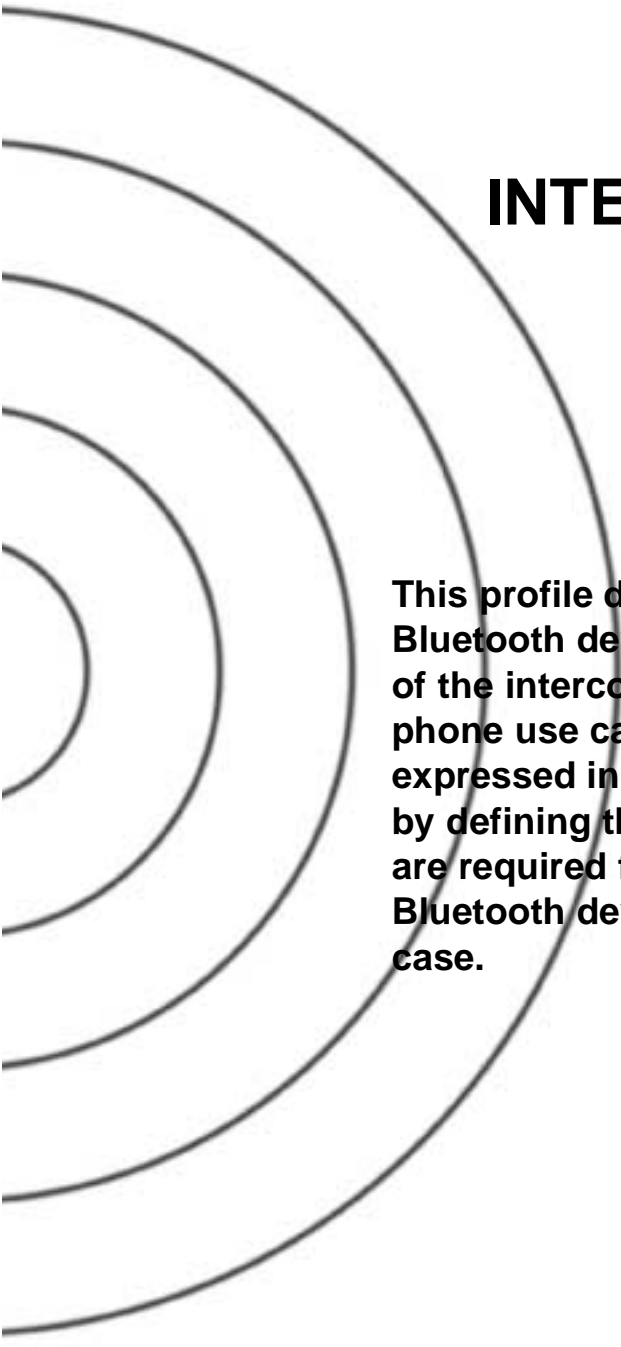# INTERCOM PROFILE

This profile defines the requirements for Bluetooth devices necessary for the support of the intercom functionality within the 3-in-1 phone use case. The requirements are expressed in terms of end-user services, and by defining the features and procedures that are required for interoperability between Bluetooth devices in the 3-in-1 phone use case.

CONTENTS

1 INTRODUCTION

1.1 SCOPE

This Intercom profile defines the protocols and procedures that shall be used by devices implementing the intercom part of the usage model called'3-in-1 phone'. More popularly, this is often referred to as the 'walkie-talkie' usage of Bluetooth.

1.2 PROFILE DEPENDENCIES

In Figure 1.1, the Bluetooth profile structure and the dependencies of the profiles are depicted. A profile is dependent upon another profile if it re-uses parts of that profile, by implicitly or explicitly referencing it. Dependency is illustrated in the figure: a profile has dependencies on the profile(s) in which it is contained – directly and indirectly. As indicated in the figure, the Intercom profile is dependent only upon the Generic Access Profile – details are provided in Section 9.
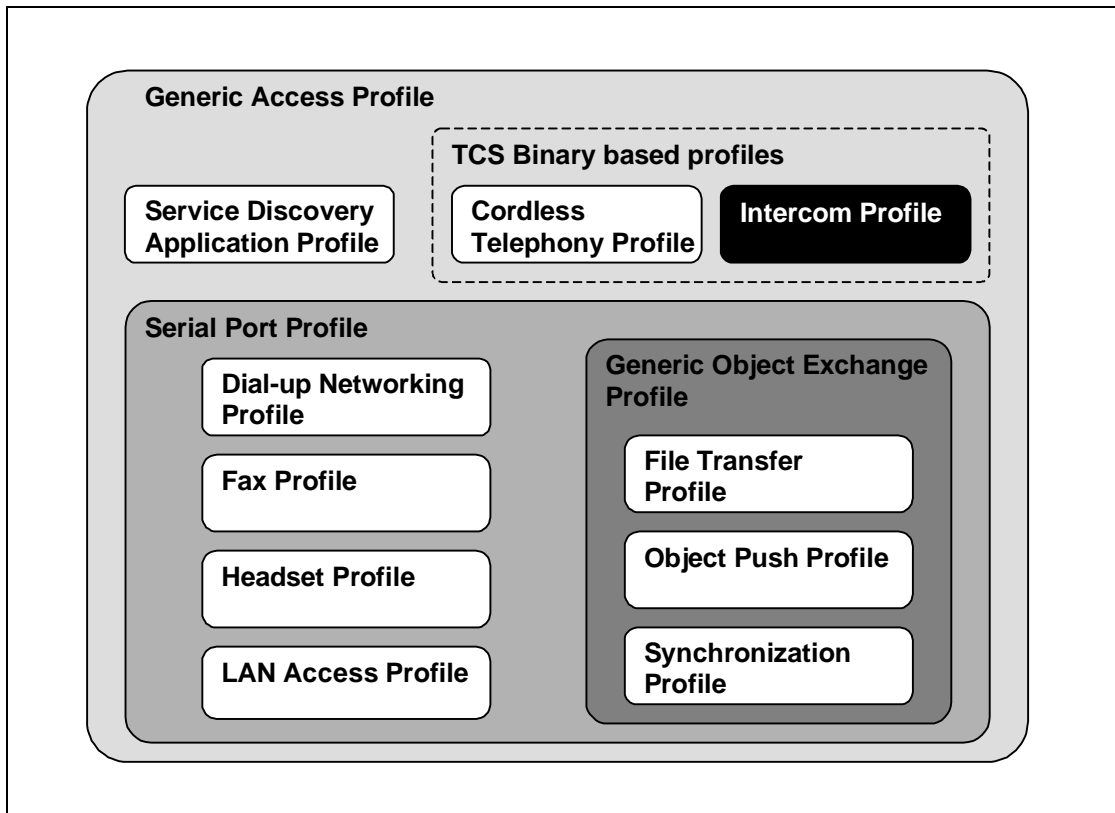
Figure 1.1: Bluetooth Profiles

Bluetooth™

1.3 SYMBOLS AND CONVENTIONS

1.3.1 Requirement status symbols

In this document, the following symbols are used:

- 'M' for mandatory to support

- 'O' for optional to support

- 'X' for excluded (used for capabilities that may be supported by the unit but shall never be used in the use case)

- 'C' for conditional to support

- 'N/A' for not applicable (in the given context it is impossible to use this capability)

Some excluded capabilities are capabilities that, according to the relevant Bluetooth specification, are mandatory. These are features that may degrade operation of devices in this use case. Therefore, these features shall never be activated while a unit is operating as a unit within this use case.

1.3.2 Signalling diagram conventions

The following arrows are used in diagrams describing procedures:

Figure 1.2: Arrows used in signalling diagrams

2 PROFILE OVERVIEW

2.1 PROFILE STACK

Figure 2.1 below shows the protocols as used within this profile:

Figure 2.1: Intercom Profile Stack

This profile will define the requirements for each of the layers in the model above.

In the profile, the interfaces in Figure 2.1 above are used for the following purposes:

A) The Call Control entity uses this interface to the speech synchronization control to connect and disconnect the internal speech paths;
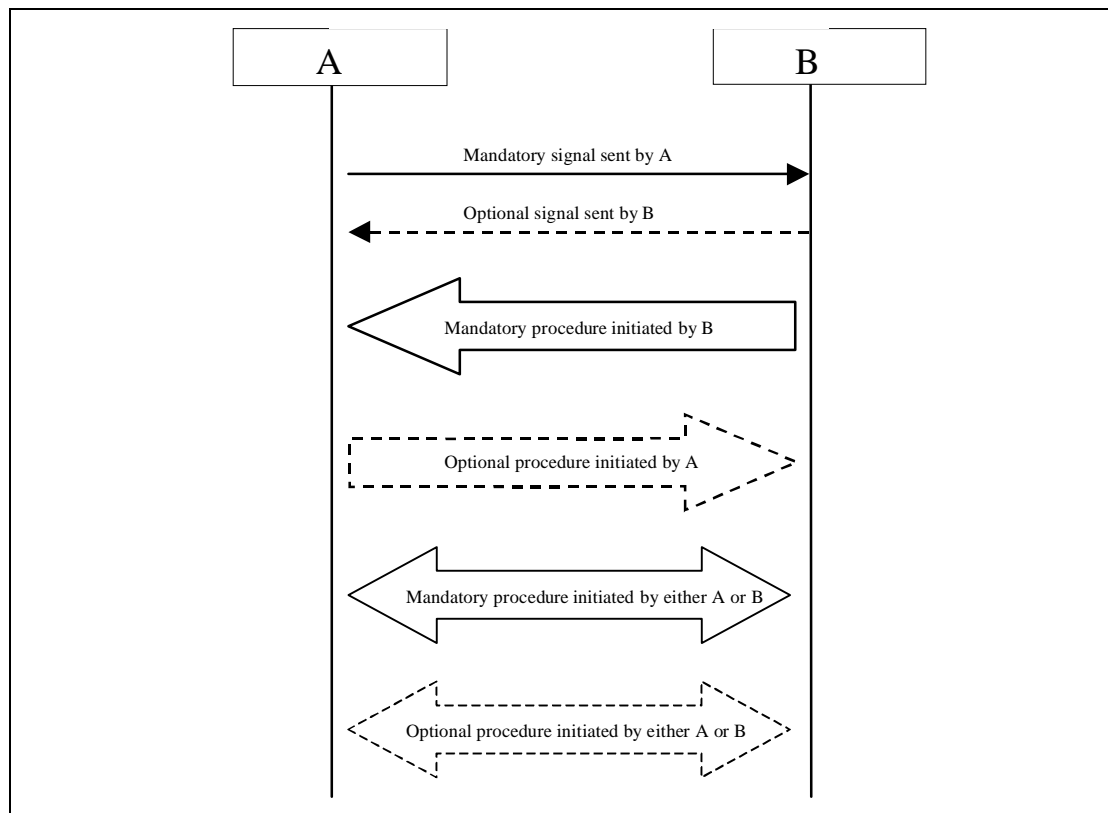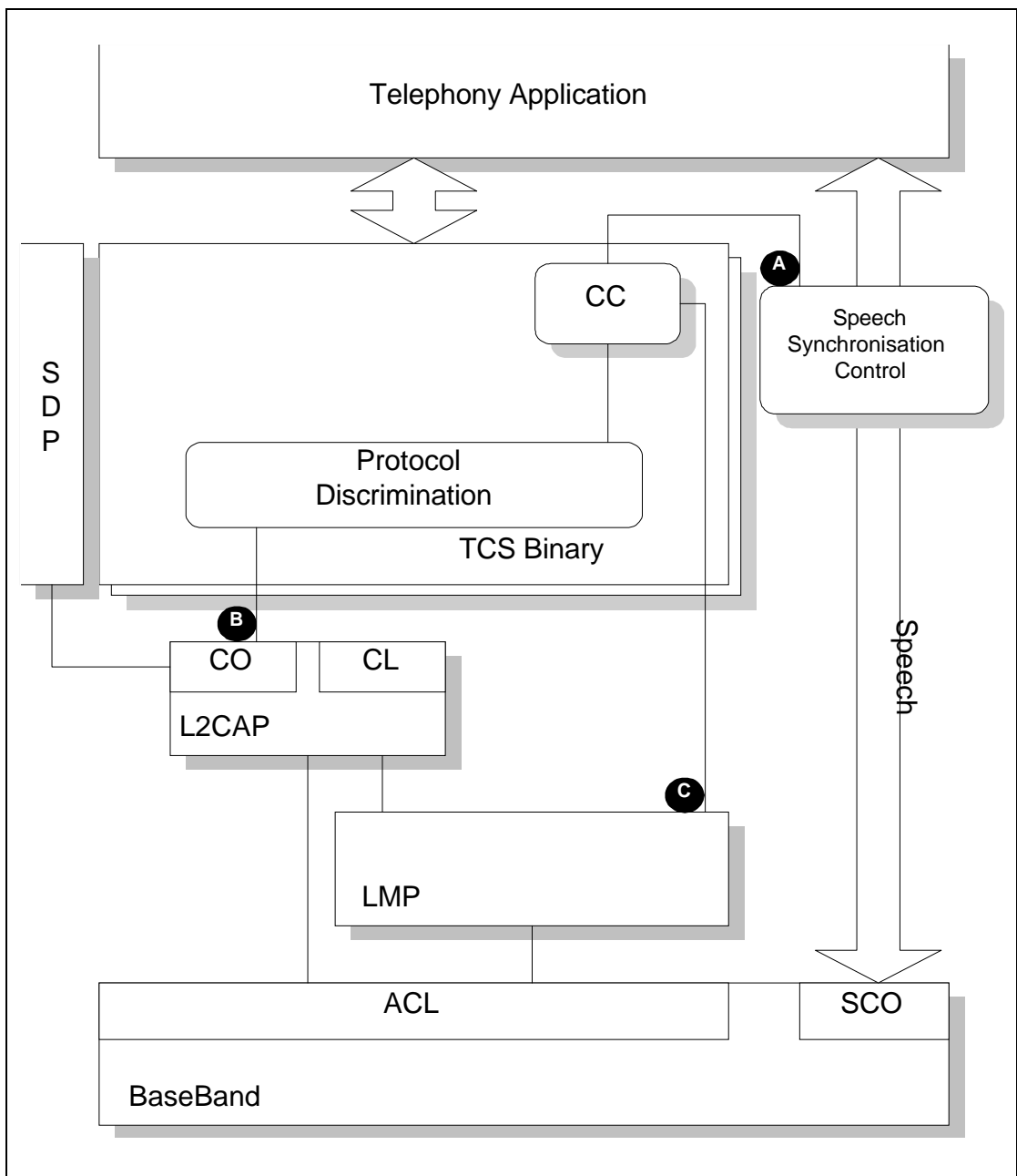
B) Used to deliver TCS messages on the connection-oriented (point-to-point) L2CAP channel;

C) Used by the Call Control entity to control the Link Manager directly for the purpose of establishing and releasing SCO links;

Note that, for initialization purposes, it is additionally required to control the LC/Baseband directly, to enable inquiry, paging, inquiry scan, page scan.

2.2 CONFIGURATION AND ROLES

The figure below shows a typical configuration of devices for which the Intercom profile is applicable:
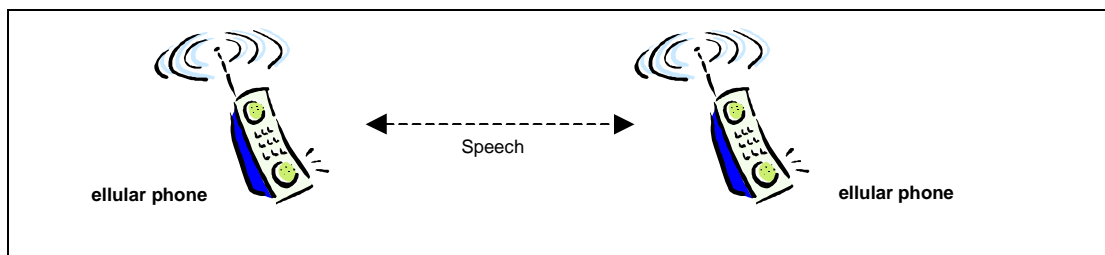
Figure 2.2: Intercom profile, example

As the intercom usage is completely symmetrical, there are no specific roles defined. A device supporting the Intercom profile will generally be denoted as Terminal (TL).

2.3 USER REQUIREMENTS AND SCENARIOS

The Intercom profile defines the protocols and procedures that shall be used by devices implementing the intercom part of the use case called '3-in-1 phone'.

The scenarios targeted by this use case are typically those where a direct speech link is required between two devices (phone, computer, …), established using telephony-based signalling.

A typical scenario is the following:

• Two (cellular) phone users engaged in a speech call, on a direct phone-to-phone connection using Bluetooth only.

2.4 PROFILE FUNDAMENTALS

Here is a brief summary of the interactions that take place when a terminal wants to establish an intercom call towards another terminal. In the description below, the term initiator (A-party) and acceptor (B-party) will be used to designate the direction of the call.

1. If the initiator of the intercom call does not have the Bluetooth Address of the acceptor, it has to obtain this; e.g. using the Device discovery procedure – see Section 6.4 of Generic Access profile.

2. The profile does not mandate a particular security mode. If users of either device (initiator/acceptor) want to enforce security in the execution of this profile, the authentication procedure (see Section 5.1 of Generic Access profile) has to be performed to create a secure connection.

3. The initiator establishes the link and channel as indicated in Section 7 of the Generic Access profile. Based on the security requirements enforced by users of either device, authentication may be performed and encryption may be enabled.

4. The intercom call is established.

5. After the intercom call has been cleared, the channel and link will be released as well.

2.5 FEATURE DEFINITIONS

Call information **–** The ability to provide additional information during the active phase of a call.

Intercom call – A speech call between two terminals.

On hook **–** The ability to indicate the action of going on-hook (e.g. to terminate a call) and release of all radio resources related to that call.

2.6 CONFORMANCE

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

3 APPLICATION LAYER

The following text together with the associated sub-clauses defines the feature requirements with regard to this profile.

Table 3.1 below shows the feature requirements made by this profile.

Item no.	Feature	Support
1.	Intercom call	M
2.	On hook	M
3.	Call information	O

Table 3.1: Application layer features

Table 3.2 below maps each feature to the TCS Binary procedures used for that feature and shows whether the procedure is optional, mandatory or conditional for that feature.

Item no.	Feature	Procedure	Ref.	Support
1.	Intercom call	Call request	4.1.1	M
		Call confirmation	4.1.2	M
		Call connection	4.1.3	M
2.	On hook	Call clearing	4.1.5	M
3.	Call information	Call information	4.1.6	M

Table 3.2: Application layer feature to procedure mapping

4 TCS BINARY

The following text together with the associated sub-clauses defines the mandatory requirements with regard to this profile.

When describing TCS Binary procedures, this chapter provides additional information concerning lower layer handling. The normative reference for TCS Binary procedures is TCS Binary.

Annex A contains signalling flows that illustrate the procedures in this chapter.

4.1 CALL CONTROL PROCEDURES

4.1.1 Call request

This procedure shall be performed as defined in Section 2.2.1 of TCS Binary. In addition, the following applies: before a call request can be made, a connection-oriented L2CAP channel needs to be established between the two devices, using the procedures as indicated in Section 6. When the L2CAP channel has been established, the terminating side will start timer $T_{ic}(100)$. When, at expiry of timer $T_{ic}(100)$, the terminating side has not received the SETUP message initiating the call request, it may terminate the L2CAP channel. Receiving the SETUP message before expiry of $T_{IC}(100)$ will cancel the timer.

4.1.2 Call confirmation

This procedure shall be performed as defined in Section 2.2.5 of TCS Binary.

4.1.3 Call connection

This procedure shall be performed as defined in Section 2.2.6 of TCS Binary. The following text defines the mandatory requirements with regard to this profile.

The SCO link establishment sub-procedure (see LMP, Section 3.21) shall be initiated before sending a CONNECT.

The speech path shall be connected by a unit when it receives a CONNECT or CONNECT ACKNOWLEDGE.

4.1.4 Failure of call establishment

This procedure shall be performed as defined in Section 2.2.10 of TCS Binary. Additionally, the text in Section 4.1.5 defines the mandatory requirements with regard to this profile concerning call clearing.

4.1.5 Call clearing

All call-clearing and call-collision procedures as defined in Section 2.3 of TCS Binary shall be supported by the TL.

In addition, the following applies: after the last call-clearing message has been sent, a unit shall:

- release the SCO link by invoking the appropriate LMP sub-procedure (see LMP, Section 3.21.5), if not already released.

- terminate the L2CAP channel used for TCS Call-control signalling (if not already terminated) and detach the other unit.

4.1.6 Call information

This procedure shall be performed as defined in Section 2.2.7 of TCS Binary.

4.2 TCS BINARY MESSAGE OVERVIEW

This section defines the requiredTCS Binary messages in the Intercom profile.

Message	Support
Alerting	M
Connect	M
Connect Acknowledge	M
Disconnect	M
Information	O
Release	M
Release Complete	M
Setup	M

Table 4.1: TCS Binary messages

4.3 INFORMATION ELEMENT OVERVIEW

This section together with the associated sub-clauses defines the requiredin-formation elements used in TCS Binary messages in the Intercom profile.

Information element	Support
Message type	M
Audio control	O
Bearer capability	M
Call class	M
Called party number	O
Calling party number	O
Cause	M
Clock offset	N/A
Company-specific	O
Configuration data	N/A
Destination CID	N/A
Keypad facility	O
Progress indicator	N/A
SCO handle	M
Sending complete	O
Signal	O

Table 4.2: TCS Binary information elements

The following subsections define restrictions that apply to the contents of the TCS Binary information elements in the Intercom profile. Note that, in the tables, only fields where restrictions apply are shown. If a field is not shown in a table, it means that all values defined in Section 7 of TCS Binary for that field are allowed.

For those information elements not listed below, no restrictions apply.

4.3.1 Bearer capability

The following restrictions apply to the contents of the Bearer capability information element:

Field	Values allowed
Link type	SCO, None
User information layer 1	CVSD

Table 4.3: Restrictions to contents of Bearer capability information element

4.3.2 Call class

The following restrictions apply to the contents of the Call class information element:

Field	Values allowed
Call class	Intercom call

Table 4.4: Restrictions to contents of Call class information element

4.3.3 Cause

The following restrictions apply to the contents of the Cause information element:

Field	Values allowed
Cause value	#16 – "Normal call clearing" #17 – "User busy", #18 – "No user responding", #19 – "No answer from user (user alerted)", #21 – "Call rejected by user" #34 – "No circuit/channel available", #41 – "Temporary failure", #44 – "Requested circuit/channel not available", #58 – "Bearer capability not presently available", #65 – "Bearer capability not implemented", #69 – "Requested facility not implemented", #102 – "Recovery on timer expiry"

Table 4.5: Restrictions to contents of Cause information element

4.4 LINK LOSS

If a unit in a CC state other than *Null* detects loss of link, it shall immediately go to the *Null* state. Call clearing procedures shall in this case not be performed.

5 SDP INTEROPERABILITY REQUIREMENTS

Table 5.1 lists all intercom-related entries in the SDP database. For each field, the Status column indicates whether the presence of this field is mandatory or optional.

The codes assigned to the mnemonic's used in the Value column as well as the codes assigned to the attribute identifiers (if not specifically mentioned in the AttrID column) can be found in the Bluetooth Assigned Numbers document (http://www.bluetooth.org/assigned-numbers.htm).

Item	Definition	Type	Value	AttrID	Status	Default
ServiceClassIDList					M	
ServiceClass0		UUID	Intercom		M	
ServiceClass1		UUID	Generic Telephony		M	
Protocol Descriptor List					M	
Protocol0		UUID	L2CAP		M	
Protocol1		UUID	TCS-BIN		M	
BluetoothProfileDe-scriptorList					O	
Profile0	Sup-ported Profiles	UUID	Intercom		M	Intercom
Param0	Profile Version	Uint16	0x0100[*]		M	0x0100
Service Name	Display-able Text name	String	Service-provider defined		O	"Intercom"

Table 5.1: Service Record

*. Indicating version 1.0

Bluetooth™

6 L2CAP INTEROPERABILITY REQUIREMENTS

The following text together with the associated sub-clauses define the mandatory requirements with regard to this profile.

6.1 CHANNEL TYPES

In this profile, only connection-oriented channels are used. In the PSM field of the Connection Request packet, the default value for TCS-BIN, 0x0005 (see Section 3.2 of Assigned Numbers) shall be used.

6.2 CONFIGURATION OPTIONS

This section describes the usage of configuration options.

6.2.1 Maximum Transmission unit

The minimum MTU that a L2CAP implementation used for this profile should support is 3 octets.

6.2.2 Flush timeout option

The flush timeout value used for both the GW and the TL shall be the default value of 0xFFFF.

6.2.3 Quality of Service

Negotiation of Quality of Service is optional.

7 LINK MANAGER (LM) INTEROPERABILITY REQUIREMENTS

7.1 CAPABILITY OVERVIEW

In the table below, all LM capabilities are listed. In the table it is shown what LMP features are mandatory to support with respect to this profile and which are optional.

	Procedure	Support in LMP	Support
1.	Authentication	M	
2.	Pairing	M	
3.	Change link key	M	
4.	Change the current link key	M	
5.	Encryption	O	
6.	Clock offset request	M	
7.	Slot offset information	O	
8.	Timing accuracy information request	O	
9.	LMP version	M	
10.	Supported features	M	
11.	Switch of master slave role	O	
12.	Name request	M	
13.	Detach	M	
14.	Hold mode	O	
15.	Sniff mode	O	
16.	Park mode	O	
17.	Power control	O	
18.	Channel quality driven DM/DH	O	
19.	Quality of service	M	
20.	SCO links	O	M
21.	Control of multi-slot packets	O	
22.	Paging scheme	O	
23.	Link supervision	M	
24.	Connection establishment	M	

Table 7.1: LMP procedures

8 LINK CONTROL (LC) INTEROPERABILITY REQUIREMENTS

8.1 CAPABILITY OVERVIEW

The following table lists all capabilities on the LC level.

	Capabilities	Support
1.	Inquiry	
2.	Inquiry scan	
3.	Paging	
4.	Page scan	
A	Type R0	
B	Type R1	
C	Type R2	
5.	Packet types	
A	ID packet	
B	NULL packet	
C	POLL packet	
D	FHS packet	
E	DM1 packet	
F	DH1 packet	
G	DM3 packet	
H	DH3 packet	
I	DM5 packet	
J	DH5 packet	
K	AUX packet	X
L	HV1 packet	
M	HV2 packet	
N	HV3 packet	
O	DV packet	
6.	Inter-piconet capabilities	

Table 8.1: Baseband/LC capabilities

	Capabilities	Support
7.	Voice codec	
A	A-law	
B	μ-law	
C	CVSD	M

Table 8.1: Baseband/LC capabilities

8.2 CLASS OF DEVICE

The Class of Device field shall be set to the following:

1. Set the 'Generic Telephony' bit in the Service Class field

2. Indicate 'Phone' as Major Device class

9 GENERIC ACCESS PROFILE

This section defines the support requirements for the capabilities as defined in Generic Access Profile.

9.1 MODES

The table shows the support status for Modes within this profile.

	Procedure	Support
1	Discoverability modes	
	Non-discoverable mode	M
	Limited discoverable mode	O
	General discoverable mode	M
2	Connectability modes	
	Non-connectable mode	N/A
	Connectable mode	M
3	Pairing modes	
	Non-pairable mode	O
	Pairable mode	C3
C3: If the bonding procedure is supported, support for pairable mode is mandatory, otherwise optional		

Table 9.1: Modes

9.2 SECURITY ASPECTS

No changes to the requirements as stated in the Generic Access Profile.

9.3 IDLE MODE PROCEDURES

The table shows the support status for Idle mode procedures within this profile.

	Procedure	Support
1	General inquiry	M
2	Limited inquiry	O
3	Name discovery	O
4	Device discovery	O
5	Bonding	O

Table 9.2: Idle mode procedures

10 ANNEX A (INFORMATIVE): SIGNALLING FLOWS

This annex contains signalling diagrams that are used to clarify the interworking between units. This annex is informative only. The diagrams do not represent all possible signalling flows as defined by this profile.

10.1 CALL ESTABLISHMENT

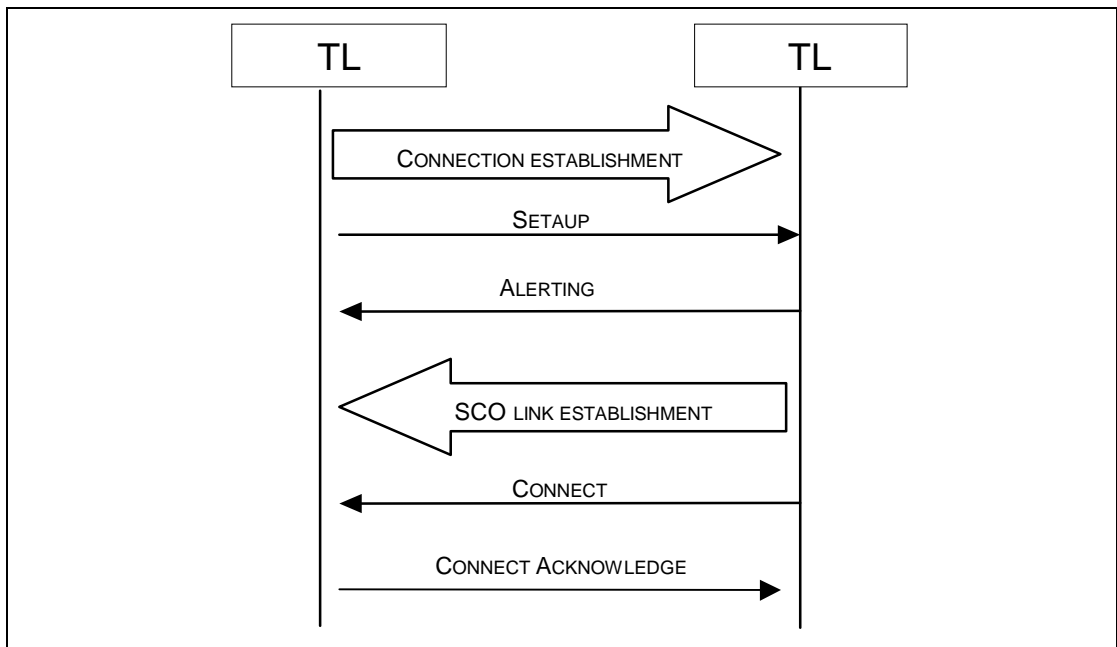The figure below shows the allowed signalling flow in the successful case:

Figure 10.1: Call establishment

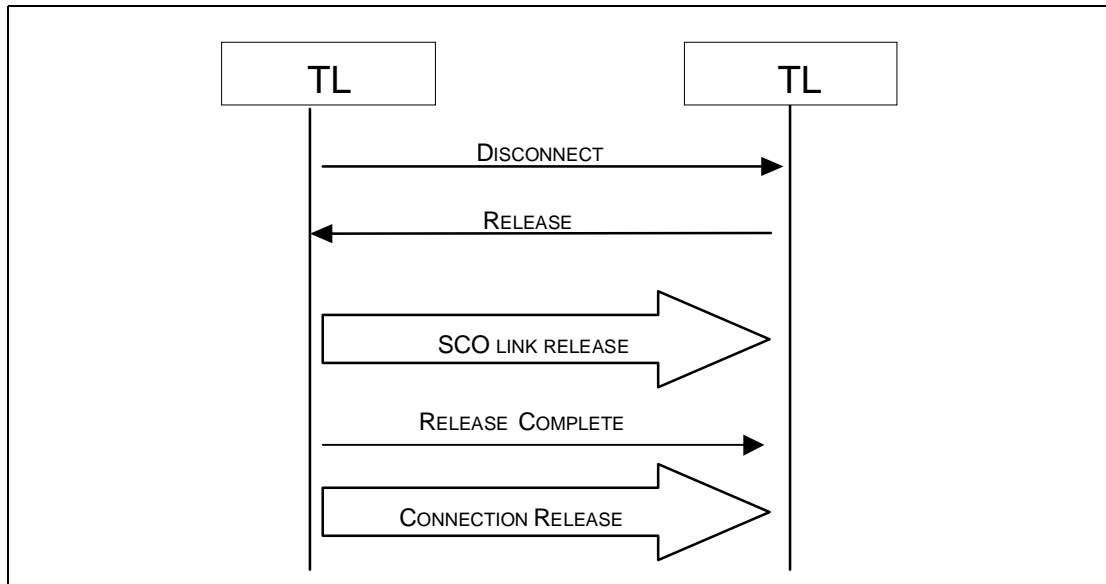## 10.2 CALL CLEARING

The figure below shows the allowed signalling flow for the call clearing:

Figure 10.2: Call Clearing signalling flow, successful case

11 TIMERS AND COUNTERS

Timer name	Proposed value	Description	Comment
$T_{IC}(100)$	10s	Time between L2CAP connection establishment and call request initiation	

Intercom Profile

12 LIST OF FIGURES

13 LIST OF TABLES