03190A8C 00000000 00000000 00000000
```

```
x1 = C1009E37 B89726AF 303F17A6 67FFA034
x2 = BF2B64AF 43766531 EF197F2E F299B4CE
x3 = C0FAAD29 268A03DA 242ED0A1 CF3D0EA7
x4 = D65D8B4F C872FAAA B2C5A663 4FD96A55
=> MIC = D65D8B4F
```

```
a0 = 0118E157 CADE9E7A 00EFB17A E7460000
```


Data Types Specification

```
a1 = 0118E157 CADE9E7A 00EFB17A E7460001
a2 = 0118E157 CADE9E7A 00EFB17A E7460002
```

```
s0 = 6C5DE283 43EA1D81 E792D7EE 9C156BAF
s1 = 7BED8FC7 B323B308 6579AC48 524C399C
s2 = 405A1293 0F6482F5 CEF58FB1 83A3B7BA
```

```
Encrypted Payload :
    74E4DCAF DC51C728 2810C221 7F0E4CEF
    4343181F
```

```
Encrypted MIC :
    BA0069CC
```

```
Encrypted Data AD Data :
    18E157CA DE74E4DC AFDC51C7 282810C2
    217F0E4C EF434318 1FBA0069 CC
```

```
Advertising data
    1E3118E1 57CADE74 E4DCAFDC 51C72828
    10C2217F 0E4CEF43 43181FBA 0069CC
```

2.3.2 Encrypted Advertising Data Set 2

This sample data contains an Encrypted Data data type with complete local name and AD_Appearance data types, using a different randomizer value than set 1.

```
tag: Complete Local Name "Short Mini-Bus"
tag: AD_Appearance "Minibus"
```

```
Before Encryption
    0F095368 6F727420 4D696E69 2D427573
    03190A8C
```

```
Randomizer (MSO to LSO) : 0x7A6E971C8D
IV (MSO to LSO) : 0x46E77AB1EF007A9E
Session Key (MSO to LSO) : 0x57A9DA12D12E6E131E20612AD10A6A19
```

```
b0 = 498D1C97 6E7A9E7A 00EFB17A E7460014
b1 = 0001EA00 00000000 00000000 00000000
b2 = 0F095368 6F727420 4D696E69 2D427573
b3 = 03190A8C 00000000 00000000 00000000
```

```
x1 = 842739EE 53DEBA5D E1FF9BC2 508FBFB0
x2 = 4E26837E DFE59561 9727EE3E 9E9821F6
x3 = E5A79BE7 6D97E3D6 1E2B2941 832EE813
x4 = 247A22E6 1B2C78AA 9771682B A2EA292D
=> MIC = 247A22E6
```

```
a0 = 018D1C97 6E7A9E7A 00EFB17A E7460000
a1 = 018D1C97 6E7A9E7A 00EFB17A E7460001
a2 = 018D1C97 6E7A9E7A 00EFB17A E7460002
```

Data Types Specification

```
s0 = 560F67AA 41569261 73B83D23 E7158AC0  
s1 = 3A4D131E 7D25FCE2 75CCE0E2 F48D85AD  
s2 = FD3C1002 113DD83E 852A0F1B F686F3F1
```

Encrypted Payload :

```
35444076 125788C2 38A58E8B D9CFF0DE  
FE251A8E
```

Encrypted MIC :

```
7275454C
```

Encrypted Data AD Data :

```
8D1C976E 7A354440 76125788 C238A58E  
8BD9CFF0 DEFE251A 8E727545 4C
```

Advertising data

```
1E318D1C 976E7A35 44407612 5788C238  
A58E8BD9 CFF0DEFE 251A8E72 75454C
```

Supplement to the Bluetooth Core Specification
Part B

**COMMON PROFILE AND
SERVICE ERROR CODES**



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1 OVERVIEW OF COMMON PROFILE AND SERVICE ERROR CODES

This document lists the common profile and service error codes sent over the Attribute Protocol. Error codes have a size of one octet.

1.1 USAGE DESCRIPTIONS

The purpose of this section is to give descriptions of how the common profile error codes should be used. It is beyond the scope of this document to give detailed descriptions of all situations where error codes can be used, especially as this is implementation dependent.

1.2 LIST OF ERROR CODES

The possible range of common profile error codes is 0xE0 to 0xFF. The Common Profile and Service Error Code Descriptions Part provides an error code usage description for each failure error code.

Values marked as “Reserved for Future Use”, can be used in future versions of the specification.

Error Code	Name
0xE0 – 0xFB	Reserved for Future Use
0xFC	Write Request Rejected
0xFD	Client Characteristic Configuration Descriptor Improperly Configured
0xFE	Procedure Already in Progress
0xFF	Out of Range

Table 1.1: List of Common Profile and Service Error Codes



2 COMMON PROFILE AND SERVICE ERROR CODE DESCRIPTIONS

2.1 OUT OF RANGE (0xFF)

The Out of Range error code is used when an attribute value is out of range as defined by a profile or service specification.

2.2 PROCEDURE ALREADY IN PROGRESS (0xFE)

The Procedure Already in Progress error code is used when a profile or service request cannot be serviced because an operation that has been previously triggered is still in progress.

2.3 CLIENT CHARACTERISTIC CONFIGURATION DESCRIPTOR IMPROPERLY CONFIGURED (0xFD)

The Client Characteristic Configuration Descriptor Improperly Configured error code is used when a Client Characteristic Configuration descriptor is not configured according to the requirements of the profile or service.

2.4 WRITE REQUEST REJECTED (0xFC)

The Write Request Rejected error code is used when a requested write operation cannot be fulfilled for reasons other than permissions.

Note: This differs from the “Write Not Permitted” error response in *Vol 3, Part F, Section 3.4.1.1* (ATT), which is intended when the write operation cannot be fulfilled due to permissions.

Supplement to the Bluetooth Core Specification
Part C

**SERVICES THAT MAY USE
SECURITY MODE 4 LEVEL 0**



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1 SERVICES THAT MAY USE SECURITY MODE 4 LEVEL 0

The following sections enumerate the services that may use Security Mode 4 Level 0 as defined in *Volume 3, Part C, of the Bluetooth Core Specification*, v2.1 + EDR and later.

[Section 1.1](#) enumerates those services that may use Security Mode 4 Level 0 over L2CAP connection oriented channels and [Section 1.2](#) enumerates those services that may use Security Mode 4 Level 0 for unicast traffic over the L2CAP connectionless data channel (CID 0x0002).

Note: Security Mode 4 does not address broadcast traffic and hence this section is not relevant to broadcast data sent over the L2CAP connectionless data channel.

1.1 SECURITY MODE 4 LEVEL 0 OVER L2CAP CONNECTION-ORIENTED CHANNELS

Services corresponding to the following UUIDs may use Security Mode 4 Level 0 over an L2CAP connection-oriented channel when operated over a BR/EDR physical link. See *Bluetooth Core Specification Volume 3, Part B, Section 2.5.1* for more information on UUIDs. Also see [Bluetooth Assigned Numbers](#) for a list of assigned Service Class UUIDs.

- 0x1000 + Bluetooth_Base_UUID (Service Discovery Server)

1.2 SECURITY MODE 4 LEVEL 0 OVER THE L2CAP CONNECTIONLESS DATA CHANNEL

Services corresponding to the following UUIDs may use Security Mode 4 Level 0 for unicast traffic over the L2CAP connectionless data channel (CID 0x0002) when operated over a BR/EDR physical link. See *Bluetooth Core Specification Volume 3, Part B, Section 2.5.1* for more information on UUIDs. Also see [Bluetooth Assigned Numbers](#) for a list of assigned Service Class UUIDs.

- 3D_Display + Bluetooth_Base_UUID
(3D Display service as defined in the 3D Synchronization Profile)
- 3D_Glasses + Bluetooth_Base_UUID
(3D Glasses service as defined in the 3D Synchronization Profile)



Bluetooth SIG Proprietary