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# Hands-Free Profile

## **Abstract**

The Hands-Free Profile (HFP) specification defines the minimum set of functions such that a Mobile Phone can be used in conjunction with a Hands-Free device (e.g. installed in the car), with a Bluetooth Link providing a wireless means for both remote control of the Mobile Phone by the Hands-Free device and voice connections between the Mobile Phone and the Hands-Free device.

Compliance with this specification assures interoperability between a Bluetooth enabled Hands-Free device and any Bluetooth equipped Mobile Phone supporting this profile.

## Special Interest Group (SIG)

The following companies are represented in the Bluetooth Special Interest Group:

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 Agere Systems  
 Microsoft Corp.  
 Motorola Corp.  
 Nokia Mobile Phones  
 Telefonaktiebolaget LM Ericsson.  
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## 1 Introduction

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### 1.1 Scope

This Hands-Free Profile defines the protocols and procedures that shall be used by devices implementing the usage model called "Operating a Phone via an In-Car Device" (see [3]). The most common examples of such devices are Hands-Free units and cellular phones.

An implementation of the Hands-Free Profile typically enables a car's embedded Hands-Free unit to be wirelessly connected to a cellular phone for the purposes of acting as the cellular phone's audio input and output mechanism, providing full duplex audio and perhaps combinations of voice recognition, noise suppression, and acoustic echo cancellation.

### 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 below: a profile has dependencies on the profile(s) in which it is contained directly and indirectly.

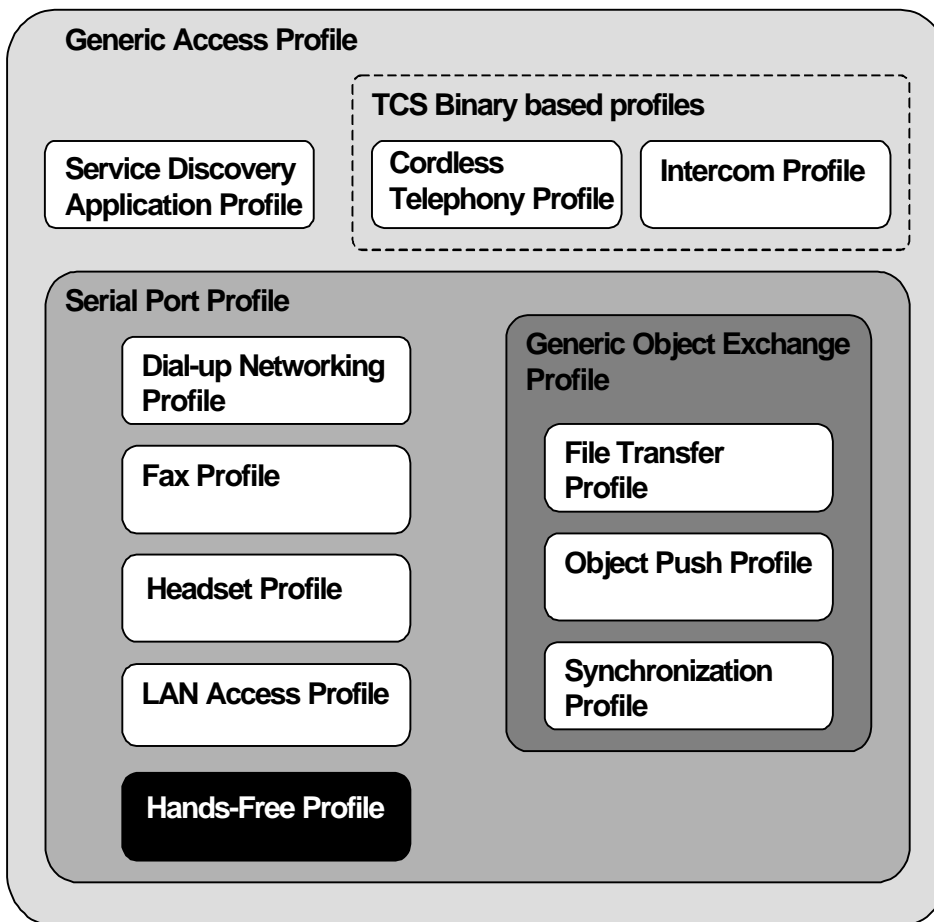


Figure 1.1 Bluetooth Profiles

As indicated in the figure, the Hands-Free Profile is dependent upon both the Serial Port Profile [6] and the Generic Access Profile [5]. Details are provided in Sections 5 (Serial Port Profile) and 6 (Generic Access Profile).

## 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 this use case)
- "C" for conditional to support
- "N/A" for not applicable (in the given context it is impossible to use this capability)

Some capabilities or features (identified as “N/A”), mandated according to the relevant Bluetooth specifications, are excluded in some use cases in this profile because they may degrade the operation of devices in the particular use case. Therefore, features or capabilities labeled “N/A” shall never be activated while operating in a use case where they are labeled as such.

### **1.3.2 Naming conventions**

In this document, the following naming conventions are used:

- Where “LMP link” is said, it means a Link Manager (LM) level link over which only Link Manager Protocol (LMP) commands are conveyed.
- Where “Service Level Connection” is said, it means a high level protocol connection involving a portion of the protocol stack. In this specific case, it refers to the presence of a RFCOMM over a L2CAP connection (see [1]).
- Where “SCO link” is said, it means a low level Synchronous Connection Oriented (SCO) link intended for supporting a full duplex Audio Connection.
- Where “Audio Connection” is said, it means an SCO link plus all the means necessary to provide a complete audio path between both actors in the profile.
- Where “incoming call” is said, it means a call connection in the direction “Cellular Network=>AG”, such that it is initiated by the Network to which the AG is attached.
- Where ‘outgoing call’ is said, it means a call connection in the direction “AG=>Cellular Network”, such that it is initiated by the AG towards the Network to which it is attached.

### **1.3.3 Signaling diagram conventions**

The following conventions are used in diagrams describing procedures:

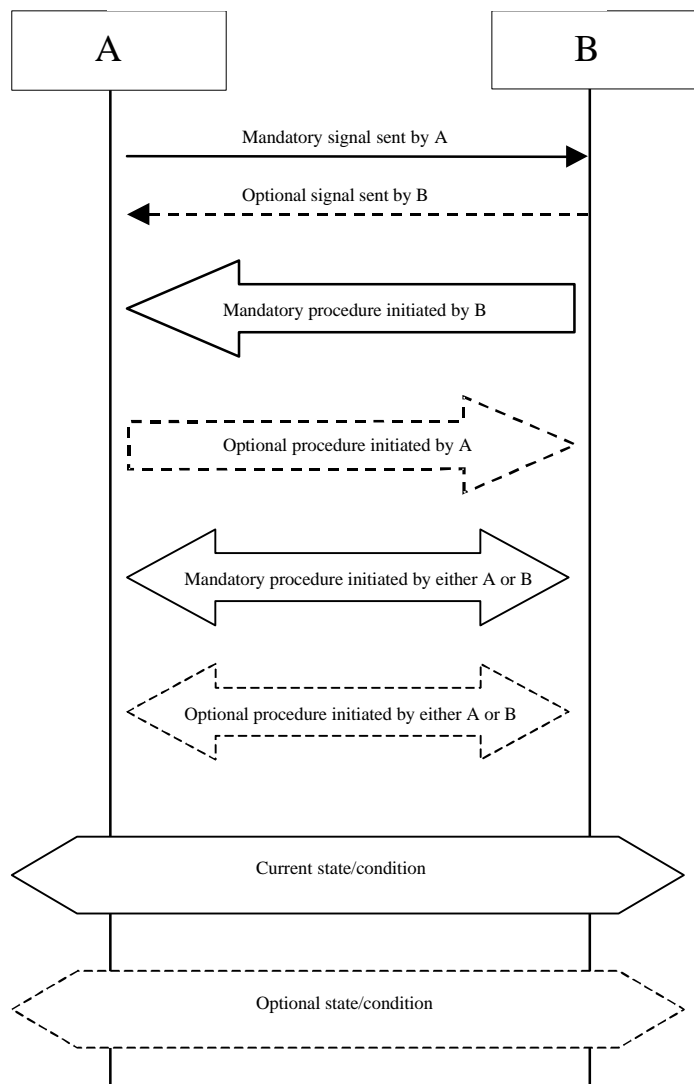


Figure 1.2 Conventions used in signaling diagrams

## 2 Profile Overview

### 2.1 Protocol stack

The figure below shows the protocols and entities used in this profile.

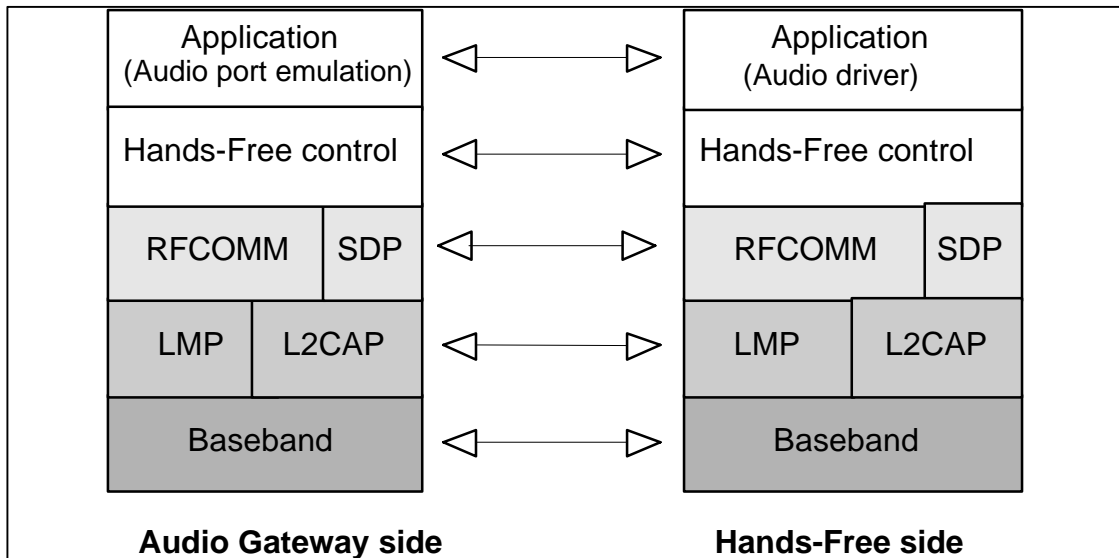


Figure 2.1 Protocol stack

The Baseband, LMP and L2CAP are the OSI layer 1 and 2 Bluetooth protocols. RFCOMM is the Bluetooth serial port emulation entity. SDP is the Bluetooth Service Discovery Protocol. See [1] for more details on these topics.

Compatibility to the current Bluetooth Core specification 1.1 (see [1]) is mandated.

Hands-Free control is the entity responsible for Hands-Free unit specific control signaling; this signaling is AT command based.

Although not shown in the model above, it is assumed by this profile that Hands-Free Control has access to some lower layer procedures (for example, SCO link establishment).

The audio port emulation layer shown in Figure 2.1 is the entity emulating the audio port on the Audio Gateway, and the audio driver is the driver software in the Hands-Free unit.

For the shaded protocols/entities in Figure 2.1, the Serial Port Profile [6] is used as the base standard. For these protocols, all requirements stated in the

Serial Port Profile apply except in those cases where this specification explicitly states deviations.

## 2.2 Configuration and roles

The figure below show a typical configuration of devices for which the Hands-Free Profile is applicable:

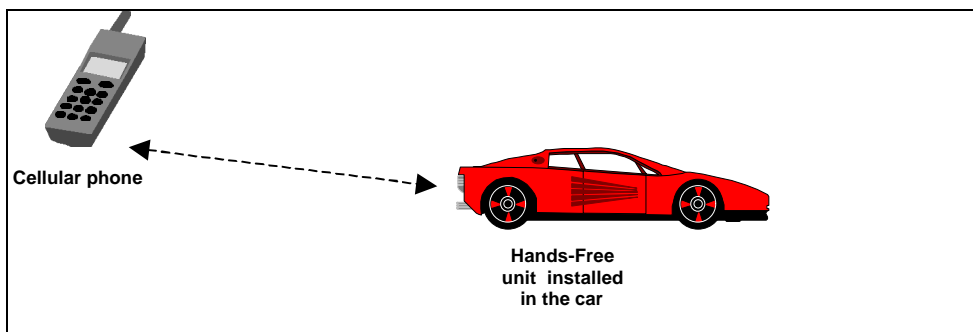


Figure 2.2 Hands-Free Profile: Example with the Hands-Free unit installed in the car

The following roles are defined for this profile:

**Audio Gateway (AG)** – This is the device that is the gateway of the audio, both for input and output. Typical devices acting as Audio Gateways are cellular phones.

**Hands-Free unit (HF)** – This is the device acting as the Audio Gateway's remote audio input and output mechanism. It also provides some remote control means.

These terms are used in the rest of this document to designate these roles.

## 2.3 User requirements and scenarios

The Hands-Free Profile defines the protocols and procedures that shall be used by devices implementing the use case called "Operating a Phone via an In-Car Device" (see [3]).

The following rules apply to this profile:

- a) For this profile, it is assumed that only a single "Operating a Phone via an In-Car Device" use case can be active between the two devices at a time.
- b) The profile mandates the usage of CVSD for transmission of audio (over the Bluetooth link). The resulting audio is monophonic, with a quality that, under normal circumstances, will not have perceived audio degradation. Optionally, other audio codecs may be used.

- c) Between the Hands-Free unit and the Audio Gateway, only one Audio Connection at a time is supported.
- d) Both the Audio Gateway and the Hands-Free unit can initiate Audio Connection establishment and release. The Hands-Free unit directly connects (or disconnects) the internal audio streams upon proper SCO link establishment (or release). Valid speech exists on the SCO link in both directions, once the Audio Connection is established.
- e) Whenever an “Audio Connection” exists, the presence of a related “Service Level Connection” is always assumed. On the other hand, removing an “Audio Connection” does not mean releasing its corresponding “Service Level Connection”. In fact, the service level connection may be kept to perform control functions not directly related to pure call processing procedures (for example a periodic update of the service status).
- f) The presence of a “Service Level Connection” does not necessarily imply that an “Audio Connection” also exists. Removing a “Service Level Connection” always implies releasing any existing “Audio Connection” related to it.
- g) The profile offers only basic interoperability. Handling of multiparty calls at the Audio Gateway, for example, is not covered in depth in this profile.
- h) Sections 4.2 through 4.23 in this document define cases in which only the “Hands-Free” use case is active. If several use cases are active at the same time, this specification only proposes implementation guidelines to cover the simultaneous presence of a single “Ultimate headset” plus a single “Hands-Free” use cases. See Section 11 for more details.

## 2.4 Profile fundamentals

A Hands-Free unit may be able to use the services of the Audio Gateway without the creation of a secure connection. It is up to the application to determine if security enforcement will be provided/supported for the user.

Whenever baseband authentication and/or encryption is desired, the two devices must create a secure connection using the GAP authentication procedure as described in Section 5.1 of the Generic Access Profile [5]. This procedure may include entering a PIN code and creation of proper link keys. In cases when the UI of the Hands-free unit is limited, a fixed PIN code may be used during the GAP authentication procedure.

If a LMP link is not already established between the Hands-Free unit and the Audio Gateway, the LMP link must be set-up before any other procedure is performed. Normally, this requires paging the other device, but optionally it may require unparking.

There are no fixed master or slave roles in this profile.



The Audio Gateway and Hands-Free unit provide serial port emulation. For the serial port emulation, RFCOMM (see [1]) is used. The serial port emulation is used to transport the user data including modem control signals and AT commands from the Hands-Free unit to the Audio Gateway. AT commands are parsed by the Audio Gateway and responses are sent to the Hands-Free unit via the Bluetooth serial port connection.

## **2.5 Conformance**

If conformance to this profile is claimed, all capabilities indicated as 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, optional and conditional capabilities, for which support is indicated, are subject to verification as part of the Bluetooth Qualification Program.

### 3 Application layer

This section describes the feature requirements on units complying with the Hands-Free Profile.

Table 3.1 below shows the feature requirements for this profile.

	Feature	Support in HF	Support in AG
1.	Connection management	M	M
2.	Phone status information	M	M
3.	Audio Connection handling	M	M
4.	Accept an incoming voice call	M	M
5.	Reject an incoming voice call	M	O <sup>(note 1)</sup>
6.	Terminate a call	M	M
7.	Audio Connection transfer during an ongoing call	M	M
8.	Place a call with a phone number supplied by the HF	O	M
9.	Place a call using memory dialing	O	M
10.	Place a call to the last number dialed	O	M
11.	Call waiting notification	O	M
12.	Three way calling	C1	O <sup>(note 2)</sup>
13.	Calling Line Identification (CLI)	O	M
14.	Echo canceling (EC) and noise reduction (NR)	O <sup>(note 3)</sup>	O <sup>(note 4)</sup>
15.	Voice recognition activation	O	O <sup>(note 5)</sup>
16.	Attach a Phone number to a voice tag	O <sup>(note 6)</sup>	O <sup>(note 7)</sup>
17.	Ability to transmit DTMF codes	O	M
18.	Remote audio volume control	O	M <sup>(note 8)</sup>

**Note 1:** Feature number “5” becomes mandatory for AGs which state “GSM like” as value for the “Network” SDP attribute (see Table 5.3).

**Note 2:** The three way calling procedures (feature number “12”) are only mandatory for AGs which state “GSM like” as value for the “Network” SDP attribute (see Table 5.3).

**Note 3:** Feature number “14” becomes mandatory for the HF whenever it supports embedded EC and/or NR functions.

**Note 4:** Feature number “14” becomes mandatory for the AG whenever it supports embedded EC and/or NR functions.

**Note 5:** Feature number “15” become mandatory for the AG whenever it supports a voice recognition function.

**Note 6:** Although the feature number “16” is considered optional at this stage, it is strongly recommended that it be implemented whenever the HF supports a voice recognition function.

**Note 7:** Although the feature number “16” is considered optional at this stage, it is strongly recommended that it be implemented because many HF units supports voice recognition function.

**Note 8:** The AG shall use the information in the SDP record of the HF to decide whether the feature number “18” is activated or not in the AG.

**C1:** The HF shall support Three Way calling (12) if it supports Call Waiting notification (11).

Table 3.1 Application layer procedures

Table 3.2 below maps each feature to the procedures used for that feature. All procedures are mandatory if the feature is supported.

	Feature	Procedure	Ref.
1.	Connection management	Service Level Connection set up	4.2
		Service Level Connection release	4.2.3
2.	Phone status information	Transfer of Registration Status	4.4
		Transfer of Call Status	4.5
3.	Audio Connection handling	Audio Connection set up	4.6
		Audio Connection release	4.7
4.	Accept an incoming voice call	Answer an incoming call	4.8
5.	Reject an incoming voice call	Reject an incoming call	4.9
6.	Terminate a call	Terminate a call process	4.10
7.	Audio Connection transfer during an ongoing call	Audio Connection transfer towards the HF	4.11
		Audio Connection transfer towards the AG	4.12
8.	Place a call with the phone number supplied by the HF	Place a call with the phone number supplied by the HF	4.13
9	Place a call using memory dialing	Memory dialing from the HF	4.14
10	Place a call to the last number dialed	Last number re-dial from the HF	4.15
11	Call waiting notification	Call waiting notification activation	4.16
12	Three way calling	Three way call handling	4.17
13	Calling Line Identification (CLI)	Calling Line Identification (CLI) notification	4.18
14	Echo canceling (EC) and noise reduction (NR)	HF unit requests turning off the AG's EC and NR	4.19
15	Voice recognition activation	Voice recognition activation	4.20
16	Attach a phone number to a voice tag	Attach a voice tag to a phone number	4.21
17	Ability to transmit DTMF codes	Transmit DTMF code	4.22
18	Remote audio volume control	Remote audio volume control	4.23

Table 3.2 Application layer feature to procedure mapping

## **4 Hands-Free Control Interoperability Requirements**

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### **4.1 Introduction**

The interoperability requirements for the Hands-Free Control entity are completely contained in this section. Sections 4.2 through 4.23 specify the requirements for the procedures directly related to the application layer features.

The procedures listed in this section are primarily based on the use of a minimum set of AT commands as the control protocol. Section 4.24 specifies these AT commands and their result codes.

Section 4.2 specifies how Service Level Connections are handled in general and specifically states how the layers beneath the Hands-Free unit Control entity are used to establish and release a Service Level Connection.

### **4.2 Service Level Connection set up**

Upon a user action or an internal event, either the HF or the AG may initiate a Service Level Connection set up procedure.

A Service Level Connection establishment requires the existence of a RFCOMM connection, that is, a RFCOMM data link channel between the HF and the AG.

Both the HF and the AG may initiate the RFCOMM connection establishment. If there is no RFCOMM session between the AG and the HF, the initiating device shall first initialize RFCOMM.

The RFCOMM connection establishment shall be performed as described in Section 7.3 of Generic Access Profile [5] and Section 3 of Serial Port Profile [6].

In general, prior to the RFCOMM connection establishment, proper SDP sessions shall be set up between the HF and the AG, such that both devices can retrieve the necessary SDP parameters from each other.

Two possible Service Level Connection set up related procedures are considered below. The selection of the procedure to be performed in each case is based on whether the PARK mode is supported or not in the HF and the AG.

#### 4.2.1 Service Level Connection establishment

During the “Service Level Connection establishment” procedure, the HF shall enable the “Indicators status update” function in the AG by issuing the `AT+CMER` command. As a result, the AG will send the `+CIEV` unsolicited result code with the corresponding indicator value whenever a change in service or call status occurs. The HF shall use the information provided by the `+CIEV` code to update its own indications.

The HF may also get the current status of the indicators in the AG using the `AT+CIND?` read command.

Prior to issuing any of the indicator related commands, (`AT+CIND?` or `AT+CMER`), it is mandatory for the HF to retrieve the information about the supported indicators in the AG via the `AT+CIND=?` test command.

Once the HF issues the `AT+CMER` command, the AG shall respond with `OK`. The AG shall then keep the “Indicators status update” enabled, at least, until either the `AT+CMER` command is issued to disable it, or the current Service Level Connection between the AG and the HF is dropped for any reason (this insures that subsequent `AT+CIND?` requests from the HF will yield valid responses).

If the “Three way calling” feature (see Section 4.17) is supported by both the HF and the AG, the HF may issue the `AT+CHLD=?` test command to retrieve the information about how the call hold and multiparty services are supported in the AG.

Refer to Section 4.24 for more information on the `AT+CIND` and `AT+CMER` commands and the `+CIEV` unsolicited result code.

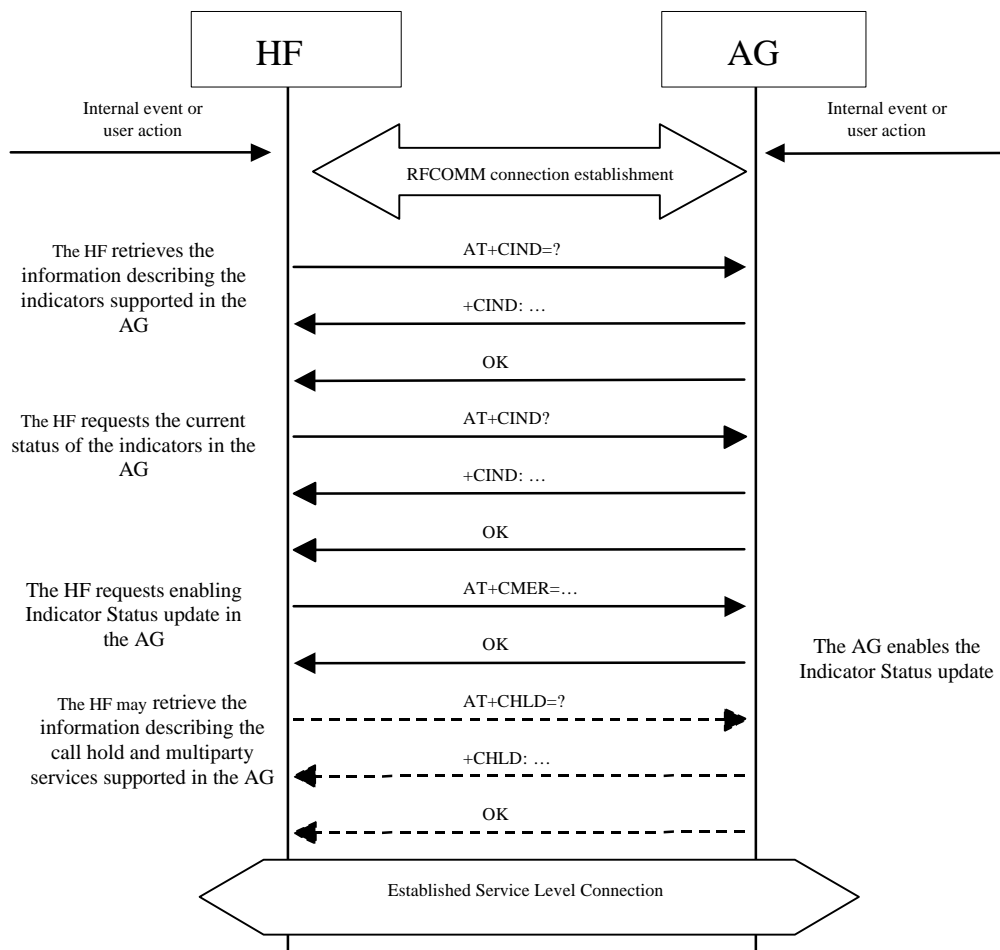


Figure 4.1 Service Level Connection establishment

#### 4.2.2 Park Mode: Service Level Connection unparking

When the HF or AG are said to enter in “park mode” or are described as “parked”, it means that they are “parked” exclusively with respect to the existing link/connection between them. How the HF and the AG handle any possible links/connections with other devices is beyond the scope of this specification.

If Park Mode is supported, the “Service Level Connection establishment”, as stated in Section 4.2.1, is performed once, on the first request. Later, when a connection is required, the AG and the HF are simply unparked, always provided that they were previously parked.

In general, once the “Service Level Connection establishment” is performed, and no activity in the resulting connection exists, the AG and the HF are parked.

In Figure 4.2 the behavior is described when a Service Level Connection needs to be “re-established”; the HF and the AG will be unparked. The

unparking procedure can be initiated from either side, depending on where the request for the connection establishment came from. When the PARK mode is used, neither the RFCOMM Data Link channel nor the L2CAP channel is released.

If the Service Level Connection was released before the HF and the AG were parked, the proper "Service Level Connection establishment" procedure (as described in Section 4.2.1) shall be performed immediately after the unparking.

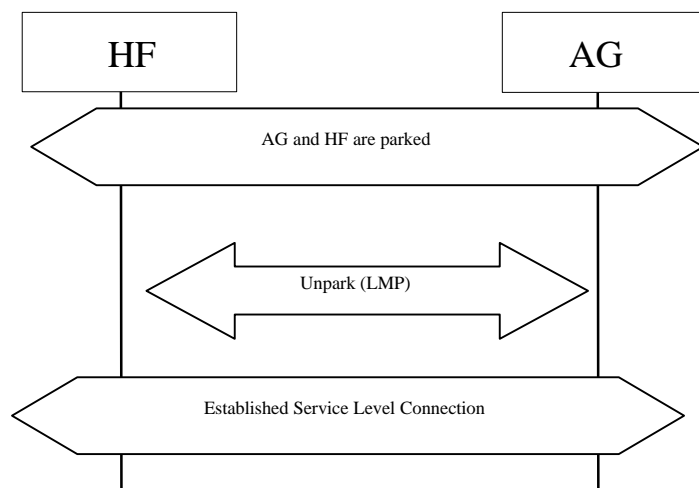


Figure 4.2 Park Mode: Service Level Connection re-establishment

### 4.2.3 Link loss recovery

This section addresses the link loss recovery from a HF unit. The HF unit may reconnect with AG whenever there is loss of Bluetooth link.

When a Service Level Connection is disconnected, the reason for the disconnection can be passed from the lower layers to the application. If the disconnection is due to user termination of the service at either end (using the "Service connection release" as described in section 4.3), then no attempt is made to re-establish the connection. If, however, the disconnection was due to a link supervision timeout, then the HF unit may execute the "Service level connection establishment" procedure as described in Section 4.2 to establish a new connection to the AG. Following a link loss due to link supervision timeout, the HF unit shall not assume that the service level connection state from the previous connection is valid (such as Call Status, Service Status).

### 4.3 Service Level Connection release

This section describes two procedures related to the Service Level Connection release. The selection of the procedure to be performed in each case is based on whether or not the PARK mode is supported in the HF and the AG.

### 4.3.1 Service Level Connection removal

Upon a user action or an internal event, both the HF and the AG may completely remove an existing connection whenever necessary.

The disconnection of a Service Level Connection shall immediately mean the removal of the corresponding RFCOMM data link channel between the HF and the AG. The removal of the L2CAP and link layers is optional.

If Park Mode is supported in both sides, the procedure stated in this section shall only be performed as a definitive removal of the Service Level Connection. Otherwise, the “Service Level Connection parking” procedure, as stated in Section 4.3.2, shall be used.

As pre-condition for this procedure, an ongoing connection between the AG and the HF shall exist.

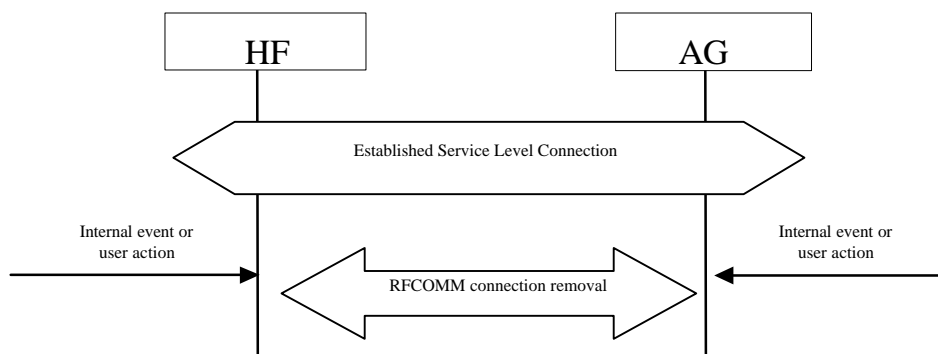


Figure 4.3 Service Level Connection removal

### 4.3.2 Park Mode: Service Level Connection parking

When the HF or AG are said to enter “park mode” or are described as “parked”, it means that they are “parked” exclusively with respect to the existing link/connection between them. How the HF and the AG handle any possible links/connections with other devices is beyond the scope of this specification.

If Park Mode is supported in both the AG and the HF, and the Service Level Connection is not needed, the HF and the AG are parked as indicated in Figure 4.4 below. The parking procedure can be initiated from either side.

When the Service Level Connection must be “definitively” released, the procedure stated in Section 4.3.1 shall be used.



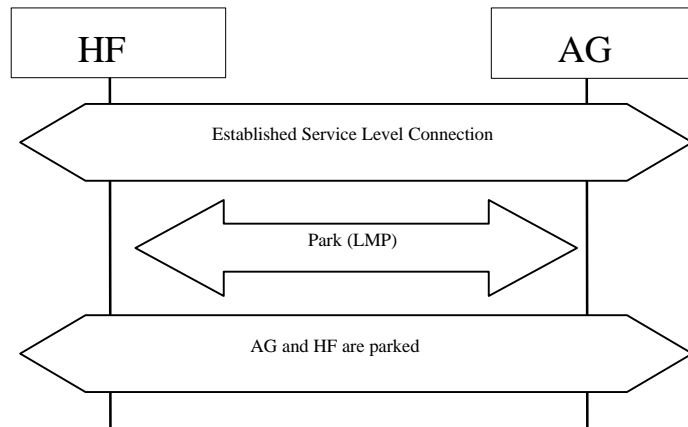


Figure 4.4 Park Mode: Service Level Connection parking

#### 4.4 Transfer of Registration Status

The AT+CMER command, as described in Section 4.2 above, enables the “Registration status update” in the AG. As a result, the AG will send the +CIEV unsolicited result code with the corresponding indicator values whenever its registration status changes. The HF shall use the information provided by the +CIEV result code to generate at least a “service/no service” indication.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the AG shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

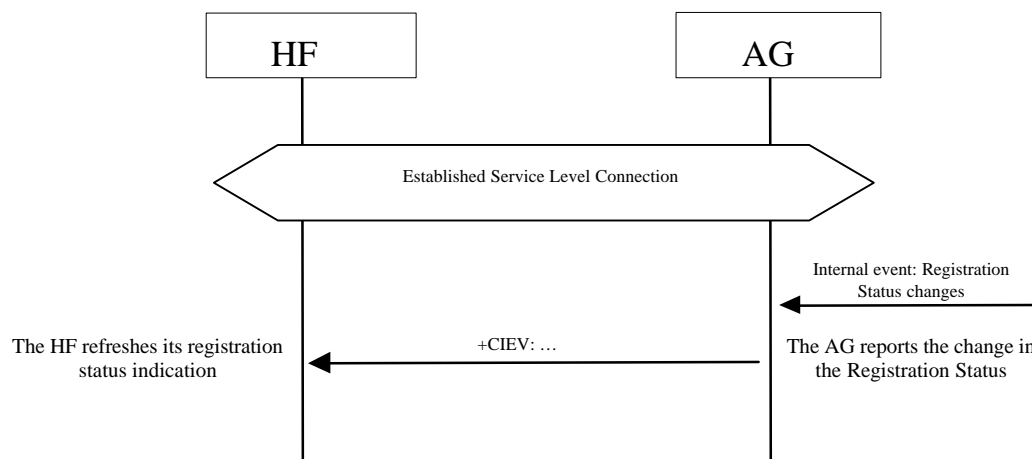


Figure 4.5 Typical Registration Status update

#### 4.5 Transfer of Call Status

The AT+CMER command, as described in Section 4.2 above, enables the “Call Status indicator update” function in the AG.

As a general rule, the AG shall issue the +CIEV result code (with the proper indicator value) on detection of a change in its current call status, and prior to any other action. For outgoing call procedures interrupted in the AG see Sections 4.13, 4.14 and 4.15.

The HF shall use the information provided by the +CIEV result code to generate at least a “call process ongoing/no call present” indication. See Sections 4.8, 4.10, 4.13, 4.14 and 4.15 for details on when the AG shall issue this call status update indication.

## 4.6 Audio Connection set up

Upon a user action or an internal event, either the HF or the AG may initiate the establishment of an Audio Connection whenever necessary. Further internal actions may be needed by the HF or the AG to internally route the audio paths.

An Audio Connection set up procedure always means the establishment of a SCO link and it is always associated with an existing Service Level Connection.

In principle, setting up an Audio Connection by using the procedure described in this section is not necessarily related to any call process.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the initiator of the procedure shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

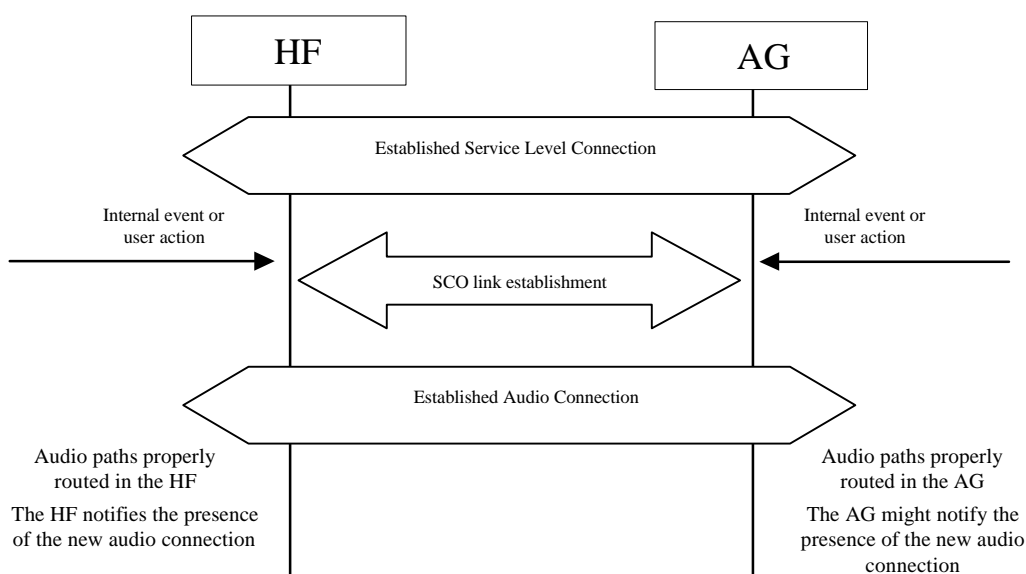


Figure 4.6 Audio Connection set up

Both the initiator and the acceptor shall notify the presence of the new Audio Connection. The incoming Audio Connection may be rejected simply by releasing it (refer to Section 4.7).

#### 4.7 Audio Connection release

Upon a user action or an internal event, either the HF or the AG may release an existing Audio Connection whenever necessary.

An Audio Connection removal always means the disconnection of its corresponding SCO link.

In principle, removing an Audio Connection by using the procedure described in this section is not necessarily related to any call process.

As pre-condition for this procedure, an ongoing Audio Connection between the AG and the HF shall exist.

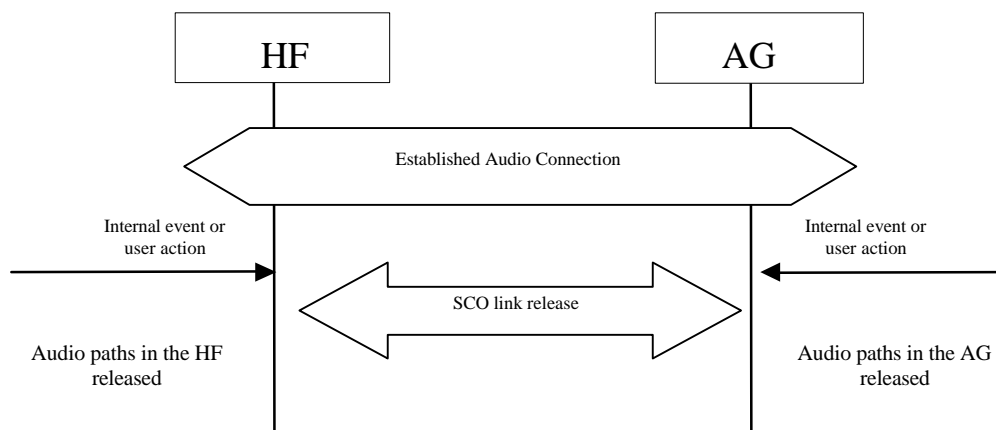


Figure 4.7 Audio Connection release

#### 4.8 Answer an incoming call

Upon an incoming call, the AG will send a sequence of unsolicited RING alerts to the HF. The RING alert shall be repeated for as long as the call acceptance is pending, or until the incoming call is interrupted for any reason.

The HF may produce a local alert (e.g. a ring tone) in reaction to the RING.

In addition, the AG may provide an in-band ring tone being sent via the SCO link. Section 4.8.4 describes a procedure which the AG may optionally use to inform the HF if the in-band ring tone is provided or not. The HF may use this information in order to determine whether to produce a local alert.

The AG may abort the incoming call when necessary. It shall then stop alerting the HF.

#### 4.8.1 Answer incoming call from the HF – in-band ringing

Optionally, the AG may provide an in-band ring tone.

This case is described in Figure 4.8 below and implies, as pre-condition, that an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the AG shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

As the figure below shows, if an in-band ring tone is used, the AG sends the ring tone to the HF via the established Audio Connection.

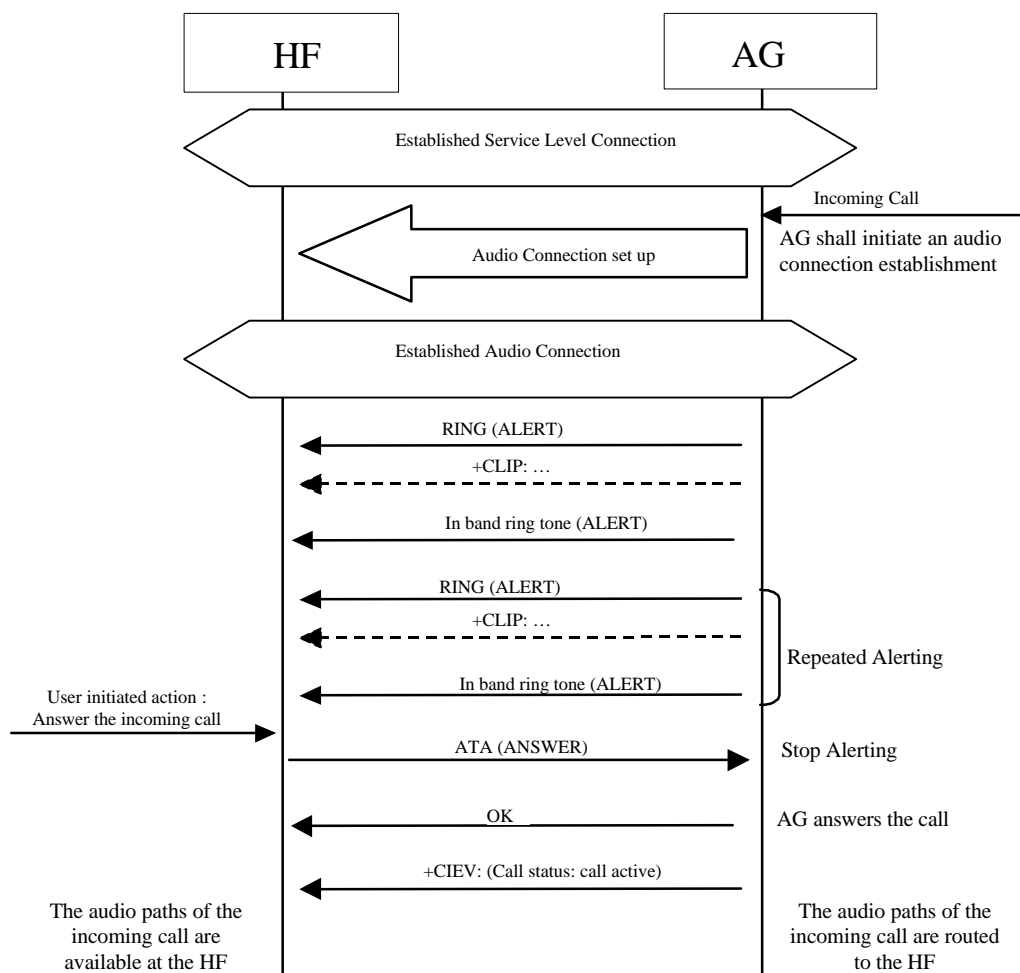


Figure 4.8 Answer an incoming call from the HF – in-band ring tone.

The user accepts the incoming voice call by using the proper means provided by the HF. The HF will then send the ATA command (see Section 4.24) to the AG. The AG will then begin the procedure for accepting the incoming call.

### 4.8.2 Answer incoming call from the HF – no in-band ringing

As pre-condition, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the AG shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

As the figure below shows, if no in-band ring tone is used and an Audio Connection does not exist, the AG shall set up the Audio Connection and route the audio paths to the HF upon answering the call.

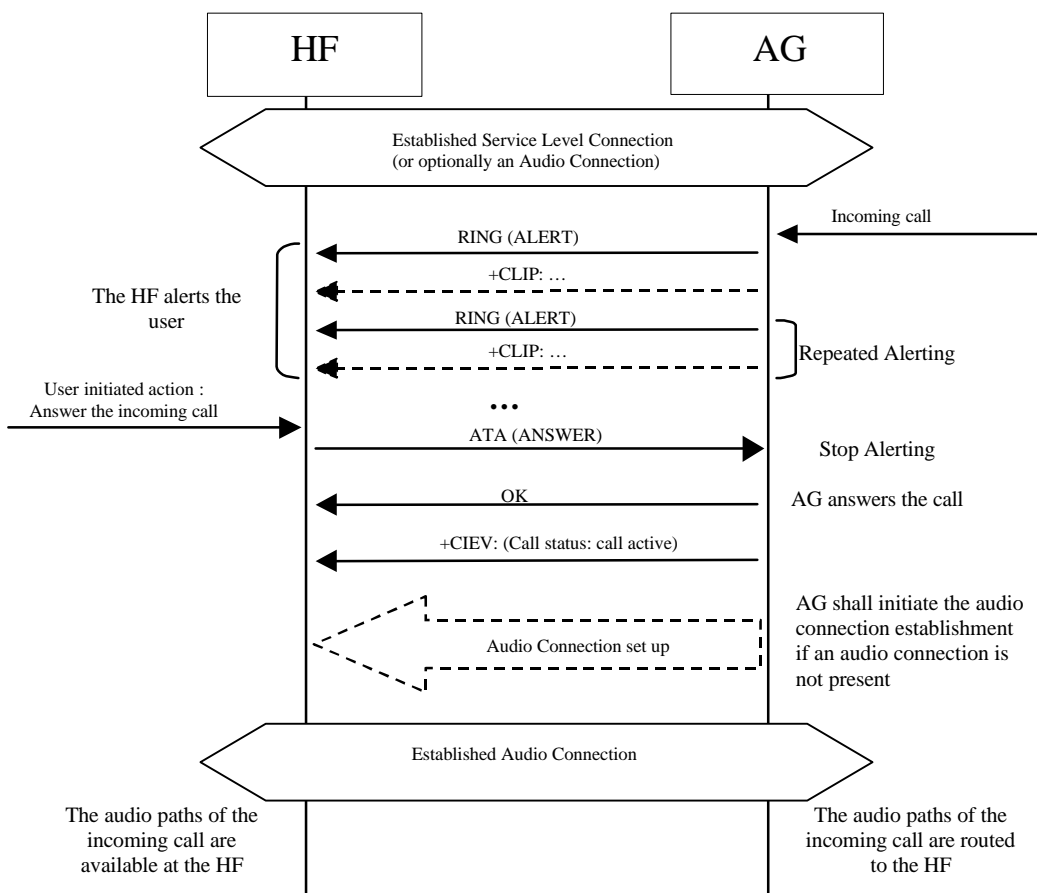


Figure 4.9 Answer an incoming call from the HF – no in-band ring tone.

The user accepts the incoming voice call by using the proper means provided by the HF. The HF will then send the `ATA` command (see Section 4.24) to the AG, and the AG will start the procedure for accepting the incoming call and establishing the Audio Connection if an Audio Connection does not exist (refer to Section 4.6).

### 4.8.3 Answer incoming call from the AG

The following pre-conditions apply for this procedure:

- The AG shall alert the HF using either of the two procedures described in Sections 4.8.1 and 4.8.2.
- The HF shall alert the user.

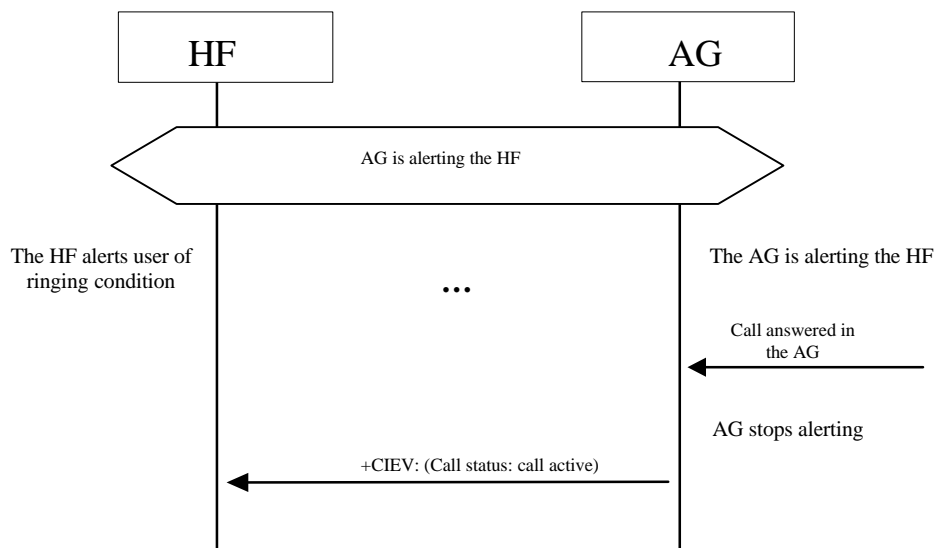


Figure 4.10 Answer an incoming call from the AG.

The user accepts the incoming call by using the proper means provided by the AG.

### 4.8.4 Change the in-band ring tone setting

The SDP record entry “In-band ring tone” of the “Supported features” record (see table 5.4) informs the HF if the AG is capable of sending an in-band ring tone or not. If the AG is capable of sending an in-band ring tone, it shall send the in-band ring tone by default. Optionally, this setting can subsequently be changed:

In case the AG wants to change the in-band ring tone setting during an ongoing service level connection, it shall use the unsolicited result code +BSIR (Bluetooth Set In-band Ring tone) to notify the HF about the change. See figure 4.11 for details.

Refer to Section 4.24 for more information on the +BSIR unsolicited result code.

The in-band ring tone setting might be changed several times during a connection.

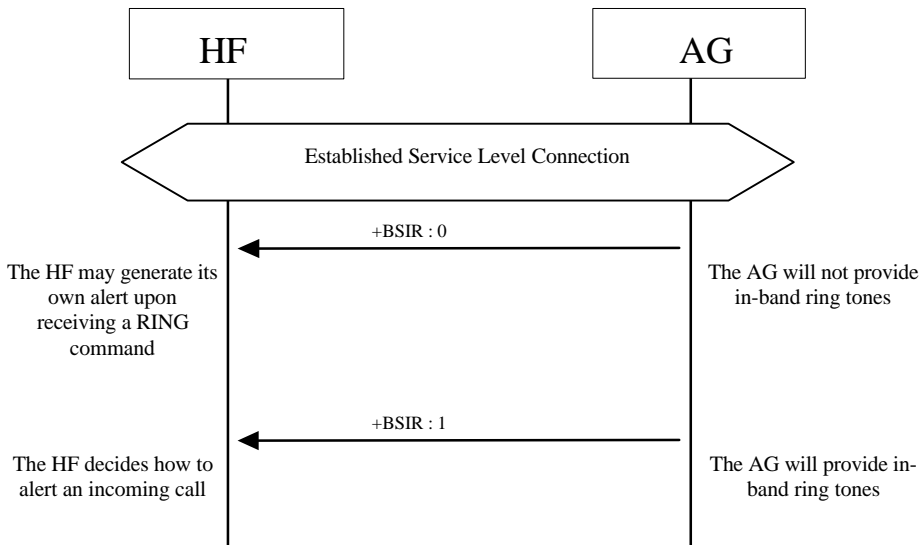


Figure 4.11: Change of the in-band ring tone setting initiated by the AG

In case the HF does not want to use the AG's in-band ring tone, it may mute the SCO link after it has received the RING result code. The HF shall un-mute the SCO link upon receiving the call active indication via the +CIEV result code.

## 4.9 Reject an incoming call

The same considerations as in Section 4.8 "Answer an incoming call" shall be observed. The only exception is that, in this case, the call is rejected and the normal process is interrupted.

The following pre-conditions apply for these procedures:

- The AG shall alert the HF using either of the two procedures described in Sections 0 and 4.8.2.
- The HF shall alert the user of the ringing condition.

### 4.9.1 Reject an incoming call from the HF

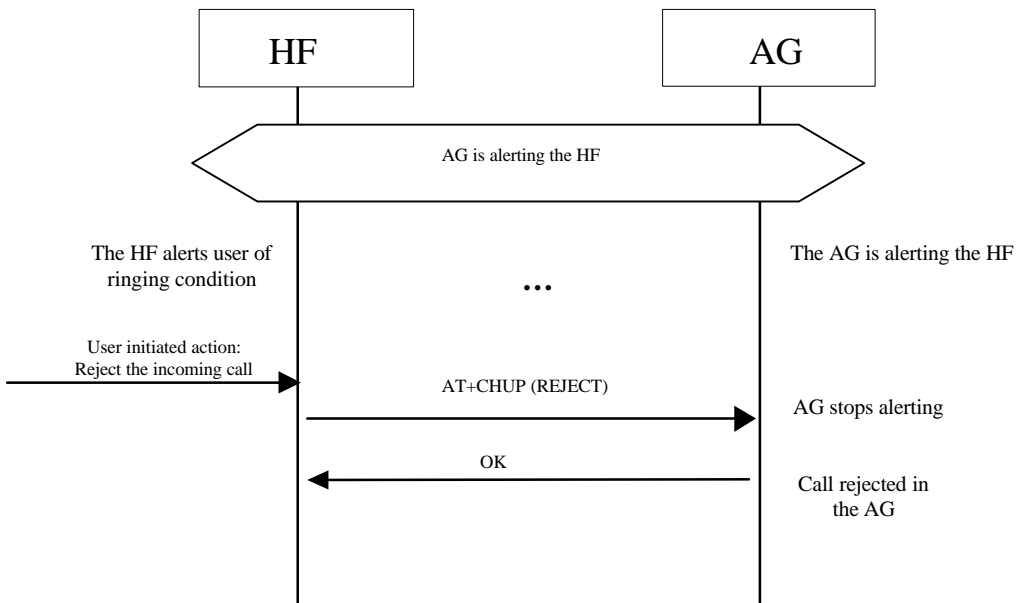


Figure 4.12 Reject an incoming call from the HF.

The user rejects the incoming call by using the proper means provided by the Hands-Free unit. The HF will then send the `AT+CHUP` command (see Section 4.24) to the AG. The AG shall then start the procedure to reject the incoming call.

### 4.9.2 Rejection/interruption of an incoming call in the AG

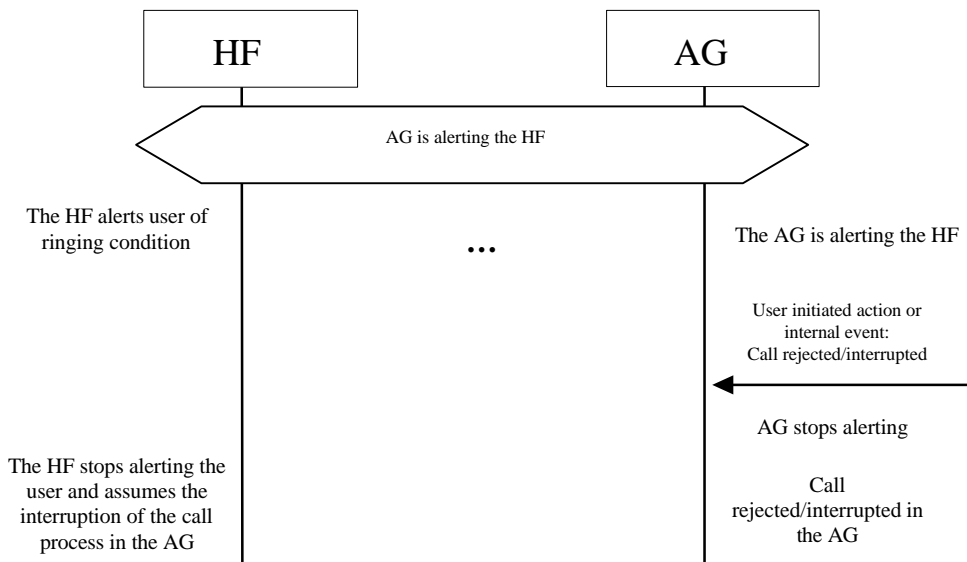


Figure 4.13 Rejection/interruption of an incoming call in the AG.

This procedure is fully applicable for cases in which, upon a user action, the AG rejects the incoming call, and for situations in which the incoming call process is interrupted in the AG for any other reason.



## 4.10 Terminate a call process

An ongoing call procedure can be terminated by either the HF or the AG by means of a user action or any other event.

### 4.10.1 Terminate a call process from the HF

The following pre-conditions apply for this procedure:

- An ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.
- A call related process is ongoing in the AG.

Although not required for the call termination process, an Audio Connection will typically also be present between the HF and AG.

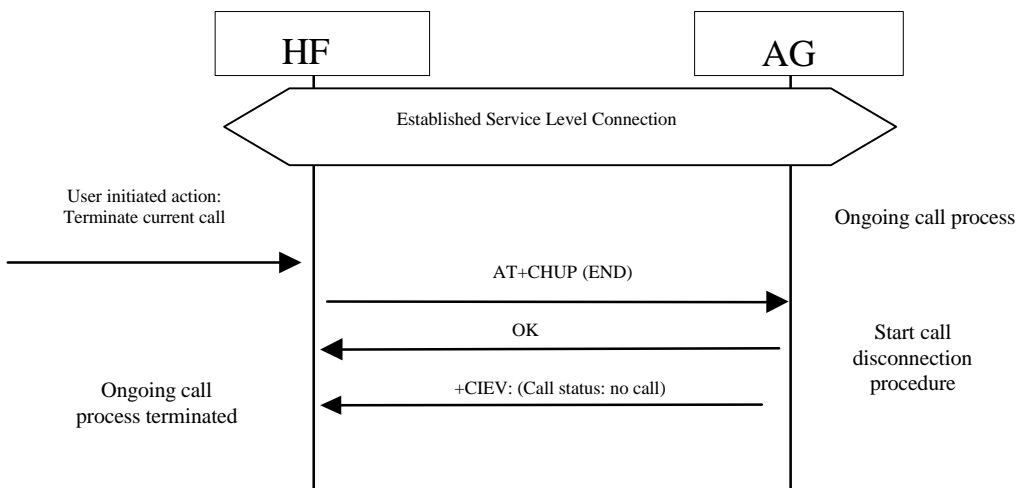


Figure 4.14 Terminate ongoing call - HF initiated

The user may abort the ongoing call process using whatever means is provided by the Hands-Free unit. The HF will send `AT+CHUP` command (see Section 4.24) to the AG, and the AG shall then start the procedure to terminate or interrupt the current call procedure.

Performing a similar procedure, the `AT+CHUP` command described above can also be used for interrupting a normal outgoing call set-up process.

Although not required for the call termination process, an Audio Connection will typically also be present between the HF and AG.

#### 4.10.2 Terminate a call process from the AG

The following pre-conditions apply for this procedure:

- An ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the AG shall establish the Service Level Connection using the proper procedure as described in Section 4.2.
- A call related process is ongoing in the AG.

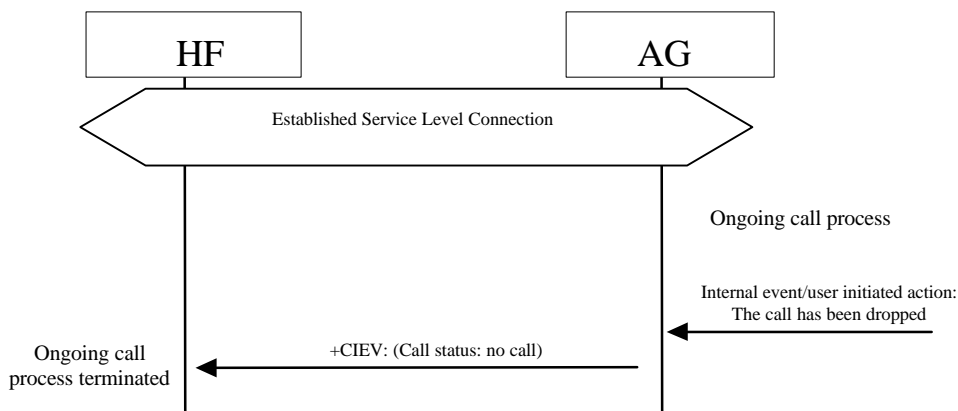


Figure 4.15 Terminate ongoing call - AG initiated

#### 4.11 Audio Connection transfer towards the HF

The audio paths of an ongoing call can be transferred from the AG to the HF. This procedure represents a particular case of an “Audio Connection set up” procedure, as described in Section 4.6.

The call connection transfer from the AG to the HF is initiated by a user action either on the HF or on the AG side. This results in either the HF or the AG, respectively, initiating an “Audio Connection set up” procedure with the audio paths of the current call being routed to the HF.

The following pre-conditions apply for this procedure:

- An ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the initiator of the “Audio Connection transfer towards the HF” procedure shall establish the Service Level Connection using the proper procedure as described in Section 4.2.
- There shall be no Audio Connection between the HF and the AG. If this connection exists, the initiator of the “Audio Connection transfer towards the HF” procedure shall release the Audio Connection using the procedure described in Section 4.7

- An ongoing call process exists in the AG.

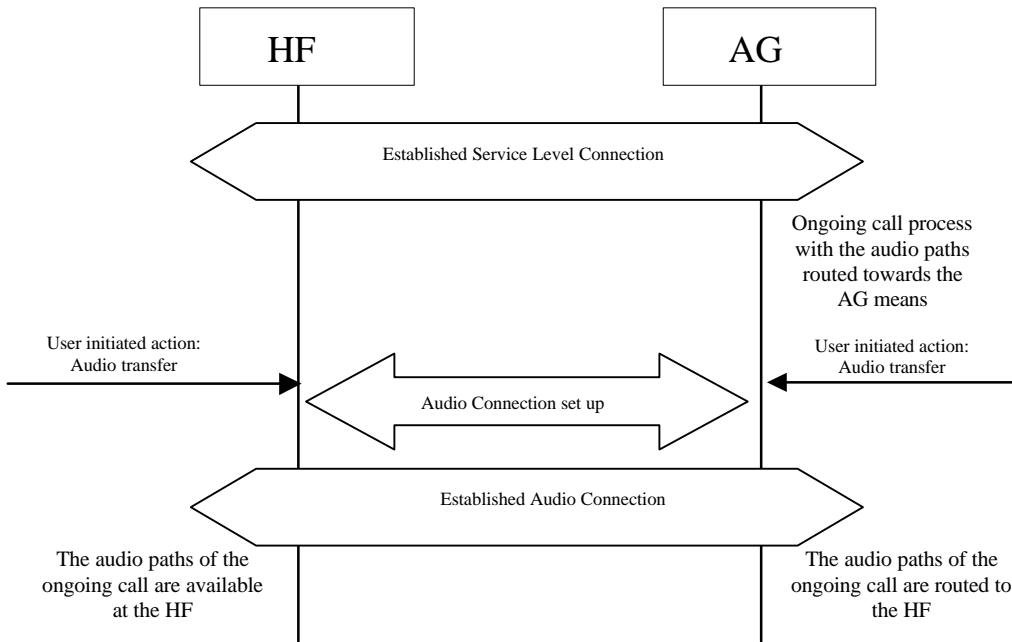


Figure 4.16 Audio Connection transfer to the HF

## 4.12 Audio Connection transfer towards the AG

The audio paths of an ongoing call can be transferred from the HF to the AG. This procedure represents a particular case of an “Audio Connection release” procedure, as described in Section 4.7.

The call connection transfer from the HF to the AG is initiated by a user action in the HF or due to an internal event or user action in the AG side. This results in a “Audio Connection release” procedure being initiated either by the HF or the AG respectively, with the current call kept and its audio paths routed to the AG.

As pre-condition for this procedure, an ongoing call process shall exist in the AG. The audio paths of the ongoing call shall be available in the HF via an Audio Connection established between the AG and the HF.

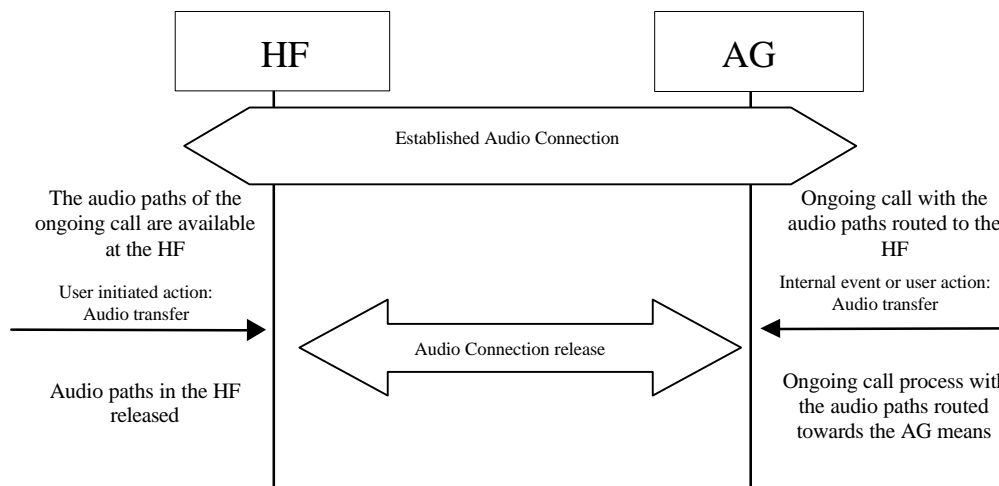


Figure 4.17 Audio Connection transfer to the AG

### 4.13 Place a call with the phone number supplied by the HF

The HF can initiate outgoing voice calls by providing the destination phone number to the AG. To start the call set-up, the HF will initiate the Service Level Connection establishment (if necessary) and will send a proper `ATDdd...dd;` command to the AG. The AG then starts the call establishment procedure using the phone number received from the HF.

Refer to Section 4.24 for more information on the `ATDdd...dd;` command.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

If an Audio Connection is not established the AG must establish the proper Audio Connection and route the audio paths of the outgoing call to the HF immediately following the commencement of the ongoing call set up procedure.

If the normal outgoing call establishment procedure is interrupted for any reason, the AG shall issue the `+CIEV:` result code, with the value indicating "Call status: no call", to notify the HF of this condition.

If a call is already ongoing in the AG, performing this procedure would result in a new call being placed to a third party with the current ongoing call put on hold. For details on how to handle multiparty calls refer to Section 4.17.2.

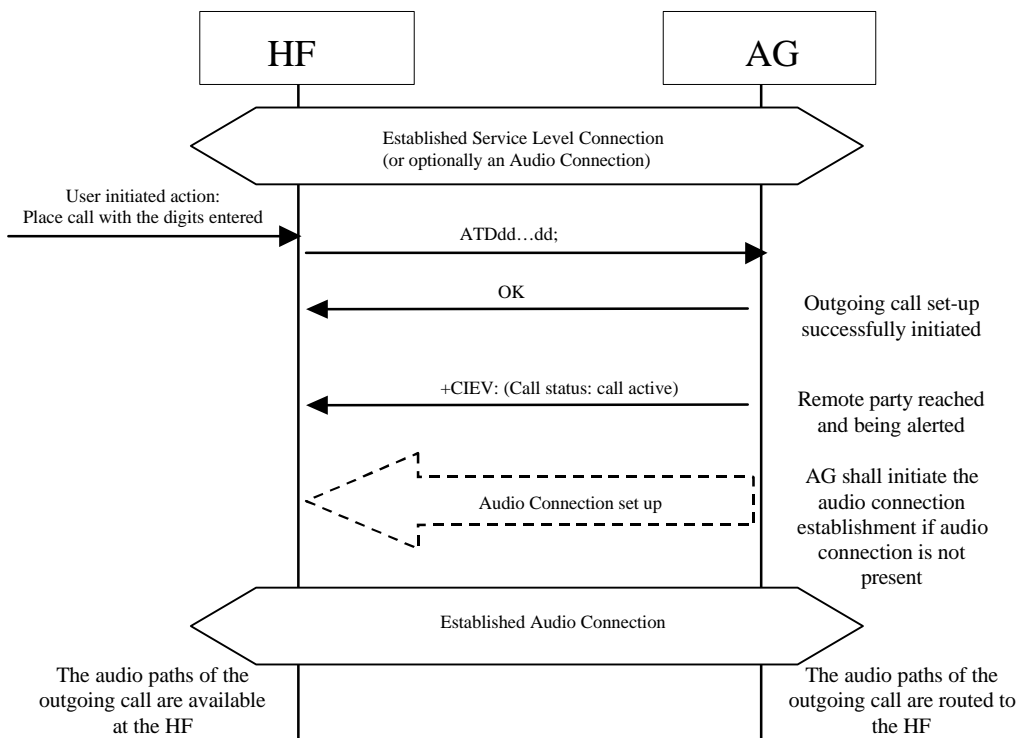


Figure 4.18 Place an outgoing voice call with the digits entered in the HF

#### 4.14 Memory dialing from the HF

The HF can initiate outgoing voice calls using the memory dialing feature of the AG. To start the call set-up, the HF will initiate the Service Level Connection establishment (if necessary) and will send an `ATD>nnn;` command to the AG. The AG will then start the call establishment procedure using the phone number stored in the AG memory location given by `nnn`.

Refer to Section 4.24 for more information on the `ATD>nnn` command.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

If an Audio Connection is not established, the AG must establish the proper Audio Connection and route the audio paths of the outgoing call to the HF immediately following the commencement of the ongoing call set up procedure.

If the normal outgoing call establishment procedure is interrupted for any reason, the AG shall issue the `+CIEV:` result code, with the value indicating "Call status: no call", to notify the HF of this condition.

If a call is already ongoing in the AG, performing this procedure would result in a new call being placed to a third party with the current ongoing call put on hold. For details on how to handle multiparty calls refer to Section 4.17.2.

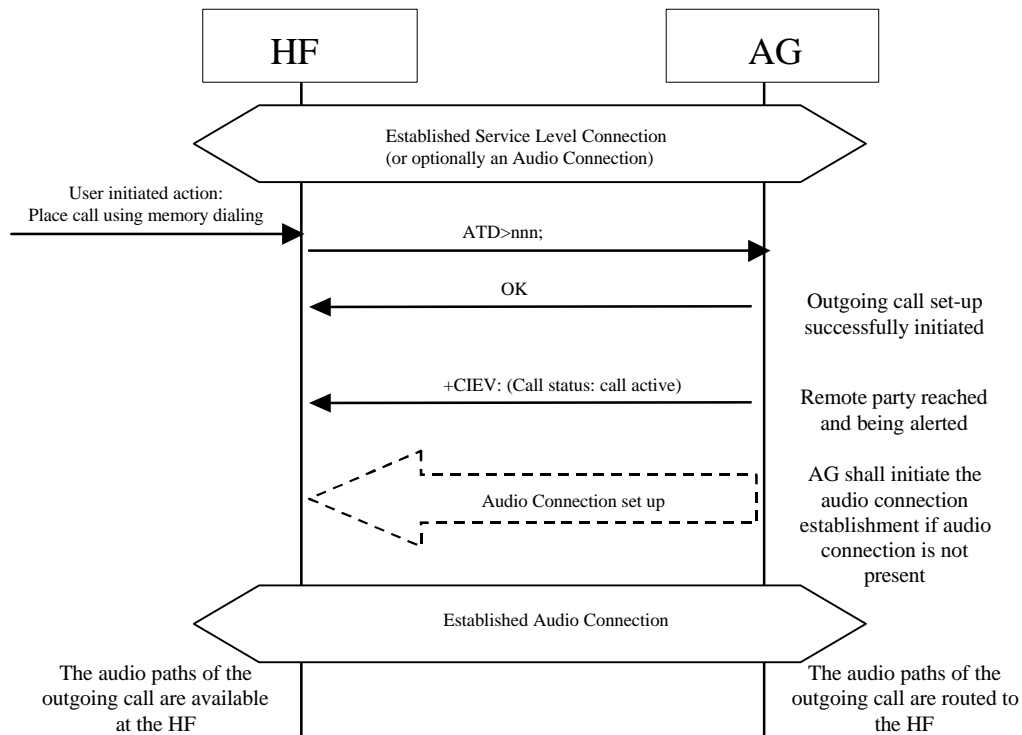


Figure 4.19 Place an outgoing voice call using memory dialing

#### 4.15 Last number re-dial from the HF

The HF can initiate outgoing voice calls by recalling the last number dialed by the AG. To start the call set-up, the HF will initiate the Service Level Connection establishment (if necessary) and will send an `AT+BLDN` command to the AG. The AG then starts the call establishment procedure using the last phone number dialed by the AG.

Refer to Section 4.24 for more information on the `AT+BLDN` command.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

If an Audio Connection is not established, the AG must establish the proper Audio Connection and route the audio paths of the outgoing call to the HF immediately following the commencement of the ongoing call set up procedure.

If the normal outgoing call establishment procedure is interrupted for any reason, the AG shall issue the `+CIEV:` result code, with the value indicating “Call status: no call”, to notify the HF of this condition.

If a call already ongoing in the AG, performing this procedure would result in a new call being placed to a third party with the current ongoing call put on hold. For details on how to handle multiparty calls refer to Section 4.17.2.

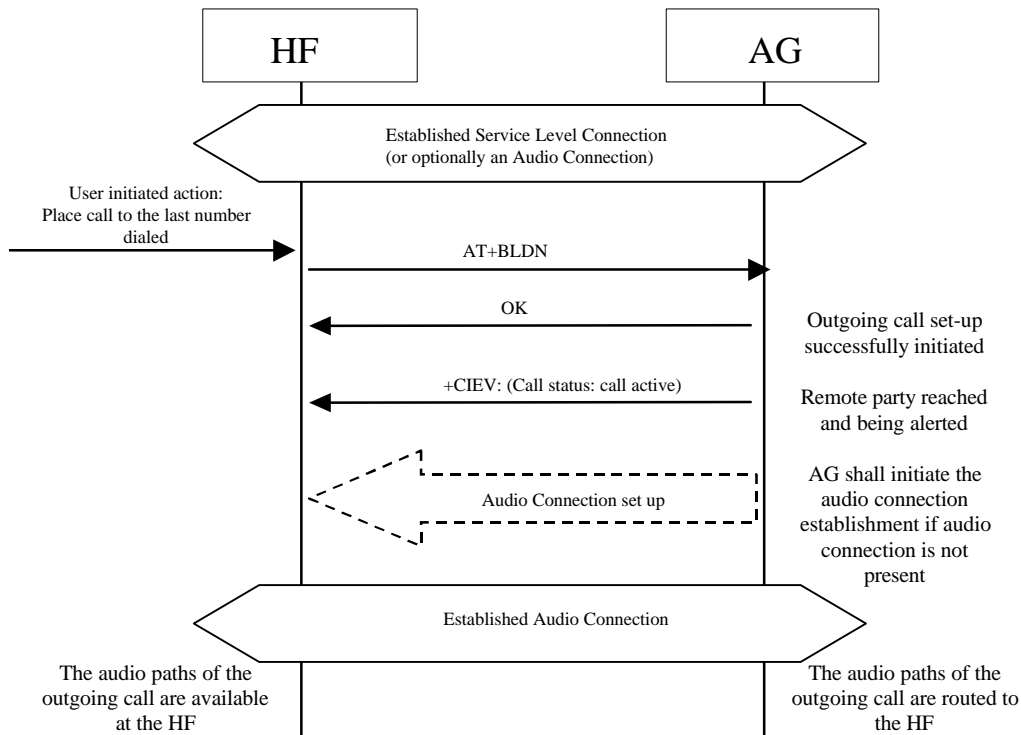


Figure 4.20 Place an outgoing voice call with the last number dialed.

## 4.16 Call waiting notification activation

The HF may issue the `AT+CCWA` command to enable the “Call Waiting notification” function in the AG. Once the “Call Waiting notification” is enabled, the AG will send the corresponding `+CCWA` unsolicited result code to the HF whenever an incoming call is waiting during an ongoing call. It is always assumed that the “call waiting” service is already active in the network.

Once the HF issues the `AT+CCWA` command, the AG shall respond with `OK`. It shall then keep the “Call Waiting notification” enabled until either the `AT+CCWA` command is issued to disable “Call Waiting notification,” or the current Service Level Connection between the AG and the HF is dropped for any reason.

Refer to Section 4.24 for more information on the `AT+CCWA` command.

Support for this call waiting notification feature implies support for the corresponding means to handle the waiting call itself. See Section 4.17 below for more details.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

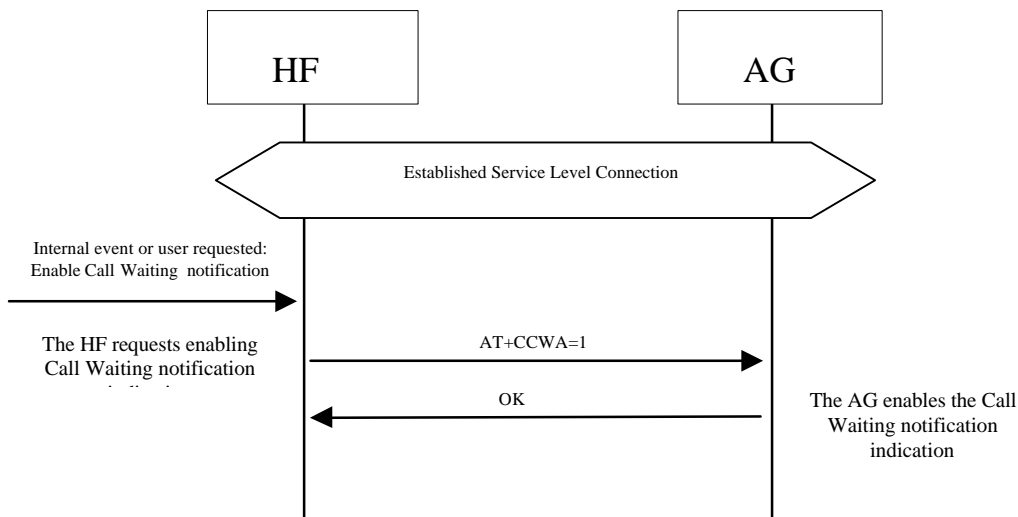


Figure 4.21 Activation of Call Waiting notification

## 4.17 Three way call handling

Proper management of several concurrent calls shall be accomplished by performing the procedures described in [2] but with some limitations stated in this specification. For more details, refer to Section 4.24.

It is always assumed that the “call hold and/or multiparty” services are available in the network.

In general, when the user deals with multiple concurrent calls, the HF shall issue the corresponding `AT+CHLD` command as a result of user actions. This command allows the control of multiple concurrent calls and provides means for holding calls, releasing calls, switching between two calls, and adding a call to a multiparty conference.

This section covers two cases. In one case the third party call is received in the AG, and notification is sent to the HF via a Call Waiting notification. In the second case, the third party call is placed from the HF.

Refer to Section 4.24 for more information on the `AT+CHLD` command.



The following pre-conditions apply for these procedures:

- An ongoing Audio Connection between the AG and the HF shall exist.
- An ongoing call in the AG shall exist. The audio paths of the ongoing call shall be available in the HF via an Audio Connection established between the AG and the HF.

#### 4.17.1 Three way calling - Call waiting notification

As additional pre-condition for this procedure, the Call Waiting notification to the HF shall already be enabled in the AG(that is, the procedure stated in Section 4.16 has been performed).

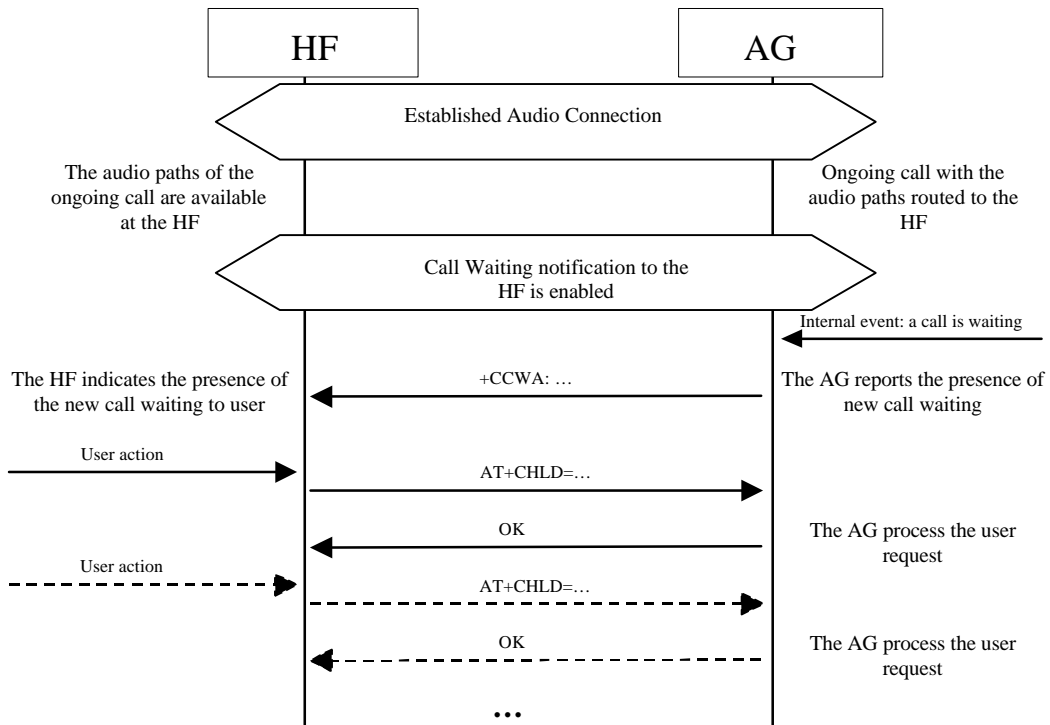


Figure 4.22 Typical Call Waiting indication followed by a three way call set up process

### 4.17.2 Three way calls – Third party call placed from the HF

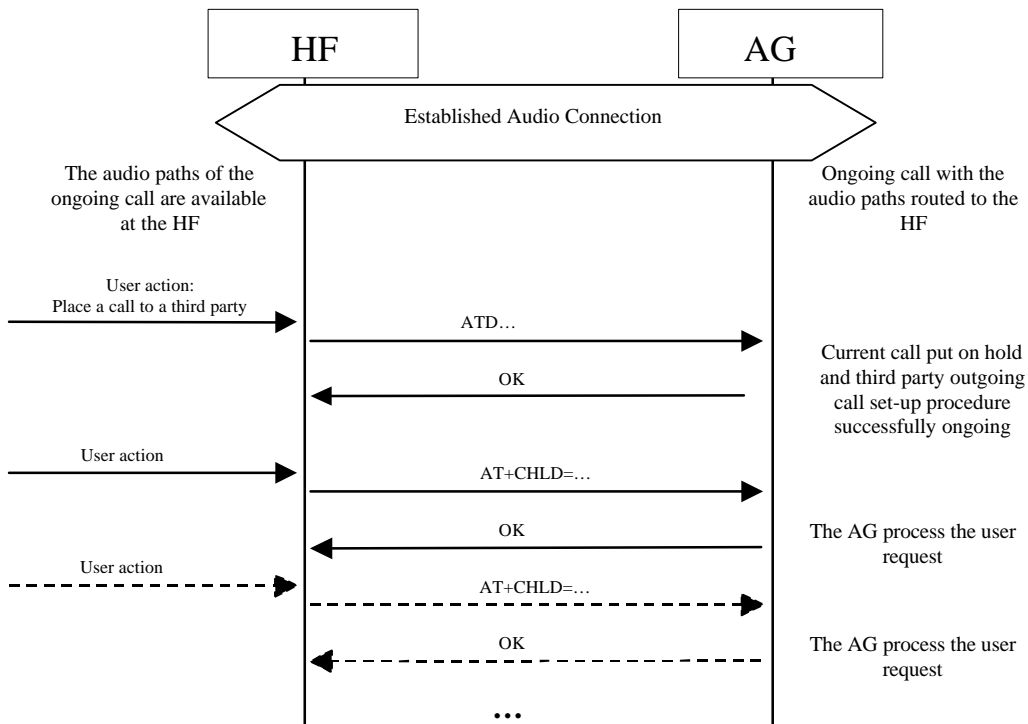


Figure 4.23 Three way call handling when the third party call is placed from the HF

### 4.18 Calling Line Identification (CLI) notification

The HF may issue the `AT+CLIP` command to enable the “Calling Line Identification notification” function in the AG.

If the calling subscriber number information is available from the network, the AG shall issue the `+CLIP` unsolicited result code just after every `RING` indication when the HF is alerted in an incoming call. See Section 4.8 for more details.

Once the HF issues the `AT+CLIP` command, the AG shall respond with `OK`. The AG shall then keep the “Calling Line Identification notification” enabled until either the `AT+CLIP` command is issued by the HF to disable it, or the current Service Level Connection between the AG and the HF is dropped for any reason.

Refer to Section 4.24 for more information on the `AT+CLIP` command.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

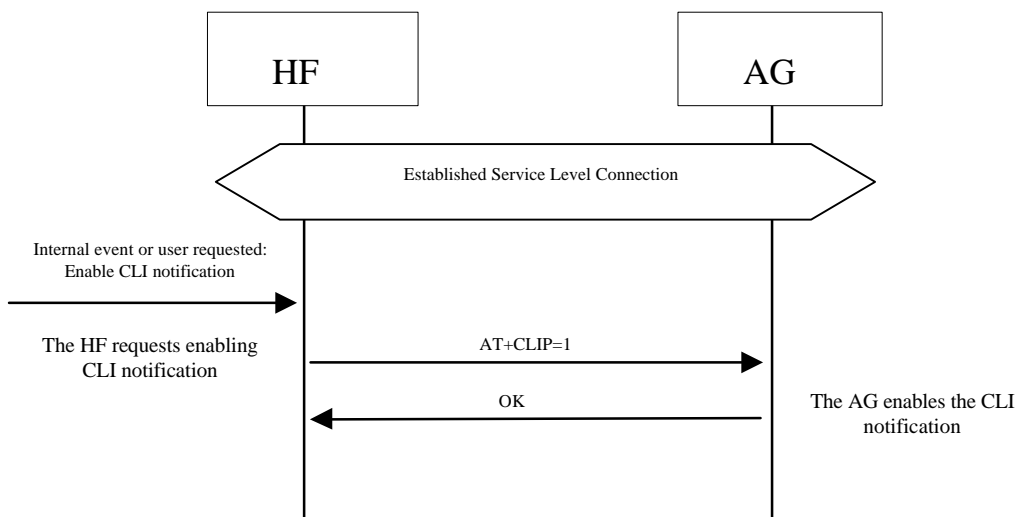


Figure 4.24 Activation of CLI notification

#### 4.19 The HF requests turning off the AG's EC and NR

The HF may disable the echo canceling and noise reduction functions resident in the AG via the `+NREC` command. This procedure should be performed before any Audio Connection between the HF and the AG is established.

If the HF supports embedded EC and/or NR functions it must support the `AT+NREC` command as described in the procedures in this section.

By default, if the AG supports its own embedded echo canceling and/or noise reduction functions, it shall have them activated until the `+NREC` command is received. From then on, and until the current Service Level Connection between the AG and HF is dropped for any reason, the AG shall disable these functions every time an Audio Connection between the HF and the AG is used for audio routing.

If the AG does not support any echo canceling and noise reduction functions, it shall respond with the `ERROR` indicator on reception of the `AT+NREC` command.

Refer to Section 4.24 for more information on the `AT+NREC` command.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

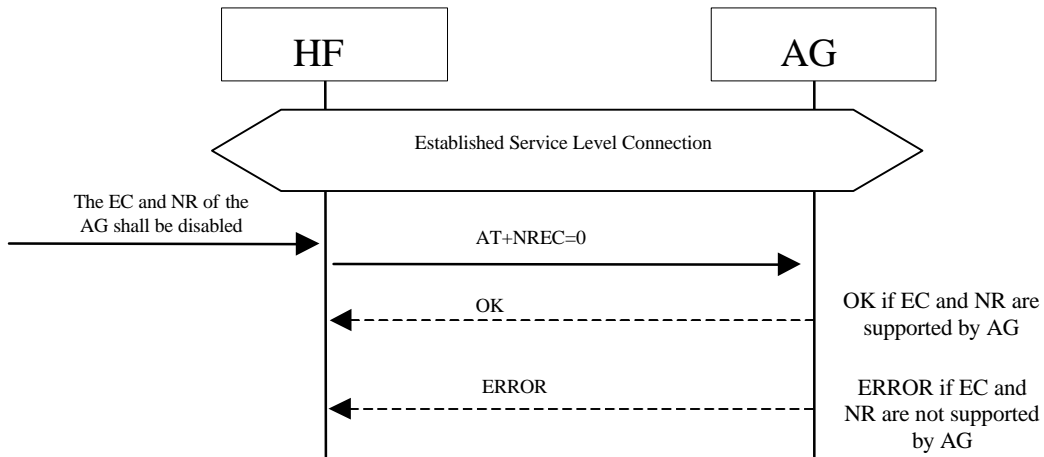


Figure 4.25 NR and EC functions available in the AG

The HF sends the `+NREC` command and AG confirms with either `OK` or `ERROR` indications.

## 4.20 Voice recognition activation

The HF may activate/deactivate the voice recognition function resident in the AG via the `AT+BVRA` command. The functionality associated with the operation of the voice recognition function in the AG is considered fully implementation dependent, therefore it is out of the scope of this specification.

Whenever the AG supports a voice recognition function it must support the `AT+BVRA` command as described in the procedures in this section.

If the HF issues the `AT+BVRA` command, the AG shall respond with the `OK` result code if it supports voice recognition, then initiate an Audio Connection establishment with the HF (if the Audio Connection does not already exist) and begin the voice input sequence. Depending upon the voice recognition implementation, the AG shall then keep the voice recognition function enabled:

- For the duration of time supported by the implementation (“momentary on” voice recognition implementation). In this case, the AG shall notify the HF by sending a `+BVRA: 0` unsolicited result code.
- Or until the `AT+BVRA` command is issued to disable voice recognition from the HF.
- Or until the current LMP link between the AG and the HF is dropped for any reason.

If the AG does not support voice recognition, the AG shall respond with the ERROR indication.

Refer to Section 4.24 for more information on the AT+BVRA command and the +BVRA result code.

As pre-condition for these procedures, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the initiator of the procedure shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

#### 4.20.1 Voice recognition activation

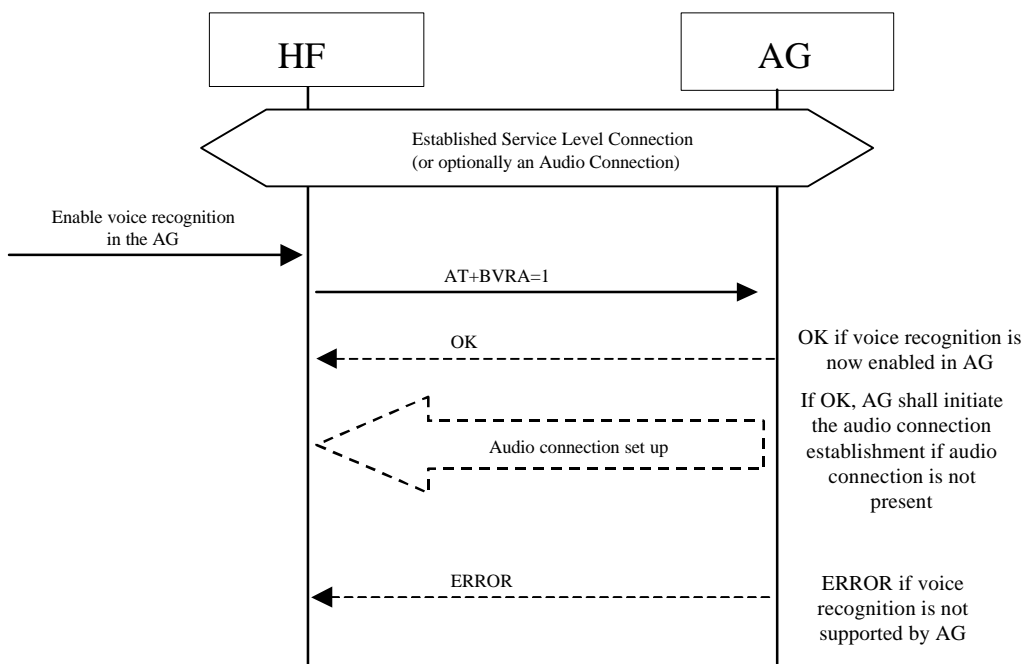


Figure 4.26 Voice recognition activation

### 4.20.2 Voice recognition deactivation

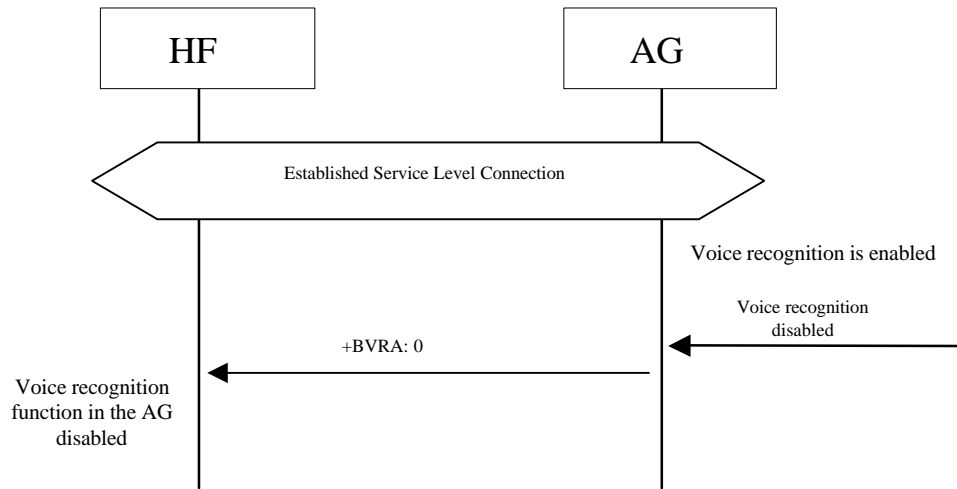


Figure 4.27 Voice recognition deactivation – “momentary on” approach

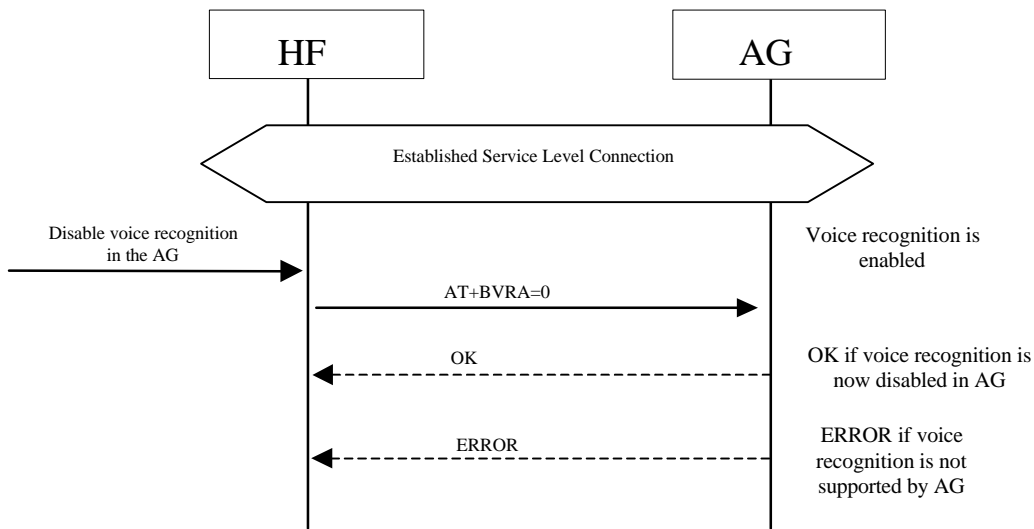


Figure 4.28 Voice recognition deactivation from the HF

### 4.21 Attach a phone number to a voice tag

This procedure is applicable to HF units supporting internal voice recognition functionality. It provides a means to read numbers from the AG for the purpose of creating a unique voice tag and storing the number and its linked voice tag in the HF unit’s memory. The HF unit can then use its internal Voice Recognition to dial the linked phone numbers when a voice tag is recognized by using the procedure “Place a call with the phone number supplied by the HF” described in Section 4.13.

Upon an internal event or user action, the HF may request a phone number from the AG by issuing the `AT+BINP=1` command. Depending on the current status of the AG, it may either accept or reject this request.

If the AG accepts the request, it shall obtain a phone number and send the phone number back to the HF by issuing the `+BINP` response.

If the AG rejects the request from the HF, it shall issue the `ERROR` result code to indicate this circumstance to the HF.

When this procedure is executed multiple times (to retrieve multiple AG phone numbers to be linked to voice tags), it is the responsibility of the user to provide the next phone number to be passed to the HF each time the procedure is executed.

Refer to Section 4.24 for more information on the `AT+BINP` command and the `+BINP` response.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

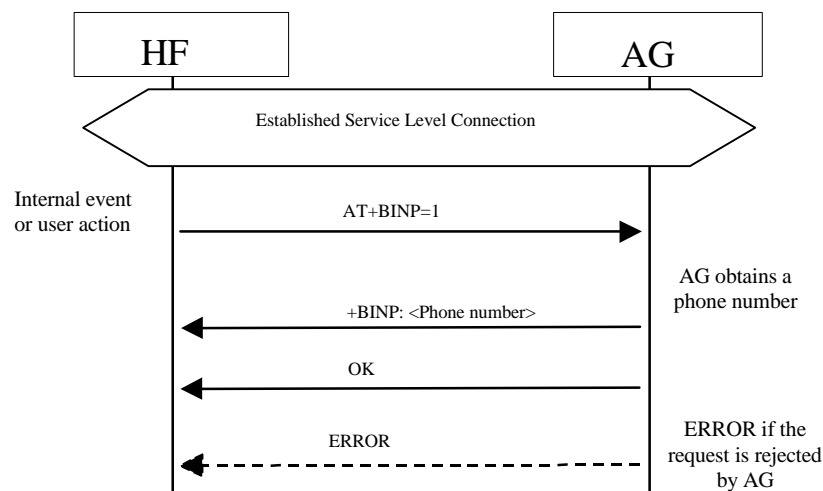


Figure 4.29 Request phone number to the AG

**Note:** Although this procedure is listed as "optional" for the Audio Gateway, it is strongly recommended that it be implemented for both interoperability and future compatibility.

## 4.22 Transmit DTMF codes

During an ongoing call, the HF transmits the `AT+VTS` command to instruct the AG to transmit a specific DTMF code to its network connection.

Refer to Section 4.24 for more information on the AT+VTS command.

The following pre-conditions apply for this procedure:

- An ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.
- An ongoing call in the AG exists.

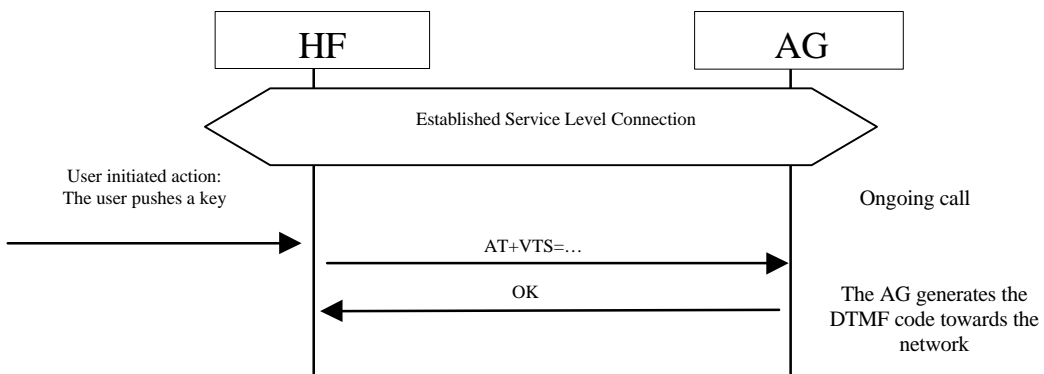


Figure 4.30 Transmit DTMF code

## 4.23 Remote Audio Volume Control

### 4.23.1 Audio volume control

This procedure enables the user to modify the speaker volume and microphone gain of the HF from the AG.

The AG can control the gain of the microphone and speaker of the HF by sending the unsolicited result codes +VGM and +VGS respectively. There is no limit in the amount and order of result codes, provided there is an active Audio Connection. When supporting the remote audio volume control procedure, an implementation is only mandated to support the control of the speaker volume.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the AG shall establish the Service Level Connection using the proper procedure as described in Section 4.2.



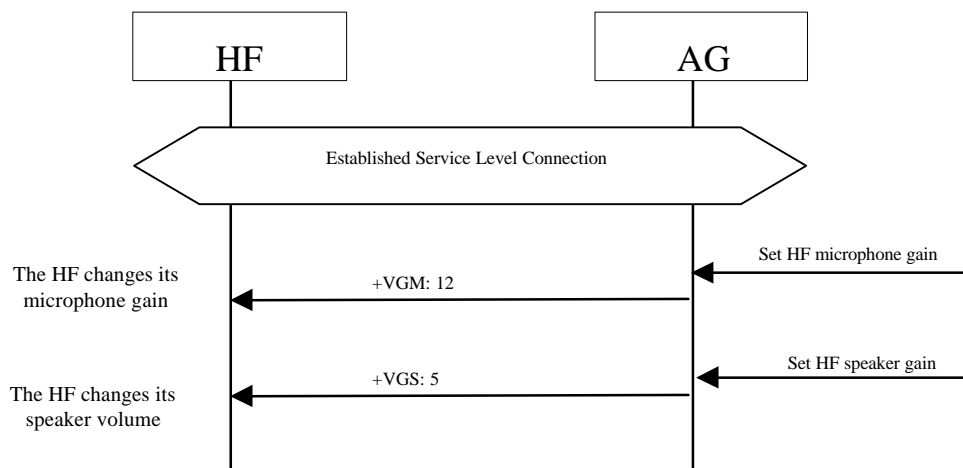


Figure 4.31 Typical example of audio volume control

Both the speaker and microphone gains are represented as parameter to the +VGS and +VGM, on a scale from 0 to 15. The values are absolute values, and relate to a particular (implementation dependent) volume level controlled by the HF.

Refer to Section 4.24 for more information on these commands and unsolicited result codes.

#### 4.23.2 Volume level synchronization

This procedure allows the HF to inform the AG of the current values of the HF's speaker volume and microphone gain.

The HF may store the VGS and VGM settings at connection release to restore the volume levels at the next connection establishment. During connection establishment, the HF shall inform the AG of the (restored) volume levels using the AT commands AT+VGS and AT+VGM. If local means are implemented on the HF to control the volume levels, the HF shall use the AT commands AT+VGS and AT+VGM to inform the AG of changes in the volume levels.

As pre-condition for this procedure, an ongoing Service Level Connection between the AG and the HF shall exist. If this connection does not exist, the HF shall establish the Service Level Connection using the proper procedure as described in Section 4.2.

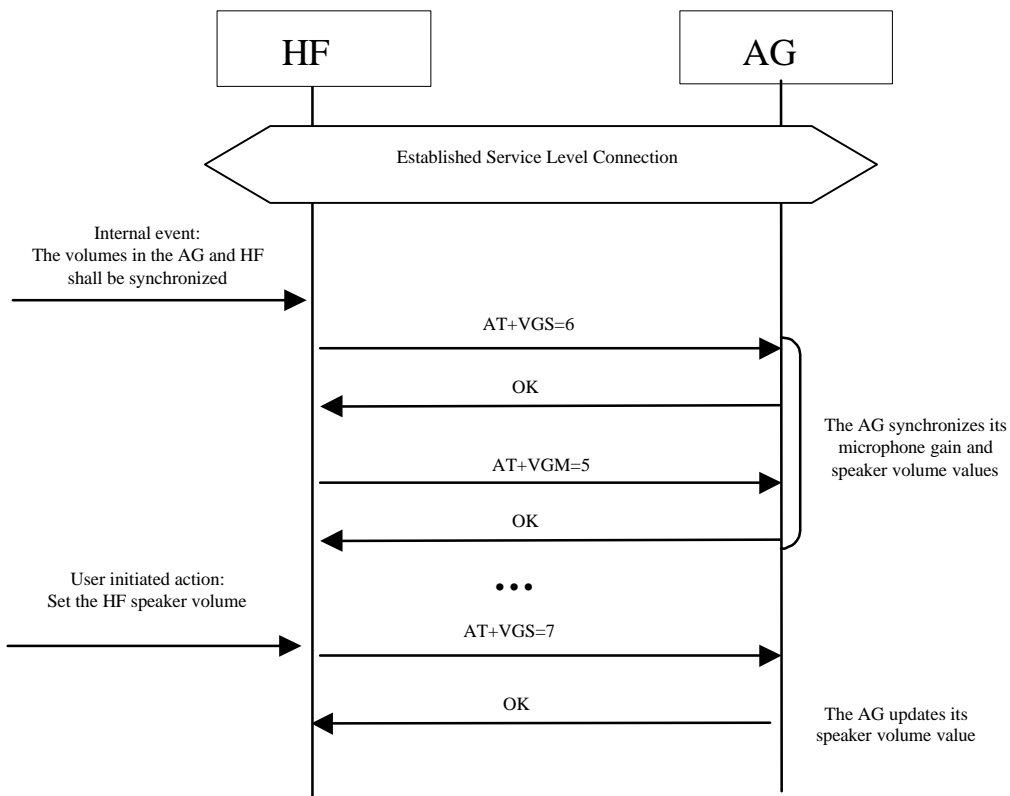


Figure 4.32 Typical example of volume level synchronization

Refer to Section 4.24 for more information on these commands and unsolicited result codes.

## 4.24 AT Commands and Result Codes

### 4.24.1 General

For the exchange of the commands and unsolicited results codes, the format, syntax and procedures of GSM 07.07 [2] shall be taken as reference. The following rules specifically apply for the HFP specification:

- Only one command (or unsolicited result code) per command line needs to be expected.
- The AG, by default, shall not echo the command characters.
- The AG shall always transmit result codes using verbose format.
- The characters below shall be used for AT commands and result codes formatting:

**<cr>** corresponds to the *carriage return (0/13)* as stated in [7]

**<lf>** corresponds to the *line feed (0/10)* as stated in [7].

- The format of an AT command from the HF to the AG shall be:

**<AT command><cr>**

- The format of the OK code from the AG to the HF shall be:

**<cr><lf>OK<cr><lf>**

- The format of the generic ERROR code from the AG to the HF shall be:

**<cr><lf>ERROR<cr><lf>**

- The format of an unsolicited result code from the AG to the HF shall be:

**<cr><lf><result code><cr><lf>**

The Hands-Free Profile uses a subset of AT commands and result codes from existing standards; these are listed in Section 4.24.2. Section 4.24.3 lists the new Bluetooth defined AT commands and result codes not re-used from any existing standard.

In general, the AG shall use the OK code, as described in Section 4.24.2, for acknowledgement of the proper execution of a command and respond with the proper error indication to any unknown command received from the HF.

It is mandatory for the AG to properly respond to any error condition and for the HF to properly process the corresponding error indication code received from the AG. The code ERROR, as described in Section 4.24.2, shall be used as error indication for this purpose.

The HF shall always ignore any unknown indication code received from the AG. The only exception is the case in which the AG issues an extended error indication. In this case, the HF shall interpret the extended error indication in the same way as if it was a generic ERROR code.

#### **4.24.2 AT capabilities re-used from GSM 07.07**

The re-used AT commands and unsolicited result codes for implementing the functionality described in this specification are listed below:

As a convention, if a parameter of an AT command or result code is not “covered” in this specification, it shall not be present in the corresponding AT

command, and the HF shall ignore the parameter whenever it is received in a result code.

- **ATA**

Standard call answer AT command. Refer to Section 6.20 in [2].

- **ATDdd...dd;**

Standard AT command intended for placing a call to a phone number. Only voice calls are covered in this specification. Refer to Section 6.2 in [2].

- **ATD>nnn;**

Extension of the standard ATD command, intended for memory dialing. Only voice calls are covered in this specification. Refer to Section 6.3 in [2].

- **ERROR**

Standard error indication code. It shall be issued on detection of any syntax, format or procedure error condition. No extended error report is required. Refer to Annex B in [2].

- **OK**

Standard acknowledgement to the execution of a command. Refer to Annex B in [2].

- **RING**

Standard “incoming call” indication. Refer to Annex B in [2].

- **AT+CCWA**

Standard “Call Waiting notification” AT command. Within the `AT+CCWA=[ <n>[ , <mode>[ , <class> ] ]` command, only enabling/disabling of the Call Waiting notification unsolicited result code `+CCWA`, using the `<n>` parameter, is covered in this specification. Refer to Section 7.11 in [2].

- **+CCWA**

Standard “Call Waiting notification” unsolicited result code.

In the +CCWA: <number>, <type>, <class> result code. Only the <number>=calling phone number digits, <type>=type of address and <class>=voice parameters are covered in this specification. Anyway, the value of the <type> parameter is not considered relevant in this specification and shall be ignored by the HF, together with any of the non-covered parameters received.

Refer to Section 7.11 in [2].

- **AT+CHLD**

Standard call hold and multiparty handling AT command. In the AT+CHLD=<n> command, this specification only covers values for <n> of 0, 1, 2, 3 and 4, where:

0 = Releases all held calls or sets User Determined User Busy (UDUB) for a waiting call.

1 = Releases all active calls (if any exist) and accepts the other (held or waiting) call.

2 = Places all active calls (if any exist) on hold and accepts the other (held or waiting) call.

3 = Adds a held call to the conversation.

4 = Connects the two calls and disconnects the subscriber from both calls (Explicit Call Transfer).

The test command AT+CHLD=? may be used for retrieving information about the call hold and multiparty services available in the AG (refer to Section 4.2.1).

Refer to Section 7.6 in [2] and Section 4.5.5.1 in [9] for details.

- **AT+CHUP**

Standard hang-up AT command. Refer to Section 6.5 in [2].

- **AT+CIND**

Standard indicator update AT command. Only read command `AT+CIND?` and test command `AT+CIND=?` are required in this specification.

The `AT+CIND?` read command is used to get current status of the AG indicators.

The `AT+CIND=?` test command is used to retrieve the mapping between each indicator supported by the AG and its corresponding range and order index. It shall be issued at least once before any other command related to these indicators (`AT+CIND?` or `AT+CMER`) is used.

The following indicators are covered in this specification:

- `service`: Service availability indication, where:
  - <value>=0 implies no service
  - <value>=1 implies presence of proper service.
- `call`: Call status indicator, where:
  - <value>=0 means no call process ongoing
  - <value>=1 means a call is ongoing.

Refer to Section 8.9 in [2].

- **AT+CLIP**

Standard “Calling Line Identification notification” activation AT command. It enables/disables the Calling Line Identification notification unsolicited result code `+CLIP`. Refer to Section 7.6 in [2].

- **+CLIP**

Standard “Calling Line Identification notification” unsolicited result code.

In the `+CLIP: <number>, <type> [, <subaddr>, <satype> [, [<alpha>] [, <CLI validity>]]]` result code. Only `<number>`=calling phone number digits and `<type>`=type of address parameters are covered in this specification. Anyway, the value of the `<type>` parameter is not considered relevant in this specification and shall be ignored by the HF, together with any of the non-covered parameters received.

Refer to Section 7.11 in [2].

- **AT+CMER**

Standard event reporting activation AT command. Only activation of the “indicator events reporting” result code +CIEV is covered in this specification.

In the AT+CMER=[<mode>[ ,<keyp>[ ,<disp>[ ,<ind>[ ,<bfr>]]]]] command, only the <mode>, and <ind> parameters are relevant for this specification. Only their values <mode>=(0,3) and <ind>=(0,1) are covered in this specification. Refer to Section 8.10 in [2].

The following examples show how the AT+CMER command may be used for activating or deactivating the “indicator events reporting” result code:

AT+CMER=3,0,0,1 would activate “indicator events reporting”.

AT+CMER=3,0,0,0 would deactivate “indicator events reporting”.

- **+CIEV**

Standard “indicator events reporting” unsolicited result code.

In the +CIEV: <ind>, <value> result code, only the indicators stated in the AT+CIND command above are relevant for this specification where:

- <ind>: Order index of the indicator within the list retrieved from the AG with the AT+CIND=? command. The first element of the list would have <ind>=1.
- <value>: current status of the indicator.

Refer to Section 8.10 in [2].

- **AT+VTS**

Standard DTMF generation AT command. Only the AT+VTS=<DTMF> command format is covered in this specification.

Refer to Annex C.2.11 in [2].

#### 4.24.3 Bluetooth defined AT capabilities

The GSM 07.07 [2] format and syntax rules shall be taken as the reference for these commands.

The new Bluetooth specific AT capabilities are listed below:

- **AT+BINP**

*Syntax:* AT+BINP=<datarequest>

*Expected response:* +BINP: <dataresp<sub>1</sub>>...<dataresp<sub>n</sub>>

*Description:*

Command used for requesting some specific data input from the AG. On reception of this command the AG shall perform the proper actions such that the requested information is sent back to the HF using the +BINP response.

The type of data the HF shall expect in the <dataresp> parameter returned by the AG depends on the information requested in each case.

Only support for execution command is mandated. Neither the read nor test commands are mandatory

*Values:*

<datarequest>: 1, where

1 = Phone number corresponding to the last voice tag recorded in the HF.

<dataresp<sub>1..n</sub>>: Data parameters returned by the AG. Their contents depends on the value of the <datarequest> parameter as follows:

<u>&lt;datarequest&gt; value</u>	<u>&lt;dataresp&gt; parameters</u>
1	<Phone number>: Phone number string (max. 32 digits). The format (type of address) of the phone number string shall conform with the rules stated in [8], subclause 10.5.4.7, for a value (in integer format) of the <i>type of address octet</i> of 145, if dialling string includes international access code character "+", and for a value of 129 otherwise.

- **AT+BLDN**

*Syntax:* AT+BLDN

*Description:*

Command used for calling the last phone number dialed. On reception of this command, the AG will set up a voice call to the last phone number dialed.

Only support for execution command is mandated. Neither the read nor test commands are mandatory



- **AT+BVRA**

*Syntax:* AT+BVRA=<vrec>

*Description:*

Enables/disables the voice recognition function in the AG.

Only support for execution command is mandated. Neither the read nor test commands are mandatory

*Values:*

<vrec>: 0, 1, entered as integer values, where

0 = Disable Voice recognition in the AG

1 = Enable Voice recognition in the AG

- **+BVRA**

*Syntax:* +BVRA: <vrect>

*Description:*

Unsolicited result code used to notify the HF when the voice recognition function in the AG has been terminated autonomously, as would be the case when voice recognition in the AG is only activated for a predefined period of time.

Only autonomous disabling of voice recognition is reported asynchronously to the HF.

*Values:*

<vrect>: 0, entered as integer value, where

0 = Voice recognition is disabled in the AG

- **AT+NREC**

*Syntax:* AT+NREC=<nrec>

*Description:*

Command issued to disable any Echo Canceling and Noise Reduction functions embedded in the AG.

Only support for execution command is mandated. Neither the read nor test commands are mandatory.

*Values:*

<nrec>: 0, entered as integer value, where

0 = Disable EC/NR in the AG

- **AT+VGM**

*Syntax:* AT+VGM=<gain>

*Description:*

Command issued by the HF to report its current microphone gain level setting to the AG. <gain> is a decimal numeric constant, relating to a particular (implementation dependent) volume level controlled by the HF. This command does not change the microphone gain of the AG, it simply indicates the current value of the microphone gain in the HF.

Only support for execution command is mandated. Neither the read nor test commands are mandatory

*Values:*

<gain>: 0 -15, entered as integer values, where

0 = Minimum gain

15 = Maximum gain

- **AT+VGS**

*Syntax:* AT+VGS=<gain>

*Description:*

Command issued by the HF to report its current speaker gain level setting to the AG. <gain> is a decimal numeric constant, relating to a particular (implementation dependent) volume level controlled by the HF. This command does not change the speaker gain of the AG, it simply indicates the current value of the speaker volume in the HF.

Only support for execution command is mandated. Neither the read nor test commands are mandatory

*Values:*

<gain>: 0 -15, entered as integer values, where

0 = Minimum gain

15 = Maximum gain

- **+VGM**

*Syntax:* +VGM:<gain>

*Description:*

Unsolicited result code issued by the AG to set the microphone gain of the HF. <gain> is a decimal numeric constant, relating to

a particular (implementation dependent) volume level controlled by the HF.

Due to the small inconsistency between the GSM 07.07 standard ([2]) and the current Headset specification ([4]), the HF shall also accept the “=” symbol in place of “:” as a valid separator for this unsolicited result code.

*Values:*

<gain>: 0 -15, integer values, where

0 = Minimum gain

15 = Maximum gain

- **+VGS**

*Syntax:* +VGS:<gain>

*Description:*

Unsolicited result code issued by the AG to set the speaker gain of the HF. <gain> is a decimal numeric constant, relating to a particular (implementation dependent) volume level controlled by the HF.

Due to the small inconsistency between the GSM 07.07 standard ([2]) and the current Headset specification ([4]), the HF shall also accept the “=” symbol in place of “:” as valid separator for this unsolicited result code.

*Values:*

<gain>: 0 -15, integer values, where

0 = Minimum gain

15 = Maximum gain

- **+BSIR**

*Syntax:* +BSIR: <bsir>

*Description:*

Unsolicited result code issued by the AG to indicate to the HF that the in-band ring tone setting has been locally changed. The HF may react accordingly by changing its own alert method.

*Values:*

<bsir>: 0 = the AG provides no in-band ring tone

1 = the AG provides an in-band ring tone

## **5 Serial Port Profile**

---

This profile requires compliance to the Serial Port Profile [6]. The following text together with the associated subclauses defines the requirements with regard to this profile in addition to the requirements as defined in the Serial Port Profile.

For the Hands-Free Profile, both the AG and the HF can initiate connection establishment. Therefore, for the purposes of reading the Serial Port Profile [6], both the AG and the HF may assume the role of Device A or B.

### **5.1 RFCOMM Interoperability Requirements**

For the RFCOMM layer, no additions to the requirements as stated in the Serial Port Profile [6] Section 4 apply.

### **5.2 L2CAP Interoperability Requirements**

For the L2CAP layer, no additions to the requirements as stated in the Serial Port Profile [6] Section 5 apply.

### 5.3 SDP Interoperability Requirements

The following service records are defined for the Hands-Free Profile. There is one service record applicable to the Hands-Free unit and another for the Audio Gateway.

The attribute “SupportedFeatures” states the features supported in each device. The set of features supported in each case is bit-wise defined in this attribute on a yes/no basis. The mapping between the features and their corresponding bits within the attribute is listed below in Table 5.2 for the HF and in Table 5.4 for the AG.

The codes assigned to the mnemonics 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 of the current Bluetooth Specification.

Item	Definition	Type	Value	Status	Default
ServiceClassIDList				M	
ServiceClass0		UUID	Hands-Free	M	
ServiceClass1		UUID	Generic Audio	M	
ProtocolDescriptorList				M	
Protocol0		UUID	L2CAP	M	
Protocol1		UUID	RFCOMM	M	
ProtocolSpecificParameter0	Server Channel	Uint8	N=server channel #	M	
BluetoothProfileDescriptorList				O	
Profile0	Supported Profiles	UUID	Hands-Free	M	Hands-Free
Param0	Profile Version	Uint16	0x0100 <sup>1</sup>	M	0x0100
ServiceName	Display-able Text name	String	<i>Service-provider defined</i>	O	“Hands-Free unit”
SupportedFeatures	Features supported	Uint16	<i>Device dependent</i>	O	0x0000

Table 5.1 Service Record for the HF

Bit position (0=LSB)	Feature	Default in HF
0	EC and/or NR function (yes/no, 1 = yes)	0
1	Call waiting and three way calling (yes/no, 1 = yes)	0
2	CLI presentation capability (yes/no, 1 = yes)	0
3	Voice recognition activation (yes/no, 1 = yes)	0
4	Remote volume control (yes/no, 1 = yes)	0

Table 5.2 “SupportedFeatures” attribute bit mapping for the HF

<sup>1</sup> Indicating version 1.0

Whenever the “SupportedFeatures” attribute is not present in the HF service record, default values as stated in Table 5.2 shall be assumed.

The “Network” attribute states the AT commands standard associated with the network the AG is being attached to. The values this attribute shall take are listed below:

- “GSM like”: The AG is being (or is currently) attached to a network in which the features listed in the present document are implemented according to what is stated in ref. [2] and all its related GSM specifications.
- “Other”: The AG is being (or is currently) attached to a network in which some of the features listed in the present document may not be implemented according to what is stated in ref. [2].

Item	Definition	Type	Value	Status	Default
ServiceClassIDList				M	
ServiceClass0		UUID	AG Hands-Free	M	
ServiceClass1		UUID	Generic Audio	M	
ProtocolDescriptorList				M	
Protocol0		UUID	L2CAP	M	
Protocol1		UUID	RFCOMM	M	
ProtocolSpecificParameter0	Server Channel	Uint8	N=server channel #	M	
BluetoothProfileDescriptorList				O	
Profile0	Supported Profiles	UUID	Hands-Free	M	Hands-Free
Param0	Profile Version	Uint16	0x0100 <sup>2</sup>	M	0x0100
ServiceName	Display-able Text name	String	<i>Service-provider defined</i>	O	“Voice gateway”
Network		Uint8	0x01=GSM like 0x02=Other	M	
SupportedFeatures	Features supported	Uint16	<i>Device dependent</i>	O	0x0009

Table 5.3 Service Record for the AG

Bit position (0=LSB)	Feature	Default in AG
0	Three way calls (yes/no, 1 = yes)	1
1	EC and/or NR function (yes/no, 1 = yes)	0
2	Voice recognition function (yes/no, 1 = yes)	0
3	In-band ring tone capability (yes/no, 1 = yes)	1
4	Attach a phone number to a voice tag (yes/no, 1 = yes)	0

Table 5.4 “SupportedFeatures” attribute bit mapping for the AG

<sup>2</sup> Indicating version 1.0

Whenever the “SupportedFeatures” attribute is not present in the AG service record, default values as stated in Table 5.4 shall be assumed.

## **5.4 Link Manager (LM) Interoperability Requirements**

In addition to the requirements for the Link Manager as stated in the “Serial Port Profile” [6] on page 165, this profile mandates support for SCO links in both the HF and the AG.

## 5.5 Link Control (LC) Interoperability Requirements

In the table below, changes to the support status as listed in the Serial Port Profile [6], Section 8.1, Table 8.1 are listed.

	Capability	Support in AG	Support in HF
1.	Inquiry		X <sup>1</sup>
2.	Inquiry scan	X <sup>1</sup>	
7	Voice CODEC		
C	CVSD	M	M

<sup>1</sup> Note: These capabilities are not used within the execution of this profile, but concurrent use by other profiles/applications is not excluded.

Table 5.5 LC capabilities

### 5.5.1 Class of Device

A device, active in the HF role, shall have the following settings in the Class of Device field:

1. Set the bit "Audio" in the Service Class field
2. Indicate "Audio" as Major Device class
3. Indicate "Hands-Free" as the Minor Device class.

An inquiring AG may use this information to filter the inquiry responses.



## 6 Generic Access Profile

This section defines the support requirements for the capabilities as defined in the “Generic Access Profile” [5].

### 6.1 Modes

The table shows the support status for GAP Modes in this profile.

	Procedure	Support in HF	Support in AG
1	<b>Discoverability modes</b>		
	Non-discoverable mode	O	N/A
	Limited discoverable mode	O	N/A
	General discoverable mode	M	N/A
2	<b>Connectability modes</b>		
	Non-connectable mode	N/A	N/A
	Connectable mode	M	M
3	<b>Pairing modes</b>		
	Non-pairable mode	O	O
	Pairable mode	O	O

Table 6.1 Modes

### 6.2 Security aspects

There are no changes to the security requirements as stated in the Generic Access Profile [5].

### 6.3 Idle mode procedures

Table 6.2 shows the support status for Idle mode procedures within this profile

	Procedure	Support in HF	Support in AG
1	General inquiry	N/A	M
2	Limited inquiry	N/A	O
3	Name discovery	N/A	O
4	Device discovery	N/A	O
5	Bonding	O (Note 1)	O (Note 1)

Note 1: Whenever supported, the AG shall at least support initiation of bonding, and the HF at least acceptance of bonding.

Table 6.2 Idle mode procedures

## 7 References

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- [1] "Specification of the Bluetooth System; Core, v1.1"
- [2] ETS 300 916, "Digital cellular telecommunications system (Phase 2+); AT command set for GSM Mobile Equipment (ME) (GSM 07.07 version 6.4.0)"
- [3] X.Y.000/0.0x, "Bluetooth SIG Car Profile Working Group MRD"
- [4] "Specification of the Bluetooth System; Profiles, v1.1, Part K:6, Headset Profile"
- [5] "Specification of the Bluetooth System; Profiles, v1.1, Part K:1, Generic Access Profile"
- [6] "Specification of the Bluetooth System; Profiles, v1.1, Part K:5, Serial Port Profile"
- [7] "ITU-T50, Terminal Equipment and Protocols for telematic services: International Reference Alphabet (IRA) (Formerly International Alphabet No. 5 IA5). Information technology – 7-Bit coded character set for information interchange"
- [8] "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification", (GSM 04.08 version 6.11.0).
- [9] "GSM 02.30 (version 7.1.0): Digital cellular telecommunications system (Phase 2+); Man-Machine Interface (MMI) of the Mobile Station (MS)"

## 8 List of Acronyms and Abbreviations

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Abbreviation or Acronym	Meaning
AG	Audio Gateway
AT	Attention
CLI	Calling Line Identification
CODEC	COder DECoder
CVSD	Continuous Variable Slope Delta modulation
DTMF	Dual Tone Multi-Frequency
GAP	Generic Access Profile
HF	Hands-Free unit
LMP	Link Manager Protocol
L2CAP	Logical Link Control and Adaptation Protocol
PIN	Personal Identification Number
RFCOMM	Serial port transport protocol over L2CAP
SCO	Synchronous Connection Oriented
SDP	Service Discovery Protocol
UI	User Interface
UUID	Universal Unique IDentifier

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## **11 Annex A (informative): Additional features**

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### **11.1 Guidelines for Hands-Free plus Headset scenario**

Whenever a Headset profile [4] compliant unit and a Hands-Free device, conforming to the HFP specification, are concurrently attached to the AG, the rules below would apply:

- a) Only a single Hands-Free device and one Headset unit are considered in the present scenario.
- b) The present scenario typically requires multi-point connection capabilities at least in the AG.
- c) Whenever the Hands-Free device remains attached to the AG, it will retain the full call control and audio capabilities as described in the HFP specification, even if a Headset unit is also active or connected.
- d) Whenever a Hands-Free device is attached to the AG, if a Headset unit is also active or connected, the Headset unit would only be considered as an audio port, using the procedures related to audio connection transfer capabilities, as described in Section 4.5 in [4]. From the AG point of view, the procedures described in Sections 4.6, 4.7, 4.11 and 4.12 of the HFP specification would be used for this purpose.

The AG has the final responsibility for this functionality. It may keep the control connection open with the Hands-Free device even if a Headset unit is concurrently being used, and in such a way that only the audio paths are 're-routed'.

The AG will follow the procedures described in the HFP specification, with the exception of the audio connections which may be immediately transferred towards the Headset whenever suitable.

When necessary, the AG may control the routing of the audio paths with both the Hands-Free device and the Headset unit via the standard procedures described in the corresponding specifications, that is, the ones described in Section 4.5 in [4] in the case of the Headset unit, and the ones stated in Sections 4.6, 4.7, 4.11 and 4.12 in the HFP specification.