

Bluetooth® Interoperability Requirements for Mobile Terminals

Version 1.0

10 October 2012

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1 Introduction

1.1 Document Purpose

This document defines a minimum common suite of Bluetooth hardware and profile requirements for two classes of Bluetooth enabled mobile Terminals - Basic and Advanced. It is based upon the OMTP Local Bluetooth Connectivity v1.1 [31]. Updates were provided by terminal vendors. Further input with focus on in-car usage is derived from CE4A (Consumer Electronics for Automotive) [32], individual car manufacturers and the GSMA Connected Living Programme's mAutomotive Work Stream.

The main purpose of the document is to improve user experience and expected functionality when using Bluetooth from a mobile Terminal.

This document specifies Bluetooth use cases for voice calling (e.g. using a headset or car kit), media playback and local data transfer.

The document references existing and industry approved Bluetooth standards as defined by the Bluetooth Special Interest Group (SIG) together with their revised qualification process for cross vendor interoperability testing.

1.2 Business Rationale

A common approach by mobile operators for Bluetooth in Terminals would greatly improve the user experience for many customers. This would be achieved by increasing expected functionality, enabling better cross-vendor interoperability and encouraging better implementation of the most recent profiles.

Currently, a typical mobile operator's portfolio consists of dozens of Terminals, complemented with a large number of different peripherals such as mono headsets for voice calls, car kits, stereo headphones for music, external speakers, etc. Today, more than 20 Bluetooth profiles exist and many Terminals support a variety of these with different models normally implementing different revisions of the Bluetooth Core Specifications. This in turn, results in compatibility and interoperability issues for the various Bluetooth use cases.

Although the level of Bluetooth interoperability testing has increased, unless the same profiles with complementary roles are supported between the two Bluetooth devices being tested, there will be lack of interoperability. It is still possible for these devices to individually carry the Bluetooth logo but the compatibility and interoperability issues can lead to customer disappointment in terms of expected functionality over actual functionality.

This fragmentation creates unnecessary cost and complexity for the whole value chain, limits the freedom of selection for customers, impacts Terminal testing and restricts competition by creating barriers to market entry.

For an operator running a customer support centre, Bluetooth issues currently are costly and difficult to resolve.

This document defines a minimum set of standard Bluetooth profiles and related options that are to be supported without restricting the freedom of innovation. This process should streamline the whole value chain and provide customers with a better user experience as well as reducing development and interoperability test costs for Terminal designs.

This document also provides valuable guidance for vendors with no expertise in the mobile market place. This would clearly benefit customers and also support new operator business cases; such as music delivery.

1.3 Intended Audience

The recommendations contained within this document are intended to be referenced by mobile operators in their Terminal requirement specifications.

There are two main audiences for this specification:

- Terminal designers and manufacturers; i.e. the equipment and technology vendors that will be required to create implementations of the requirements contained within this document.
- The Bluetooth SIG, who are invited to use these recommendations in their tools to specify best practice design guidelines for Bluetooth enabled Terminals for the benefit of their members.

1.4 Conventions

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 of the IETF [1].

- MUST: This word, or the terms "REQUIRED" or "SHALL", mean that the definition is a “MANDATORY” requirement of the specification.
- MUST NOT: This phrase, or the phrase "SHALL NOT", means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective "RECOMMENDED", means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase "NOT RECOMMENDED" means that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
- MAY: This word, or the adjective "OPTIONAL", means that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option MUST be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option MUST be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides.)

The requirements within this document are uniquely identified using the following format:

BTIR-####, where:

- BTIR is the acronym used to identify the subject of this GSMA document (i.e. Bluetooth® Interoperability Requirements for Mobile Terminals)
- #### is a 4 digit number that identifies the requirement (e.g. 0020) and which is to be unique within the document.

2 Definition of Terms

The Bluetooth SIG has published a terminology guideline document which is available in 34 different languages.

These terms in the guide were not developed for Bluetooth technical communication, (e.g. specifications, profiles). However, developers may wish to utilise these terms to avoid confusion within their own documentation. The proposed terms are intended to be used in materials for consumer consumption, e.g. marketing materials, press releases, packaging, user manuals, documentation, help desk training, user interface software and hardware labelling.

This document can be downloaded from the following URL / hyperlink:

https://www.bluetooth.org/Marketing/Technology/user_terminology.htm

Term	Description
Acceptor	This is the device that shall respond to the incoming request from the Initiator
Client	The Client device retrieves the source objects from the server
Controller	A device that initiates a transaction by sending a command frame to a target device
DevA	A device that initiates a connection to another device
DevB	A device that waits for another device to initiate a connection
Gateway	Device providing access to the public network
Hid-Host	The device using or requesting the services of a Human Interface Device
Initiator	The device that initiates a signalling procedure
Role	Device configuration mode
Sender	This is the Client device that pushes an object to the printer
Server	The Server device has direct access to the Source objects
Source	A device is the Source when it acts as a source of a digital audio stream
Target	A device that receives a command frame and accordingly generates a response frame
Terminal	Used as an alternative term for a cellular telephone or handset

3 Abbreviations

Term	Description
A2DP	Advanced Audio Distribution Profile
A/V	Audio Visual
AVCTP	A/V Control Transport Protocol
AVDTP	A/V Distribution Transport Protocol
AVRCP	A/V Remote Control Profile
BT	Bluetooth
BT SIG	Bluetooth Special Interest Group
BIP	Basic Imaging profile
BPP	Basic Printing profile
CE4A	Consumer Electronics for Automotive
DID	Device ID
DUN	Dial Up Networking
EDR	Enhanced Data Rate
eSCO	Extended Synchronous Connection Oriented
E-IOT	Enhanced Interoperability Testing
EPL	End Product Listing
FTP	File Transfer profile
GAVDP	Generic A/V Distribution Profile
GN	Group ad-hoc Network
GOEP	Generic Object Exchange Profile
HCRP	Hard Copy Replacement Profile
HFP	Hands-Free Profile
HID	Human Interface Device
HSP	Headset Profile
IOT	Interoperability Testing
NAP	Network Access Point
MAP	Message Access Profile
OMTP	Open Mobile Terminal Platform
OPP	Object Push Profile
PAN	Personal area Network
PANU	Personal area Network User
PBAP	Phone Book Access Profile

Term	Description
PDA	Personal Digital Assistant
PRD	Program Reference Document (Bluetooth SIG Qualification Program)
PTS	Profile Tuning Suite
QDL	Qualified Design Listing
QPL	Qualified Product Listing
SAP	SIM Access Profile
SDAP	Service Discovery Application Profile
SIG	Special Interest Group
SPP	Serial Port Profile
VDP	Video Distribution Profile

4 References

Ref	Document	Author	Date
1	RFC 2119 - Key words for use in RFCs to Indicate Requirement Levels	IETF	
2	Bluetooth Core v2.1 + EDR	BT SIG	July 2007
3	Simultaneous use of HFP, A2DP, and AVRCP_WP	BT SIG	January 2007
4	Message Access Profile v1.0	BT SIG	June 2009
5	Qualification program reference document PRD v2.0	BT SIG	March 2008
6	Program reference document PRD v1.0	BT SIG	1996
7	Core Version 3.0 + HS	BT SIG	April 2009
8	Simple pairing and user interface flow whitepaper	BT SIG	Sep 2007
9	Device to Device IOT test case hyperlink https://www.bluetooth.org/apps/content/?doc_id=62088#Device2DeviceTests	BT SIG	2006
10	E-IOT white paper hyperlink https://www.bluetooth.org/docman/handlers/DownloadDoc.ashx?doc_id=69604	BT SIG	June 2007
11	Profile Device ID v1.3	BT SIG	July 2007
12	Profile Dial Up Networking v1.1	BT SIG	February 2001
13	File Transfer Profile v1.1	BT SIG	October 2005
14	Generic Object Exchange Profile v1.1	BT SIG	February 2005
15	Hands Free Profile v1.5	BT SIG	Nov 2005
16	Headset Profile v1.1	BT SIG	February 2001
17	Object Push Profile v1.2	BT SIG	26 Aug. 2010
18	Serial Port Profile v1.1	BT SIG	February 2001

Ref	Document	Author	Date
19	Service Discovery Application Profile v1.1	BT SIG	February 2001
20	Advanced Audio Distribution Profile v1.2	BT SIG	April 2007
21	Generic A/V Distribution Profile v1.2	BT SIG	March 2005
22	A/V Remote Control Profile v1.4	BT SIG	June 2006
23	Basic Imaging Profile v1.2	BT SIG	October 2005
24	Minimal Basic Printing Profile Requirements for a Sender. White paper.	BT SIG	Sept 2002
25	Basic Printing Profile v1.2	BT SIG	June 2006
26	SIM Access Profile v1.0	BT SIG	May 2006
27	Phone Book Access Profile v1.1	BT SIG	26 Aug. 2010
28	Human Interface Device Profile v1.0	BT SIG	June 2006
29	Personal Area Network Profile v1.0	BT SIG	October 2005
30	Hardcopy Replacement Profile v1.2	BT SIG	April 2006
31	OMTP Local Bluetooth Connectivity v1.1 http://www.gsma.com/newsroom/wp-content/uploads/2012/03/omtplocalbluetoothconnectivityv11final.pdf	OMTP	2 March 2010
32	Official WebSite of the CE4A (Consumer Electronics for Automotive) http://www.ce4a.org	CE4A	n/a
33	Hands Free Profile v1.6	BT SIG	10 May 2011

5 Use Cases

This recommendation document considers six common Bluetooth use cases. Additional aspects address the automotive usage.

The requirements in section 3 aim to standardise Bluetooth Interoperability (IOT) testing between different vendor reference designs, thereby meeting the expectation of Bluetooth feature support from consumers and improving the reliability of Bluetooth links.

5.1 Common User Case Scenarios

The key operator use cases are listed below in priority order:

5.1.1 Headset

This use case provides connectivity in the following user scenarios

- Using a mobile Terminal paired with a Bluetooth wireless headset.
- Talking hands-free in a car; either with an aftermarket kit or an integrated in-car system.
- Using a headset paired with a personal computer for VoIP communication.

5.1.2 Music

This use case provides that a user can listen to streamed stereo audio through Bluetooth enabled speakers, headsets and personal computers from a Bluetooth enabled source such as;

- Computers
- Audio players
- Mobile phones
- Other devices

The user will be able to stream music to Bluetooth enabled speakers, headsets and personal computers.

5.1.3 File Transfer

This use case provides that the user will be able to transfer digital files, such as photos, calendar events and business cards between a variety of devices including the following:

- Computers
- Mobile phones
- PDAs
- Cameras
- Media players

5.1.4 Print

This use case provides that the user will be able to print images or documents to a Bluetooth enabled printer from:

- Mobile phones
- Computers
- PDAs
- Cameras

5.1.5 Input

This use case provides that the device connects a:

- Mouse
- Keyboard
- Game controllers
- Other input/output devices

to a

- Computer
- Game console
- PDAs
- Other Bluetooth enabled device.

5.1.6 Automotive

In addition to the user scenarios covered by the headset and music Icons, the automotive use cases enable

- Accessing the phonebook stored on the mobile phone from the vehicle's user interface

- Receiving and answering messages on the vehicle's user interface
- Browsing the mobile phone's music database from the vehicle's user interface
- Connecting the car to the web via the mobile phone.

5.2 Possible Future Operator Use Cases

Bluetooth is evolving and developing new profiles to cover more mobile user scenarios. Revised and/or additional profiles will be addressed as applicable.

6 General Requirements

This section defines the generic hardware requirements followed by two Bluetooth class definitions. The Bluetooth classes are named ‘Basic’ and ‘Advanced’. The ‘Basic’ class is a subset of the ‘Advanced’ class.

The Basic class requirements should be considered as a minimum design.

These classes are defined by this GSMA document and therefore do not refer to Bluetooth SIG requirements or recommendations.

6.1 Requirements Applicable To All Terminals

Req. ID	Requirement
BTIR-0010	Terminal MUST support Bluetooth Core specification v2.1 [2]
BTIR-0020	Terminal MUST use extended Synchronous Connection Oriented (eSCO) connections when BTIR-0130 (Hands Free Profile) is implemented.
BTIR-0030	The Terminal MUST support simultaneous multi profile usage via one Bluetooth link. The Bluetooth SIG paper ‘Simultaneous use of hands free profile (HFP), Advanced Audio Distribution Profile (A2DP) and A/V Remote Control Profile (AVRCP)’ provides guidance in this area [3]. (For example; 1. The Hands Free Profile and the Phone Book Access Profile can be used simultaneously. 2. The Hands Free Profile and the Advanced Audio Distribution Profile can be used together simultaneously. 3. The Hands Free Profile and the Message Access Profile can be used simultaneously.)
BTIR-0035	The Terminal SHALL support each profile connection independently from other profile connections. For example, the Terminal SHALL NOT require HFP to establish Phone Book Access Profile (PBAP); PBAP SHALL be available regardless of other profile connections.
BTIR-0050	The Terminal manufacturer MUST be able to quote device QDL for Program Reference Document (PRD) 2 [5] OR Qualified Product Listing (QPL) for PRD 1.0 [6]. This allows product traceability through the Bluetooth SIG qualification and End Product Listing (EPL) programs [5].
BTIR-0060	The Terminal MUST implement the Bluetooth SIG secure simple pairing user interface flow whitepaper [8].

Req. ID	Requirement
BTIR-0080	In addition to obtaining Bluetooth Qualified Design Listing (QDL) by running all applicable Profile Tuning Suite (PTS) and non-PTS tests the Bluetooth platform MUST have been tested with device-to-device [9] and Enhanced Interoperability Testing (E-IOT) (Bluetooth SIG optional enhanced test cases) with at least 3 other different vendor platforms [10] for all the profiles supported.

6.2 Requirements Applicable To Different Types of Terminal

In the columns defining the classes a '✗' indicates that the requirement does not apply to this class. A '✓' indicates that the requirement does apply to this class.

Requirement IDs marked with an asterisk (*) are of special interest for in-car usage and will be further detailed in section 3.3.

Req. ID	Requirement	Basic	Advanced
BTIR-0090*	Profile Device ID (DID). The Terminal SHOULD support this profile which is intended for all Bluetooth devices. Version 1.3 [11] or later is REQUIRED.	✓	✓
BTIR-0100*	Profile Dial Up Networking (DUN). The Terminal MUST support this profile with the Role of Gateway. At time of writing version 1.1 [12] is REQUIRED Note: As DUN is going to phase out, this requirement is mandatory for any new mobile terminal launched until 1 January 2015.	✓	✓
BTIR-0120	Generic Object Exchange Profile (GOEP). The Terminal MUST support this profile with the Roles of Client and Server. At time of writing version 1.1 [14] is REQUIRED.	✓	✓
BTIR-0130*	Hands-Free Profile (HFP). The Terminal MUST support this profile with the Role of Gateway. Version 1.5 [15] is REQUIRED. Version 1.6 [33] is RECOMMENDED. This profile is required to qualify for the Headset experience icon.	✓	✓
BTIR-0150*	Object Push Profile (OPP). The Terminal MUST support this profile with the Roles of Client and Server. At time of writing version 1.2 [17] is REQUIRED. This profile is required to qualify for the Printer and File Transfer experience icon.	✓	✓

Req. ID	Requirement	Basic	Advanced
BTIR-0160	Serial Port Profile (SPP). The Terminal MAY support this profile with the Roles of DevA and DevB. At time of writing version 1.1 [18] is REQUIRED.	✓	✓
BTIR-0170*	Phone Book Access Profile (PBAP). The Terminal MUST support this profile with the Role of Server. Version 1.1 [27] or later is REQUIRED.	✓	✓
BTIR-0180*	Advanced Audio Distribution Profile (A2DP). The Terminal MUST support this profile with the Role of Source At time of writing version 1.2 [20] is REQUIRED. The Bluetooth SIG White paper on the simultaneous use of HFP/A2DP and AVRCP [3] gives guidance in this area. This profile is required to qualify for the Music experience icon.	✓	✓
BTIR-0190	Generic A/V Distribution Profile (GAVDP). The Terminal MUST support this profile with the Roles of Initiator and Acceptor. Version 1.2 [21] or later is REQUIRED. This is mandatory for products supporting A2DP or Video Distribution Profile (VDP).	✓	✓
BTIR-0200*	A/V Remote Control Profile, (AVRCP). The Terminal MUST support this profile with the Roles of Target and Controller. Version 1.4 [22] is REQUIRED.	✓	✓
BTIR-0210	The Terminal MUST support Enhanced Data Rate (EDR). Refer to Bluetooth Core Specification 2.1 + EDR [2] or later.	✓	✓
BTIR-0240*	SIM Access Profile (SAP). The Terminal MUST support this profile with the Role of Server, if the terminal supports SIM cards. At time of writing version 1.1 [26] is REQUIRED. BTIR-0030 refers to multi profile support when implementing this profile. Bluetooth SIG white paper User Interface and security recommendations.	✗	✓

Req. ID	Requirement	Basic	Advanced
BTIR-0260	Human Interface Device Profile (HID). The Terminal MAY support this profile with the Role of HID-Host. Version 1.0 [28] or later is REQUIRED. This profile is required to qualify for the Input experience icon.	×	✓
BTIR-0270*	Personal Area Network Profile (PAN). The Terminal MUST support this profile with the Role of Network Access Point (NAP) The Terminal SHOULD support this profile with the Role of Group ad-hoc Network (GN) and Personal area Network User (PANU). At time of writing version 1.0 [29] is REQUIRED.	✓	✓
BTIR-0280	Hardcopy Replacement Profile (HCRP). The Terminal MAY support this profile with the Role of Client. At time of writing version 1.2 [30] is REQUIRED.	×	✓
BTIR-0290*	Message Access Profile (MAP). The Terminal SHOULD support this profile with the Role of Message Server Equipment. Version 1.0 [4] or later is REQUIRED.	×	✓

6.3 Detailed Profile Requirements

Some BT Profiles are of special relevance, e.g. for in-car usage. The ones for in-car usage have been further detailed by the CE4A (Consumer Electronics for Automotive) [32].

The CE4A has classified individual features within a profile into three categories:

1. FUNDAMENTAL: This profile feature is considered to be fundamental for the operation of a mobile terminal in the vehicular environment.
2. SOPHISTICATED: This profile feature is considered to be important for an adequate user experience for the operation of a mobile terminal in the vehicular environment.
3. PREMIUM: This profile feature is considered to provide an excellent user experience for the operation of a mobile terminal in the vehicular environment.

Furthermore, some individual features are declared as OPTIONAL (O) since an implementation might not make any use of this feature.

Some features are explicitly excluded by CE4A. These features will most likely be suppressed by vehicle implementations, because it might be harmful or cause issues in the automotive context. Mobile phones should expect an error response from a car kit when trying to use this feature.

For reference, the Bluetooth SIG requirements are provided for comparison in the column ‘SIG’ of the following tables.

6.3.1 Profile Device ID (DID), BTIR-0090

Item	Capability	SIG	CE4A Category	Comment
1	SpecificationID	M	Premium	
2	VendorID	M	Premium	
3	ProductID	M	Premium	
4	Version	M	Premium	
5	PrimaryRecord	M	Premium	
6	VendorIDSource	M	Premium	

6.3.2 Profile Dial Up Networking (DUN), BTIR-0100

Item	Capability	SIG	CE4A Category	Comment
	Circuit connections	O.1	O.1	O.1: It is mandatory to support at least one of the defined configurations.
	Packet connections	O.1	Fundamental	
1	General Inquiry	N/A	N/A	
2	General Discoverable Mode	C.2	C.2	C.2: Either Limited or General Discoverable Mode has to be supported.
3	Limited Inquiry	N/A	N/A	
4	Limited Discoverable mode	C.2	C.2	
5	Non-Discoverable mode	O	O	
6	Name Discovery	N/A	N/A	
7	Device Discovery	N/A	N/A	
8	Connectable Mode	M	Fundamental	
9	Bonding	M	Fundamental	
10	Data call without audio Feedback – Outgoing call	M	Fundamental	
11	Data call without audio Feedback – Incoming call	O	X	
12	Data call with audio Feedback – Outgoing call	O	X	
13	Accept Termination from DT	M	Fundamental	
14	Initiate Termination from GW – Circuit Network	C.3	C.3	C.3 Prerequisite Circuit Connections
14b	Initiate Termination from GW – Packet Network	C.4	C.4	C.4 Prerequisite Packet Connections
15	Termination – NT	M	Fundamental	

6.3.3 Hands-Free Profile (HFP), BTIR-0130

Item	Capability	SIG	CE4A Category	Comment
1	Connection Management	M	Fundamental	

Item	Capability	SIG	CE4A Category	Comment
1a	SLC initiation during active ongoing call	O	O	
2	Phone Status Information	M	Fundamental	
3	Audio connection handling	M	Fundamental	
3a	Audio connection establishment independent of call processing	O	X	unsolicited audio channel establishment might not be understandable for the driver. It might annoy and distract the driver. HU might accept SCO channel, but not route the audio to the driver
3b	eSCO support in Audio Connection	C7	Fundamental	C.7: Optional if BB:2/3 is supported, otherwise excluded.
4a	Accept an incoming voice call (in-band ring)	C1	Premium	C1: one of 4a/4b must be supported;
4b	Accept an incoming voice call (no in-band ring)	C1	Fundamental	C1: one of 4a/4b must be supported
4c	Capability to change the “in-band ring” settings	O	Premium	In silent Mode there shall be an inband-ringtone via Bluetooth or +BSIR shall indicate absence of inband-ringtone during silent mode
5	Reject an incoming voice call	O	Fundamental	the reject command shall also work for waiting calls
6	Terminate a call	M	Fundamental	
7	Audio connection transfer during an ongoing call	M	Fundamental	
7a	HF-initiated Audio transfer to AG during ongoing Call	O	Premium	
7b	AG releases SLC upon audio connection transfer toward AG	O	X	
8	Place a call with a phone number supplied by the HF	M	Fundamental	
9	Place a call using memory dialling	M	Fundamental	
10	Place a call to the last number dialled	M	Fundamental	
11	Call waiting notification	M	Fundamental	
12	Three Way Calling	O	Sophisticated	
12a	User Busy (AT+CHLD value 0)	C3	Sophisticated	C3: Optional if (12); otherwise excluded
12b	Call Hold Handling (AT+CHLD value 1,2)	C2	Sophisticated	C2: Mandatory if (12); otherwise excluded.
12c	Three Way Call (AT+CHLD value 3)	C3	Sophisticated	
12d	Explicit Call Transfer (AT+CHLD value 4)	C3	Sophisticated	
13	Calling Line Identification (CLI)	M	Fundamental	
14	Echo cancelling (EC) and Noise reduction (NR)	O	Fundamental	CE4A requires actual switching off of EC and NR in the phone. See the appendix of HFP 1.6 for further information on audio quality testing.
15	Voice recognition activation	O	Sophisticated	may be in use for “low-end” car kit implementations

Item	Capability	SIG	CE4A Category	Comment
15a	Initiate voice recognition from AG	C6	O	Voice recognition is preferably initiated from the car kit. Interaction on the AG's UI might distract the driver.
15b	Autonomous voice deactivation	C6	O	C6: Optional if 15 is supported, otherwise excluded
16	Attach a phone number to a voice tag	O	O	
17	Ability to transmit DTMF codes	M	Fundamental	
18a	Remote audio volume control – speaker	O	O	Unsolicited remote control of the car's speaker volume might be dangerous for the driver - mobile devices shall not even try to execute the command when no support of the Remote Volume Control is indicated in the car's SDP/BRSF feature bits.
18b	Remote audio volume control – microphone	O	O	
18c	Volume Level Synchronization – speaker and microphone	C5	O	C5: Mandatory if 2/18a or 2/18b, otherwise optional.
19	Response and hold	O	Sophisticated	Dependent on PDC and CDMA network support
20	Subscriber Number Information	M	Fundamental	
21a	Enhanced Call Status	C4	C4	C4: The AG must support one of item 21a or 21c.
21b	Enhanced Call Control	C3	Sophisticated	C3: Optional if (2/12); otherwise excluded
21c	Enhanced Call Status with limited network notification	C4	C4	
22	Support for automatic link loss recovery	O	Sophisticated	
24	Wide Band Speech Service	C.8	Fundamental	C.8: Bluetooth SIG Requirement: Excluded if HFP 1.5

6.3.4 Object Push Profile (OPP), BTIR-0150

Item	Capability	SIG	CE4A Category	Comment
Service Discovery				
1	Perform SD request	M	Fundamental	
Authentication				
2	Authentication/PIN exchange supported	M	Fundamental	
2a	Require Authentication/PIN by default	O	O	
Object Push				
3	Push Object	M	Fundamental	
Content Format				
4	vCard 2.1	C.3	Fundamental	C.3: vCard 2.1 support is required for devices containing phonebook applications. vCard 2.1 support optional for other devices.

Item	Capability	SIG	CE4A Category	Comment
5	vCalendar 1.0	O	O	
6	vMSG as defined in IrMC 1.1	O	O	
7	VNote as defined in IrMC 1.1	O	O	
8	Support content formats other than those declared in 2/4 through 2/7	O	O	
8a	Support specific set of other content formats (please specify below)	C.4	O	C.4: Mandatory to support one of 8a or 8b if 8 is supported. Otherwise, both items are excluded.
8b	Support all content formats	C.4	O	
9	Push multiple vCard objects	O	Sophisticated	
9a	Push multiple vCard objects using different PUT operations.	C.5	C.5	C.5: Mandatory to support at least one of 9a and 9b if 9 is supported. Otherwise, both items are excluded.
9b	multiple Card objects using the same PUT operation.	C.5	C.5	
10	Push multiple vCalendar objects	O	O	
10a	Push multiple vCalendar objects using different PUT operations.	C.6	O	C.6: Mandatory to support at least one of 10a and 10b if 10 is supported. Otherwise, both items are excluded.
10b	Push multiple vCalendar objects using the same PUT operation.	C.6	O	
11	Push multiple vMsg objects	O	O	
11a	Push multiple vMsg objects using different PUT operations.	C.7	O	C.7: Mandatory to support at least one of 11a and 11b if 11 is supported. Otherwise, both items are excluded
11b	Push multiple vMsg objects using the same PUT operation.	C.7	O	
12	Push multiple vNote objects	O	O	
12a	multiple vNote objects using different PUT operations.	C.8	O	C.8: Mandatory to support at least one of 12a and 12b if 12 is supported. Otherwise, both items are excluded
12b	Push multiple vNote objects using the same PUT operation.	C.8	O	
Business Card Pull				
13	Pull business card	O	O	
Content Format				
14	vCard 2.1	C.1	O	C.1: Mandatory to support if OPP 13 (Business Card Pull) is supported.
	Business Card Exchange			
15	Exchange business card	O	O	
Content Format				
16	vCard 2.1	C.2	O	C.2: Mandatory to support if OPP 15 (Business Card Exchanged) is support.

6.3.5 Phone Book Access Profile (PBAP), BTIR-0170

Item	Capability	SIG	CE4A Category	Comment
1	Phone Book Download	M	Fundamental	at least 2000 phone book entries should be supported
2	Phone Book Browsing	M	Fundamental	
3	Session Management	M	Fundamental	
4	Able to request the size of the Phonebook	M	Fundamental	
1	PullPhonebook	M	Fundamental	
1	SetPhonebook	M	Fundamental	
2	PullvCardListing	M	Fundamental	
3	PullvCardEntry	M	Fundamental	
1	VCard 2.1	M	Fundamental	
2	VCard 3.0	M	Fundamental	Preference for v2.1 due to interoperability issues with the v3.0 format
1	telecom/pb Phonebook		Fundamental	
2	SIM1/telecom/pb Phonebook		Sophisticated	
1	VERSION	M	Fundamental	vCard Version
2	FN	M	Fundamental	Formatted Name
3	N	M	Fundamental	Structured Presentation of Name
4	PHOTO	O	Premium	Associated Image or Photo
5	BDAY	O	Premium	Birthday
6	ADR	O	Sophisticated	Delivery Address
7	LABEL	O	O	Delivery
8	TEL	O	Fundamental	Telephone Number
9	EMAIL	O	Premium	Electronic Mail Address
10	MAILER	O	O	Electronic Mail
11	TZ	O	O	Time Zone
12	GEO	O	Premium	Geographic Position
13	TITLE	O	O	Job
14	ROLE	O	O	Role within the Organization
15	LOGO	O	O	Organization Logo
16	AGENT	O	O	vCard of Person Representing
17	ORG	O	Premium	Name of Organization
18	NOTE	O	Premium	Comments

Item	Capability	SIG	CE4A Category	Comment
19	REV	O	O	Revision
20	SOUND	R	Premium	Pronunciation of Name *(from CE4A Recommended for Japanese Market only)*
21	URL	O	Premium	Uniform Resource Locator
22	UID	O	O	Unique ID
23	KEY	O	O	Public Encryption Key
24	NICKNAME	O	Premium	Nickname
25	CATEGORIES	O	O	Categories
26	PROID	O	O	Product ID
27	CLASS	O	O	Class information
28	SORT-STRING	O	Premium	String used for sorting operations
29	X-IRMC-CALL-DATETIME	O	Sophisticated	Time stamp; strongly recommended by SIG, mandated by CE4A
30	Proprietary Filter	O	O	Indicates the usage of a proprietary filter
	X-IRMC-CALL-DATETIME; MISSED	O	Fundamental	strongly recommended by SIG, mandated by CE4A
	X-IRMC-CALL-DATETIME; RECEIVED	O	Fundamental	strongly recommended by SIG, mandated by CE4A
	X-IRMC-CALL-DATETIME; DIALED	O	Fundamental	strongly recommended by SIG, mandated by CE4A
Telephone Number Types				
1	PREF		Fundamental	Indicates preferred number
2	WORK		Fundamental	Indicates a work number
3	HOME		Fundamental	Indicates a home number
4	VOICE		Fundamental	Indicates a voice number (Default
5	FAX		Sophisticated	Indicates a facsimile number
6	MSG		O	Indicates a messaging service on the number
7	CELL		Fundamental	Indicates a cellular number
8	PAGER		Sophisticated	Indicates a pager number
9	BBS		O	Indicates a bulletin board service number
10	MODEM		O	Indicates a MODEM number
11	CAR		Fundamental	Indicates a car-phone number
12	ISDN		O	Indicates an ISDN number
13	VIDEO		O	Indicates a video-phone number
Photo Types				
	JPEG		Fundamental	Indicates ISO JPEG format

6.3.6 Advanced Audio Distribution Profile (A2DP), BTIR-0180

Item	Capability	SIG	CE4A Category	Comment
1	Initiate Connection Establishment	M	Fundamental	
2	Accept Connection Establishment	M	Fundamental	
3	Initiate Start Streaming	M	Fundamental	
4	Accept Start Streaming	M	Fundamental	
5	Send Audio Stream	M	Fundamental	
6	Initiate Connection Release	M	Fundamental	
7	Accept Connection Release	M	Fundamental	
8	Initiate Suspend	O	O	
9	Accept Suspend	O	Sophisticated	
10	SBC Encoder	M	Fundamental	
11	SBC Configurations in 16 KHz sampling frequency rate	O	O	
12	SBC Configurations in 32 KHz sampling frequency rate	O	O	
13	SBC Configurations in 44.1 KHz sampling frequency rate	C.1	C.1	C.1: AT least one of the values shall be supported.; CE4A: 44.1 is preferred
14	SBC Configurations in 48 KHz sampling frequency rate	C.1	C.1	
Additional CE4A Requirements				
	Audio output level shall be normalized.		Fundamental	
	Audio output level must not be influenced by any volume setting on mobile device.		Fundamental	

6.3.7 Audio/Video Remote Control Profile (AVRCP), BTIR-0200

Item	Capability	SIG	CE4A Category	Comment
1	Initiating connection establishment for control	O	O	
2	Accepting connection establishment for control initiated by CT	M	Fundamental	
3	Initiating connection release for control	M	Fundamental	
4	Accepting connection release for control initiated by CT	M	Fundamental	
5	Receiving UNIT INFO command	M	Fundamental	
6	Receiving SUBUNIT INFO command	M	Fundamental	
7	Receiving PASS THROUGH command in category 1	C1	C1	C1: Mandatory to support at least one of the categories. Supported operation_id's are shown in Table 8 to Table 11
8	Receiving PASS THROUGH command in category 2	C1	C1	
9	Receiving PASS THROUGH command in category 3	C1	C1	

Item	Capability	SIG	CE4A Category	Comment
10	Receiving PASS THROUGH command in category 4	C1	C1	
11	Get Capabilities Response	C3	Fundamental	C3: Mandatory if item 7 and 0/2 (AVRCP 1.3) are supported.
12	List Player Application Settings Attributes Response	O1	Sophisticated	O1: Optional if AVRCP 1.3 is supported, excluded otherwise.
13	List Player Application Setting Values Response	O1	Sophisticated	
14	Get Current Player Application Settings Value Response	O1	Sophisticated	If 30 is supported, this is mandatory
15	Set Player Application Setting Value Response	O1	Sophisticated	If 30 is supported, this is mandatory
16	Get Player Application Setting Attribute Text Response	O1	O1	
17	Get Player Application Setting Value Text Response	O1	O1	
18	Inform Displayable Character Set Response	O1	O1	UTF-8 needed
19	Inform Battery Status Of CT Response	O1	Premium	
20	Get Element Attributes Response	C3	Fundamental	
21	Get Play Status Response	C2	Fundamental	C2: Mandatory if 20 (Get Element Attributes Response) supported
22	Register Notification Response	C2	Fundamental	
23	Notify Event Response: PLAYBACK_STATUS_CHANGED	C.4	Fundamental	C4: Mandatory if 22 (Register Notification Response) supported.
24	Notify Event Response: TRACK_CHANGED	C.4	Fundamental	
25	Notify Event Response: TRACK_REACHED_END	O1	O1	
26	Notify Event Response: TRACK_REACHED_START	O1	O1	
27	Notify Event Response: PLAYBACK_POS_CHANGED	O1	Sophisticated	
28	Notify Event Response: BATT_STATUS_CHANGED	O1	Premium	
29	Notify Event Response: SYSTEM_STATUS_CHANGED	O1	Premium	
30	Notify Event Response: PLAYER_APPLICATION _SETTING_CHANGED	O1	Sophisticated	If 14 and 15 is supported this is mandatory default player should stay the same, mandatory if multiple players supported
31	Request ContinuingResponse Continuation	C2	C2	
32	Abort ContinuingResponse Response	C2	C2	
33	This item left intentionally blank	N/A	N/A	
34	Next Group	O1	O1	
35	Previous Group	O1	O1	

Item	Capability	SIG	CE4A Category	Comment
36	**Media Player Selection**	C8	Premium	C8: Mandatory for Category 1 and 3, Excluded otherwise
37	SetAddressedPlayer	C8	Premium	
38	GetFolderItems(MediaPlayerList)	C8	Premium	
39	EVENT_AVAILABLE_PLAYERS_CHANGED	C8	Premium	
40	EVENT_ADDRESSED_PLAYER_CHANGED	C8	Premium	
41	Supports Multiple Players	O	Premium	default player should stay the same, mandatory if multiple players supported
42	**Browsing**	O	Premium	
43	SetBrowsedPlayer	C6	Premium	C6: Mandatory if item 42 (Browsing) is supported, Excluded otherwise
44	ChangePath	C6	Premium	
45	GetFolderItems(Filesystem)	C6	Premium	
46	GetItemAttributes	C6	Premium	
47	PlayItem(Filesystem)	C6	Premium	
48	EVENT_UIDS_CHANGED	C9	Premium	C9: Mandatory if item 49 (Database Aware Players) is supported, Optional otherwise.
49	Database Aware Players	O	Premium	
50	**Searching**	O	O	
51	Search	C10	C10	C10: Mandatory if item 50 (Searching) is supported, Excluded otherwise
52	GetFolderItems(Search Results)	C10	C10	
53	PlayItem(SearchResultList)	C10	C10	
54	**NowPlaying**	C11	Premium	C11: Mandatory if item 42 (Browsing) is supported, Optional otherwise
55	GetFolderItems(NowPlayingList)	C11	Premium	
56	PlayItem(NowPlayingList)	C11	Premium	
57	AddToNowPlaying	O	Premium	
58	EVENT_NOW_PLAYING_CONTENT_CHANGED	C11	Premium	
59	Playable Folders	O	Premium	
60	**Absolute Volume**	C5	C5	C5: Mandatory for Category 2, Excluded otherwise; Mobile device shall not change the volume without user interaction
61	SetAbsoluteVolume	C5	C5	stream level
62	NotifyVolumeChange	C5	C5	
63	**Error Response**	O	Sophisticated	
64	General Reject	C11	Premium	
65	**Discoverable Mode**	M	Fundamental	

Item	Capability	SIG	CE4A Category	Comment
Automatic Player Application Execution		N/A	Fundamental	This is an additional automotive requirement currently not covered by the SIG. It requires that upon reception of an AVRCP command, the player application is automatically executed on the mobile device and no manual interaction locally on the mobile device
	Operation Ids			
	0	O	O	
	1	O	O	
	2	O	O	
	3	O	O	
	4	O	O	
	5	O	O	
	6	O	O	
	7	O	O	
	8	O	O	
	9	O	O	
	Dot	O	O	
	Enter	O	O	
	Clear	O	O	
	Sound select	O	O	
	Input select	O	O	
	Display information	O	O	
	Help	O	O	
	Power	O	O	
	Play	M	Fundamental	
	Stop	M	Fundamental	
	Pause	O	Fundamental	
	Record	O	O	
	Rewind	O	Fundamental	
	Fast forward	O	Fundamental	
	Eject	O	O	
	Forward	O	Fundamental	
	Backward	O	Fundamental	
	Angle	O	O	
	Subpicture	O	O	
	F1	O	O	
	F2	O	O	
	F3	O	O	
	F4	O	O	

Item	Capability	SIG	CE4A Category	Comment
	F5	O	O	
	vendor unique	O	O	
Player Application Settings				
	Equalizer ON/OFF status	O	Sophisticated	
	Repeat Mode status	O	Sophisticated	
	Shuffle ON/OFF status	O	Sophisticated	
	Scan ON/OFF status	O	Premium	
Media Attributes				
	Title of the media	M	Fundamental	
	Name of the artist	O	Sophisticated	Should be standard for an up-to-date player to transmit at least the same information as on its own display
	Name of the album	O	Sophisticated	Should be standard for an up-to-date player to transmit at least the same information as on its own display
	Number of the media (ex. Track number of the CD)	O	Sophisticated	
	Total number of the media (ex. Total track number of the CD)	O	Sophisticated	
	Genre	O	Sophisticated	
	Playing time in millisecond	O	Sophisticated	

6.3.8 SIM Access Profile (SAP), BTIR-0240

Item	Capability	SIG	CE4A Category	Comment
1	Connection Management	M	Fundamental	
1a	Passkey length – Devices are bonded	C1	C1	C.1: Mandatory if 12 otherwise optional.
1b	Security mode 4 support	C4, C5	C4, C5	C.4: Mandatory if GAP 2/7 (security mode 4) is supported, otherwise excluded. C.5: Prerequisite Table 0/2 (SAP v1.1)
2	Transfer APDU	M	Fundamental	
3	Transfer ATR	M	Fundamental	
4	Power SIM off	M	Fundamental	
5	Power SIM on (SIM can be inserted into the Server without terminating the SIM Access Profile connection)	C2	C2	C.2: It is mandatory to support at least one of these two features.
6	Power SIM on (SIM cannot be inserted into the Server without terminating the SIM Access Profile connection)	C2	C2	
7	Reset SIM	M	Fundamental	
8	Report Status (SIM can be inserted into or removed from the Server without terminating the SIM Access Profile connection)	C3	C3	C.3: It is mandatory to support at least one of these two features.

Item	Capability	SIG	CE4A Category	Comment
9	Report Status (SIM cannot be inserted into or removed from the Server without terminating the SIM Access Profile connection)	C3	C3	
10	Transfer Card Reader Status	M	Fundamental	
11	Set Transport Protocol	O	O	
12	Perform bonding outside SIM Access Profile connection	O	O	

6.3.9 Personal Area Network (PAN), BTIR-0270

Item	Capability	SIG	CE4A Category	Comment
1	Support BNEP	M	Fundamental	
2	Support BNEP Forwarding	M	Fundamental	
3	Support Layer 2-Bridging between PAN and External Network	C.1	C.1	C.1: NAP Devices must support either item 3 or 4.
4	Support IP Forwarding between PAN and External Network	C.1	C.1	
5	Support BNEP Packet Filtering	O	O	
6	Support IPv4	C.2	C.2	C.2: Mandatory if any IPv4-based transport protocol is supported or any of the items 7 – 11 is supported, otherwise optional.
6a	Supports operable routable IPv4 address	O	Fundamental	
6b	Support link-local address configuration for IPv4	C.4	C.4	C.4: Mandatory if item 6 is supported and item 6a is not supported, otherwise optional.
7	Support ping client for IPv4	O	O	
8	Support DHCP Client for IPv4	O	?	
9	Support DNS/ Resolver for IPv4	O	Fundamental	
9a	Support LLMNR Sender for IPv4	C.5	C.5	C.5: Mandatory if item 6 supported (Support IPv4)
9b	Support LLMNR Responder for IPv4	O	O	
10	Support HTTP Client for IPv4	O	O	
11	Support WAP Client for IPv4	O	O	
12	Support IPv6	C.3	Premium	C.3: Mandatory if any IPv6-based transport protocol is supported or any of the items 13 – 16 is supported, otherwise optional.
13	Support ping client for IPv6	O	O	
14	Support DNS/ Resolver for IPv6	O	Premium	
14a	Support LLMNR Sender for IPv6	C.6	C.6	C.6: Mandatory if item 12 supported (Support IPv6)
14b	Support LLMNR Responder for IPv6	O	O	
15	Support HTTP Client for IPv6	O	O	

Item	Capability	SIG	CE4A Category	Comment
16	Support WAP Client for IPv6	O	O	
17	Supports Connectable Mode	M	Fundamental	
18	NAP Service Record	M	Fundamental	
19	Support at least three PANUs	O	O	
20	Support at least two PANUs	O	O	
Additional CE4A Requirements				
	Support stateless autoconfiguration (tbc)		Premium	IPv6 feature (RFC 4862)
	Support DHCP v6 for DNS announcements (tbc)		Premium	IPv6 feature (RFC 3646)

6.3.10 Messaging Access Profile (MAP), BTIR-0290

Item	Capability	SIG	CE4A Category	Comment
1	**Message Notification**	M	Fundamental	
1a	SendEvent	M	Fundamental	
2	**Message Browsing**	M	Fundamental	
2a	SetFolder	M	Fundamental	
2b	GetFoldersListing	M	Fundamental	
2c	GetMessagesListing	M	Fundamental	
2d	GetMessage	M	Fundamental	
2e	SetMessageStatus	M	Fundamental	
2f	UpdateInbox	M	Fundamental	
3	**Message Uploading**	M	Fundamental	
3a	SetFolder	M	Fundamental	
3b	GetFoldersListing	M	Fundamental	
3c	PushMessage	M	Fundamental	
4	**Message Delete**	M	Fundamental	
4a	SetMessageStatus	M	Fundamental	
5	**Notification Registration**	M	Fundamental	
5a	SetNotificationRegistration	M	Fundamental	
6	**Supported Message Types**			
6a	EMAIL	C1	C1	C1: Mandatory to support at least one of the defined message types 6a to 6d IF 2 (message browsing) or 3 (message uploading) is supported
6b	SMS_GSM	C1	C1	
6c	SMS_CDMA	C1	C1	
6d	MMS	C1	C1	

6.3.11 AT Command Requirements

These AT Commands are recommended to be implemented by mobile terminals for in-car usage.

Command	Description	CE4A Category	Comment
AT+CGMI	Query Manufacturer Identification	Sophisticated	
AT+CGMM	Query Model Identification	Sophisticated	
AT+CGMR	Query Revision Identification	Sophisticated	
AT+CGSN	Query Product Serial Number ID (IMEI)	Sophisticated	
AT+CIMI	Query International Mobile Subscriber ID (IMSI)	Sophisticated	
AT+CREG?	Query Network Registration State	Sophisticated	
AT+CSQ	Query Signal Quality	Sophisticated	
AT+CPAS	Query Phone Activity Status	Sophisticated	
AT+CPIN=b	Enter SIM PIN code	Sophisticated	
AT+CPIN?	Detect SIM PIN lock state	Sophisticated	
AT+CSCS="GSM" AT+CSCS="HEX" AT+CSCS="IRA" AT+CSCS="UCS2"	Set Character Set: - GSM 7 bit default alphabet - Hexadecimal - Internat. reference alphabet - Unicode (16 bit)	Sophisticated	
AT+CSCS=?	Query Character Set	Sophisticated	
AT+CSCS?		Sophisticated	
AT+CPBS=?	Query Supported Phonebooks	Premium	Phonebook access should be enabled via PBAP. AT-commands useful for legacy cars.
AT+CPBS?			
AT+CPBS=s	Select Phonebook	Premium	
AT+CPBS?	Get Phonebook Info	Premium	
AT+CPBR=?	Get Phonebook Size	Premium	
AT+CPBR=n,m	Read Phonebook Entries	Premium	
+CPBS: <storage>	PhoneBookSelection	Premium	
+CPBR: <idex1>,<number>,<type>,“<text><contact_flag>	ReturnPhoneBookEntries	Premium	
+CSCS: <charset>	CharacterSetSelection	Sophisticated	

7 Future Short To Mid Term Requirements

The Bluetooth technology evolution continues. Bluetooth 4.0 (Bluetooth Low Energy) was introduced on the market during 2011 and 2012 with support for coin cell battery operated accessories. This implies no improvement in power consumption for mobile terminals, but means a shift in software strategy and way of working. Onwards, Bluetooth profiles can generally be installed on application level and the eco system of devices is more diverse. Applications include sensors for sports/health as well as proximity and security devices.

Furthermore, overlap in a number of use cases and relation to other technologies such as Wi-Fi, USB and NFC should be addressed in future releases of this PRD.

ANNEX A: Detailed Document Change Record

Version	Approved Date	Record of changes made to previous version	
		Section	Comment
OMTP v1.1	2 March 2010	n/a	Basis for this PRD: OMTP “Local Bluetooth Connectivity” version 1.1
1.0	28 Sept. 2012	All	Rename of PRD to TS.19 “Bluetooth® Interoperability Requirements for Mobile Terminals” Major update of all sections with input from CE4A, individual car manufacturers, Terminal Vendors and the GSMA Connected Living Programme’s mAutomotive Work Stream.

Document Management

Document History

Version	Date	Brief Description of Change	Approval Authority	Editor / Company
1.0	20 August 2012	Submitted to DAG and PSMC for approval, final approval date 28th September	PSMC & TSG	Harald Ruff (Dt. Telekom) Hajo Schulze (Vodafone D2 GmbH)

Other Information

Type	Description
Document Owner	GSMA Terminal Steering Group
Editor / Company	Harald Ruff (Dt. Telekom) Hajo Schulze (Vodafone D2 GmbH)

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Your comments or suggestions & questions are always welcome.