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## MULTI PROFILE SPECIFICATION

### Abstract:

The Multi-Profile Specification (MPS) specifies the behavior for Bluetooth devices supporting multiple Bluetooth profiles.

## Revision History

Revision	Date(yy-mm-dd)	Comments
D0.7 r01	11-07-26	First draft of V0.7 specification
D0.7 r02	11-08-17	Update scenarios and handle some V0.5 review comments
D0.7 r03	11-09-15	Removed scenarios with Chapter 5 revisions
D0.7 r04	11-10-01	F2F revisions; draft for V0.7 1 <sup>st</sup> submission approval vote
D0.7 r05	11-10-18	1 <sup>st</sup> MPWG review revisions and Denso/MCPC updates
D0.7 r06	11-11-03	2 <sup>nd</sup> MPWG review revisions
D.07r07	11-11-09	3 <sup>rd</sup> MPWG review revision
D.07r08	11-11-21	4 <sup>th</sup> MPWG review revision – following changes – 4.1.1.1 - adding GAVDP_Suspend for clarity and consistency 4.1.7.1 – MSC diagrams updated to reflect the notion that changes to HFP volume must not affect AV volume, and vice versa. 4.2.8 - adding a new scenario per Tamura-san: Terminate voice call / data call during data communication and voice call (old) 4.1.11 - removing for simplification purposes - HFP SLC Connection during Audio Streaming (headers' numbering now updated) 5.1 - adding placeholder for SDP procedure Aligned inconsistencies between PICS and Tables in Chapter 3 and 5
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D07r13	11-11-30	Accepted all changes for the v0.7 release
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Revision	Date(yy-mm-dd)	Comments
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D09r03	12-08-03	Changes due to discussions on CC 2012-08-01: <ul style="list-style-type: none"> <li>- Clarified conditional dependency of multiple link feature</li> <li>- Added section 2.5 with timers and specified DUN and PAN IP data traffic halting</li> <li>- Made reference to callsetup more generic in reject call scenarios</li> <li>- Merged the new SDP definition into the document</li> <li>- Completed the referenced command descriptions in Appendix A</li> </ul>
D09r05	12-08-20	Updates after MPWG internal reviews, especially: <ul style="list-style-type: none"> <li>- Made references to underlying profile procedures more generic (e.g. HFP callsetup, AVRCP GetPlayStatus, etc.) in MSCs</li> <li>- Added figure for DUN multi device in section 4.2</li> <li>- Added text and clarified MSC</li> <li>- Removed the content of 2.4 on Use Case illustrations</li> </ul>
D09r06	12-08-21	Addressed further review comments: <ul style="list-style-type: none"> <li>- Merged acronym definitions in sections 1 and 7</li> <li>- Revised AVRCP eL2CAP usage recommendation</li> </ul>
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D09r08	12-09-17	Preparation for BARB release (accepted all changes, updated dates)
D09r09	12-09-17	Corrected core spec version reference in reference table in chapter 7
D09r10	12-10-13	Addressed BARB review comments
D09r11	12-10-14	Further addressed feedback from IOP and Reviews; recovered all figures to be editable in Visio again
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D09r13	12-10-19	Further addressed feedback from IOP and Reviews

Revision	Date(yy-mm-dd)	Comments
D09r14	12-10-25	Update with results from MPWG CC Removed HID requirements in lack of support from membership Renamed 'Multi Link Support' feature to 'Multiple Connected Devices' Simplified Table 6-1 removed the HFP requirement section
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D09r16	12-12-04	Updated with MPWG internal review comments
D09r17	12-12-07	Updated with MPWG internal review comments
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V10r02	13-04-26	Editorial: removed remaining occurrences of the Word 'SAP'
V10r03	13-04-29	Editorial: removed references to FTP and OPP from Profile Version table
V10r04	13-04-30	Corrected Company name in contributor table
V10r05	13-05-06	- change v1.0 to D1.0 in header - change 'approved' in header to 'draft'
V10r05	13-05-10	Addressed comments from BARB review: <ul style="list-style-type: none"> <li>- Corrected page breaks throughout the document</li> <li>- Corrected links and formatting of links after removal of SAP scenario</li> <li>- Add 'or later' to core spec reference in section 7</li> </ul>
V10	13-07-02	Adopted by BoD

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# 1 Introduction

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## 1.1 Scope

This specification defines the behavior of devices supporting multiple Bluetooth profiles. Any device claiming support for this profile shall fulfill all applicable requirements defined in this specification in addition to the requirements defined in each individual Bluetooth profile it supports.

This document specifies device behavior for the Multiple Profiles Single Device (MPSD) and Multiple Profiles Multiple Devices (MPMD) configurations.

The Single Profile Single Device (SPSD) and Single Profile Multiple Devices (SPMD) configurations are out of scope of this document.

Please see section [2.2 Configurations, Roles, and Modes](#) for definitions of these configurations.

This specification always assumes ideal baseband/radio conditions and does not address constraints that might be imposed by radio interference.

## 1.2 Conformance

This specification does not require each profile that is referenced to be supported. If conformance to this Profile is claimed, all capabilities indicated as mandatory in this specification for all Scenarios applicable to the device's supported profiles 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.

## 1.3 Profile Dependencies

Since the Multi-Profile Specification deals with various profiles in different use cases, the profile dependencies vary according to the particular profiles involved in each use case. The detail of the profile dependencies are provided in the scenario description section.

Please refer to [Table 3.1](#) for details on these profile and use case dependencies. Also, please refer to section [6.1 MPS SDP Record](#) for details on how the SDP records are used to convey MPS support information to the connected device(s).

## 1.4 Bluetooth Specification Release Compatibility

This specification is compatible with Bluetooth Core Specification version(s) 2.1 or later.

## 1.5 Symbols, Conventions, and Definitions

This section explains any symbols, nomenclature, etc., that are unique to this specification. This should not include entries that could be included by reference to other sections of the Bluetooth documentation (e.g., Volume 1, Part B of the Bluetooth specification [1]).

### 1.5.1 Symbols

In this document, the following symbols are used:

‘M’ for mandatory to support (used for MPS features that are applicable and shall be used in the profile).

‘O’ for optional to support (used for MPS features that are applicable and that may be used in the profile).

‘C’ for conditional to support (used for applicable MPS features that shall be used in case a certain condition applies).

‘N/A’ for not applicable (MPS does not define any requirements beyond what is defined in the individual profile specification).

### 1.5.2 Conventions

The following formatting conventions are used to designate key concepts in a concise and recognizable fashion.

Profile-Role	The hyphen (‘-’) is used to separate a profile and its defined role (e.g. HFP-AG; A2DP-SNK; PBAP-PCE)
<b>Profile_Command</b>	The underscore (‘_’) is used to connect a profile or protocol with a command or feature (e.g. <b>AVRCP_Pause</b> ) and a <b>fixed width font</b> is applied

### 1.5.3 Definitions

Table 1.1 below provides definition of acronyms used throughout this document. Please also refer to Appendix A – Reference of Commands, Roles and Features of Other Profiles Used in MPS for definition of more complex commands and features used.

Item	Meaning
AVP	Combination of A2DP and AVRCP profiles
MPMD	Multiple Profiles Multiple Devices
MPS	Multi-Profile Specification (this document)
MPSD	Multiple Profiles Single Device
SPMD	Single Profile Multiple Devices
SPSD	Single Profile Single Device
AG	HFP Audio Gateway Role
HF	HFP Hands-free unit Role

Item	Meaning
SRC	A2DP Source Role
SNK	A2DP Sink Role
CT	AVRCP Controller Role
TG	AVRCP Target Role
GW	DUN Gateway Role
DT	DUN Data Terminal Role
NAP	PAN Network Access Point Role
PANU	PAN User Role
SRV	Server Role (e.g. PBAP)
CLI	Client Role (e.g. PBAP)
MSC	Message Sequence Chart

Table 1.1 Acronyms

### 1.5.4 Document Terminology

- The Bluetooth SIG has adopted section 13.1 of the IEEE Standards Style Manual, which dictates use of the words “shall”, “should”, “may”, and “can” in specifications, as follows:
- The word *shall* is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted (*shall* equals is required to).
- The use of the word *must* is deprecated and shall not be used when stating mandatory requirements; *must* is used only to describe unavoidable situations.
- The use of the word *will* is deprecated and shall not be used when stating mandatory requirements; *will* is only used in statements of fact.
- The word *should* is used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain course of action is deprecated but not prohibited (*should* equals is recommended that).
- The word *may* is used to indicate a course of action permissible within the limits of the standard (*may* equals *is permitted*).
- The word *can* is used for statements of possibility and capability, whether material, physical, or causal (*can* equals *is able to*).

## 2 Profile Overview

---

The Multi-Profile Specification specifies behavior for devices that support a variety of profiles.

### 2.1 Protocol Stack

As the Multi-Profile Specification integrates multiple profiles, of itself, it has no protocol stack.

### 2.2 Configurations, Roles, and Modes

The Multi-Profile Specification does not introduce any new roles or modes. Roles and modes from the existing profile specifications are referenced.

The following configurations are distinguished in order to define the scope of this specification. Section 1.1 defines which configurations are within the scope of MPS.

**Single Profile Single Device (SPSD):** In this configuration, a single profile is used between a single pair of Bluetooth devices. No other profile is used concurrently.

**Single Profile Multiple Devices (SPMD):** In this configuration, a single profile is used concurrently between several Bluetooth devices. For example, one device runs multiple instances of the same profile and each instance is connected to a separate Bluetooth device supporting that profile.

**Multiple Profiles Single Device (MPSD):** In this configuration, multiple Bluetooth profiles are used concurrently between two devices.

**Multiple Profiles Multiple Devices (MPMD):** In this configuration, multiple Bluetooth profiles are used concurrently among several devices. The number of devices is defined case by case.

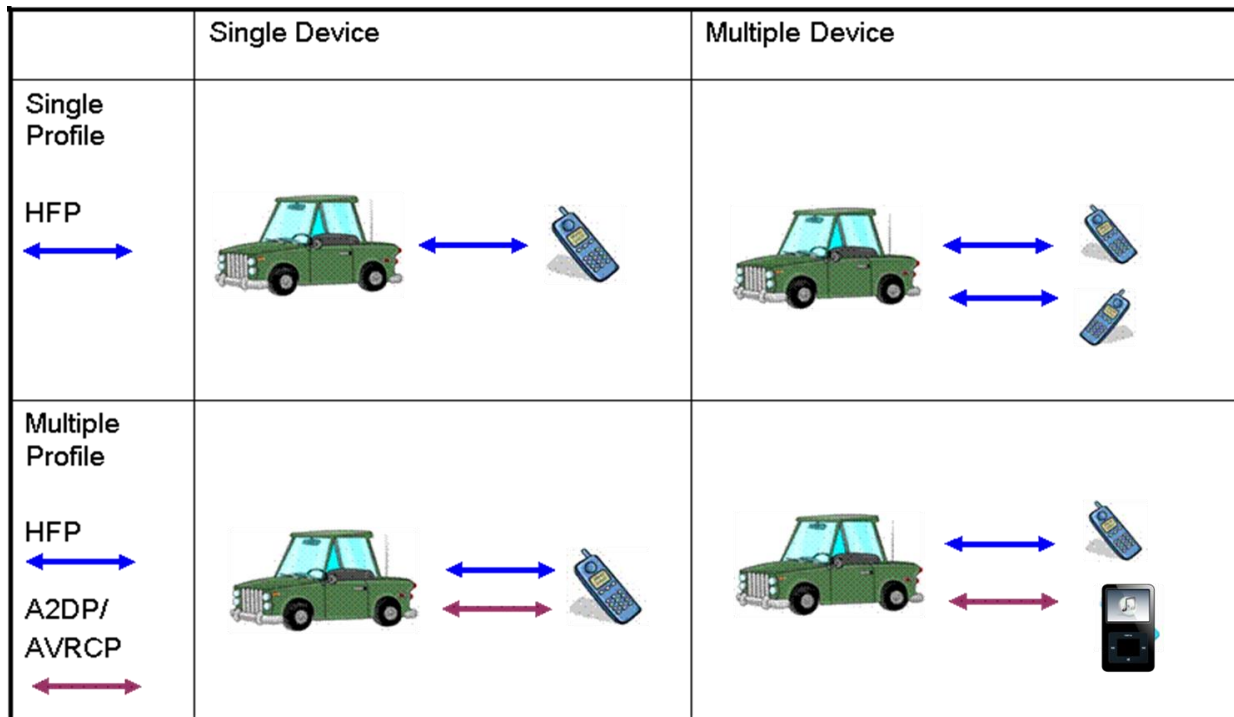


Figure 2.1: MPS Configurations

(Examples shown in [Figure 2.1](#) are illustrative only.)

## 2.3 Profile Versions

Table 2.1 identifies which profiles at which versions are referenced by the MPS. Any earlier versions of these profiles are not relevant for MPS. Any later versions are applicable.

Profile	Version
A2DP	1.2
AVRCP	1.3
DUN	1.1
HFP	1.5
PAN	1.0
PBAP	1.1

Table 2.1: Profile Version

### 3 Scenario Dependencies

The MPS is defined based on various Bluetooth scenarios. This allows for tailoring of this specification based on a device's supported features and roles within these scenarios.

This section provides a cross-reference between the scenarios and the supported Bluetooth profiles and roles.

MPS allows, but does not specify the operation of additional profiles/roles concurrently with the defined scenarios.

Additional scenarios may be added to future versions of MPS via the Bluetooth SIG specification enhancement process.

MPS Section Ref.	Scenario / Feature	Device	Mandatory / Optional	A2DP	AVRCP	DUN	HFP	PAN	PBAP
3.1	Multiple Connected Devices	N/A	C.4						
4.1	<b>HFP+AVP</b>								
4.1.1	Answer Incoming Call during Audio Streaming (MPSD)	A	C.1	SRC	TG		AG		
		B	C.1	SNK	CT		HF		
4.1.2	Answer Incoming Call during Audio Streaming (MPMD)	A	N/A				AG		
		B	C.2	SNK	CT		HF		
		C	C.1	SRC	TG				
4.1.3	Outgoing Call during Audio Streaming (MPSD)	A	C.1	SRC	TG		AG		
		B	C.1	SNK	CT		HF		
4.1.4	Outgoing Call during Audio Streaming (MPMD)	A	N/A				AG		
		B	C.2	SNK	CT		HF		
		C	C.1	SRC	TG				
4.1.5	Reject/Ignore Incoming Call during Audio Streaming (MPSD)	A	C.1	SRC	TG		AG		
		B	C.1	SNK	CT		HF		
4.1.6	Reject/Ignore Incoming Call during Audio Streaming (MPMD)	A	N/A				AG		
		B	C.2	SNK	CT		HF		
		C	C.1	SRC	TG				
4.1.7	HFP Call Termination during AVP Connection (MPSD)	A	C.1	SRC	TG		AG		
		B	C.1	SNK	CT		HF		
4.1.8	HFP Call Termination	A	N/A				AG		

MPS Section Ref.	Scenario / Feature	Device	Mandatory / Optional	A2DP	AVRCP	DUN	HFP	PAN	PBAP
	during AVP Connection (MPMD)	B	C.2	SNK	CT		HF		
		C	C.1	SRC	TG				
4.1.9	Press Play on Audio Player during active call (MPSD)	A	C.1	SRC	TG		AG		
		B	C.1	SNK	CT		HF		
4.1.10	Press Play on Audio Player during active call (MPMD)	A	N/A				AG		
		B	C.2	SNK	CT		HF		
		C	C.1	SRC	TG				
4.1.11	Start Audio Streaming after AVRCP_Play (MPSD)	A	C.1	SRC	TG				
		B	C.1	SNK	CT				
4.1.12	Suspend Audio Streaming after AVRCP_Pause (MPSD)	A	C.1	SRC	TG				
		B	C.1	SNK	CT				
4.2	<b>DUN Scenarios</b>								
4.2.1	Data communication under PSDM during active voice call	A	C.3			GW	AG		
		B	C.3			DT	HF		
4.2.2	Outgoing voice call during Data communication under PSDM	A	C.3			GW	AG		
		B	C.3			DT	HF		
4.2.3	Incoming voice call during Data communication under PSDM	A	C.3			GW	AG		
		B	C.3			DT	HF		
4.2.4	Start Audio Streaming during Data communication under PSDM	A	C.1	SRC	TG	GW			
		B	C.1	SNK	CT	DT			
4.2.5	Start Audio streaming during Data communication under PSDM (MPMD)	A	C.1	SRC	TG				
		B	C.2	SNK	CT	DT			
		C	N/A			GW			
4.2.6	Data communication establishment under PSDM during Audio Streaming	A	C.1	SRC	TG	GW			
		B	C.1	SNK	CT	DT			
4.2.7	Start Packet data communication during Audio streaming (MPMD)	A	C.1	SRC	TG				
		B	C.2	SNK	CT	DT			
		C	N/A			GW			
4.2.8	Terminate voice call /	A	C.1			GW	AG		



MPS Section Ref.	Scenario / Feature	Device	Mandatory / Optional	A2DP	AVRCP	DUN	HFP	PAN	PBAP
	data call during data communication and voice call	B	C.1			DT	HF		
4.3	<b>PAN Scenarios</b>								
4.3.1	Data communication in Personal Area Network during active voice call (MPSP)	A	C.3				AG	NAP	
		B	C.3				HF	PANU	
4.3.2	Outgoing voice call during Data communication in a Personal Area Network	A	C.3				AG	NAP	
		B	C.3				HF	PANU	
4.3.3	Incoming voice call during Data communication in a Personal Area Network	A	C.3				AG	NAP	
		B	C.3				HF	PANU	
4.3.4	Start Audio Streaming during Data communication in PAN	A	C.1	SRC	TG			NAP	
		B	C.1	SNK	CT			PANU	
4.3.5	Data communication establishment in Personal Area Network during Audio Streaming (MPSP)	A	C.1	SRC	TG			NAP	
		B	C.1	SNK	CT			PANU	
		C	C.1					NAP	
4.4	<b>PBAP Related Scenarios</b>								<b><u>PBAP</u></b>
4.4.1	Phonebook Download and Audio Streaming (MPSP)	A	C.1	SRC	TG				PSE
		B	C.1	SNK	CT				PCE
4.4.2	PBAP and HFP Connection behavior (MPSP)	A	C.1				AG		PSE
		B	N/A				HF		PCE

Table 3.1: Scenario Dependencies

- O: Optional if all profile roles for either Device A or B in that row are supported, N/A otherwise
- C.1: Mandatory when all profile roles listed in that row are supported, N/A otherwise. A device shall be capable of supporting this feature, but the feature may be deactivated in order to allow an alternative procedure that is not defined by MPS for that scenario. The feature bitmask in the SDP record shall reflect the current setting of used scenarios.
- C.2: C.1 if Multiple Connected Devices is supported, N/A otherwise. The Device is physically connected to multiple devices in these scenarios.
- C.3: Mandatory if the network allows parallel data and call operation

C.4: Mandatory to support if the Device supports connecting multiple devices concurrently

N/A: Not Applicable. The Device with the profile roles indicated in that row is part of the scenario, but MPS does not impose any requirements beyond what is defined in the individual profile specification.

### 3.1 Multiple Connected Devices

This feature is defined by a device's ability to concurrently connect to multiple devices. The purpose of defining this feature in MPS is to distinguish between devices with and without this ability.

Throughout this document, Device B is defined to be the central device in MPMD scenarios. Support of the MPMD scenarios for Device B is conditional in MPS depending on a device supporting the concurrent connection of multiple devices.

Thus, devices with resource and user interface limitations that are not capable of point-to-multipoint connection can support the Device B MPMD set of scenarios.

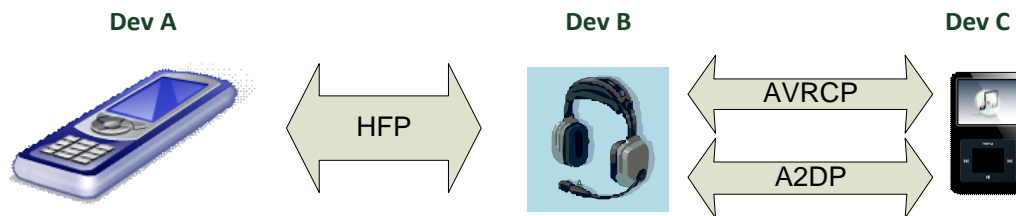


Figure 3.1: Multiple Connected Devices

The MPMD scenarios for Device A and Device C do not require that the devices are actually connected to multiple devices. They are only part of a multi device setup and are not aware of being part of a multi device scenario.

## 4 Scenario (Use Case) Definitions

This section specifies the behavior of devices compliant with MPS in the different scenarios. A scenario is a realization of a use case that combines procedures from multiple individual Bluetooth profile specifications.

### 4.1 HFP + AVP Scenarios

This section deals with scenarios involving HFP, A2DP, and AVRCP. This is a common MPSP configuration; for example, a mobile phone that also has a built-in media player. The MPMD configuration occurs when one device is used for the mobile phone (HFP) functions and another device is used for the media playback (A2DP/AVRCP).

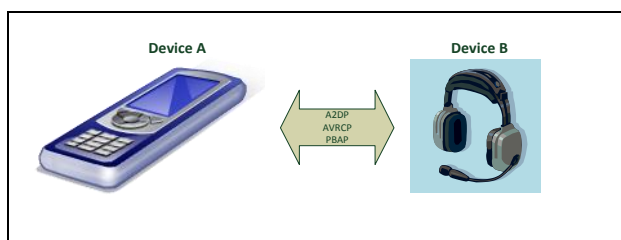


Figure 4.1: HFP + AVP MPSP

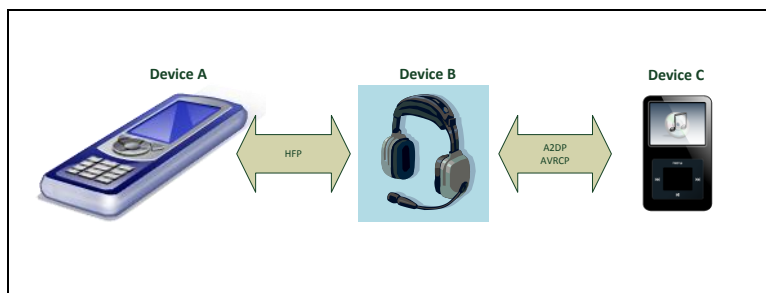


Figure 4.2: HFP + AVP MPMD

## 4.1.1 Answer Incoming Call during Audio Streaming (MPSD)

### 4.1.1.1 Profile Roles

This scenario shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT
HFP-AG	HFP-HF

### 4.1.1.2 Description

The purpose of this scenario is to verify that Device A can suspend the stream when the call comes in and is answered. An ongoing HFP Service Level Connection between the devices shall exist and the AVDTP shall be in the **AVDTP\_state** Streaming.

The Device A shall suspend the stream using **GAVDP\_Suspend** when the call comes in and shall alert Device B as defined in the HFP procedures. Whether answered at Device A, or at Device B using the relevant HFP procedures, Device A shall indicate acceptance of the incoming call and establish the HFP audio connection following the pertinent HFP procedures. The completion of the suspend procedure may overlap with the HFP audio connection establishment procedure.

Device A should locally pause the audio that is sent over the A2DP stream depending on the audio application. If AVRCP 1.3 or above is used in the connection, Device A shall update the play status over AVRCP.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.4</a>	<a href="#">GAVDP Requirements</a>

#### 4.1.1.3 Sequence Chart

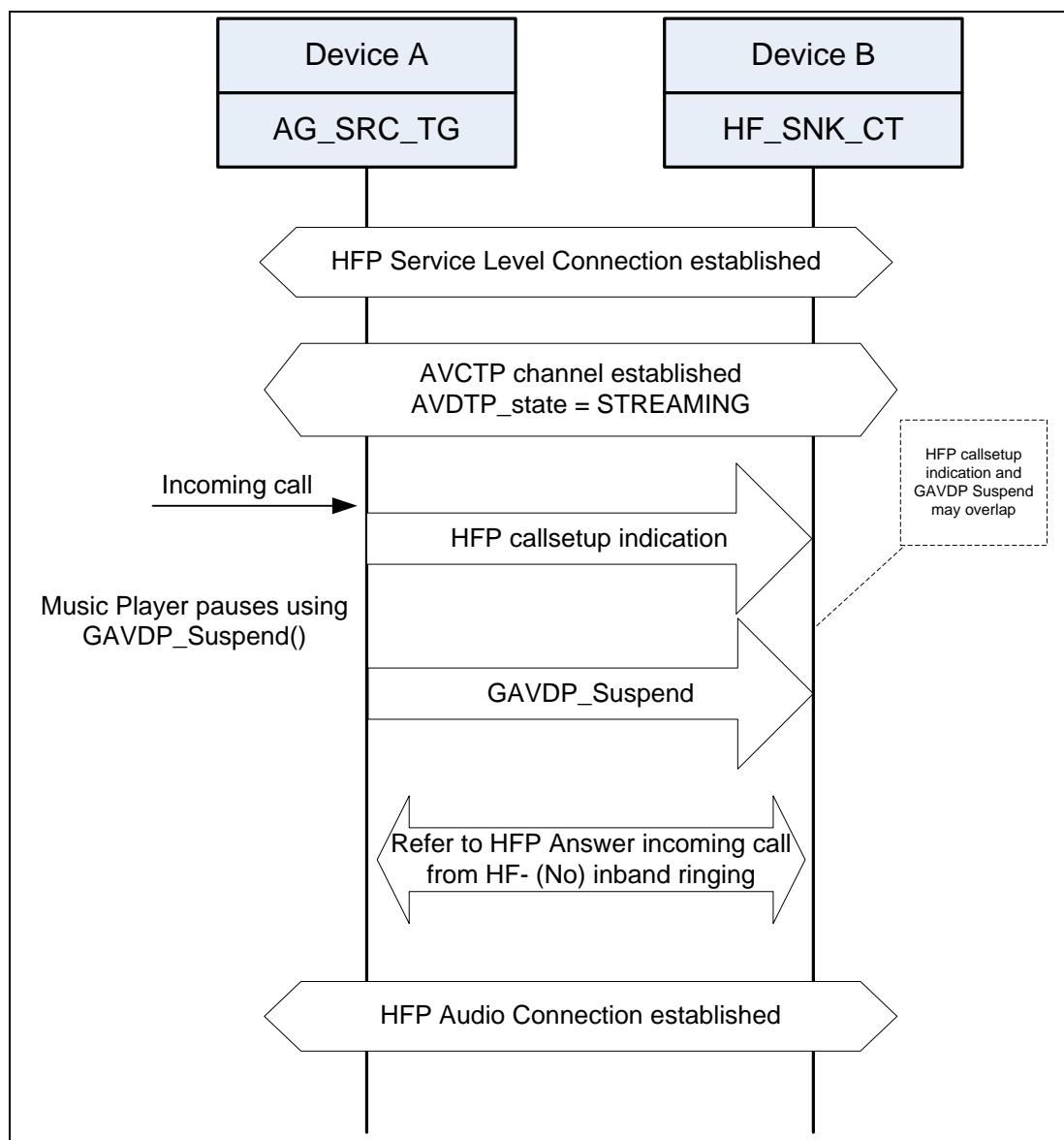


Figure 4.3: Answer Incoming Call during Audio Streaming (MPSD)

## 4.1.2 Answer Incoming Call during Audio Streaming (MPMD)

### 4.1.2.1 Profile Roles

This scenario shall apply to devices supporting the following combination of profile roles:

Device A	Device B	Device C
HFP-AG	HFP-HF	—
—	A2DP-SNK	A2DP-SRC
—	AVRCP-CT	AVRCP-TG

### 4.1.2.2 Description

The purpose of this scenario is to verify that Device B can suspend the stream by sending **AVRCP\_Pause** command to Device C when Device A receives an incoming call and Device B can answer the call. An ongoing HFP Service Level Connection between Device A and Device B shall exist and the AVDTP between Device B and Device C shall be in the **AVDTP\_state** Streaming.

The Device B shall initiate the MPS\_AVP\_Suspension procedure when it receives indication of an incoming call from Device A per the HFP Incoming Call procedures. Device B and Device C shall then follow the MPS\_AVP\_Suspension procedure. The completion of the suspension procedure may overlap with the HFP audio connection establishment procedure.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.4</a>	<a href="#">GAVDP Requirements</a>

#### 4.1.2.3 Sequence Chart

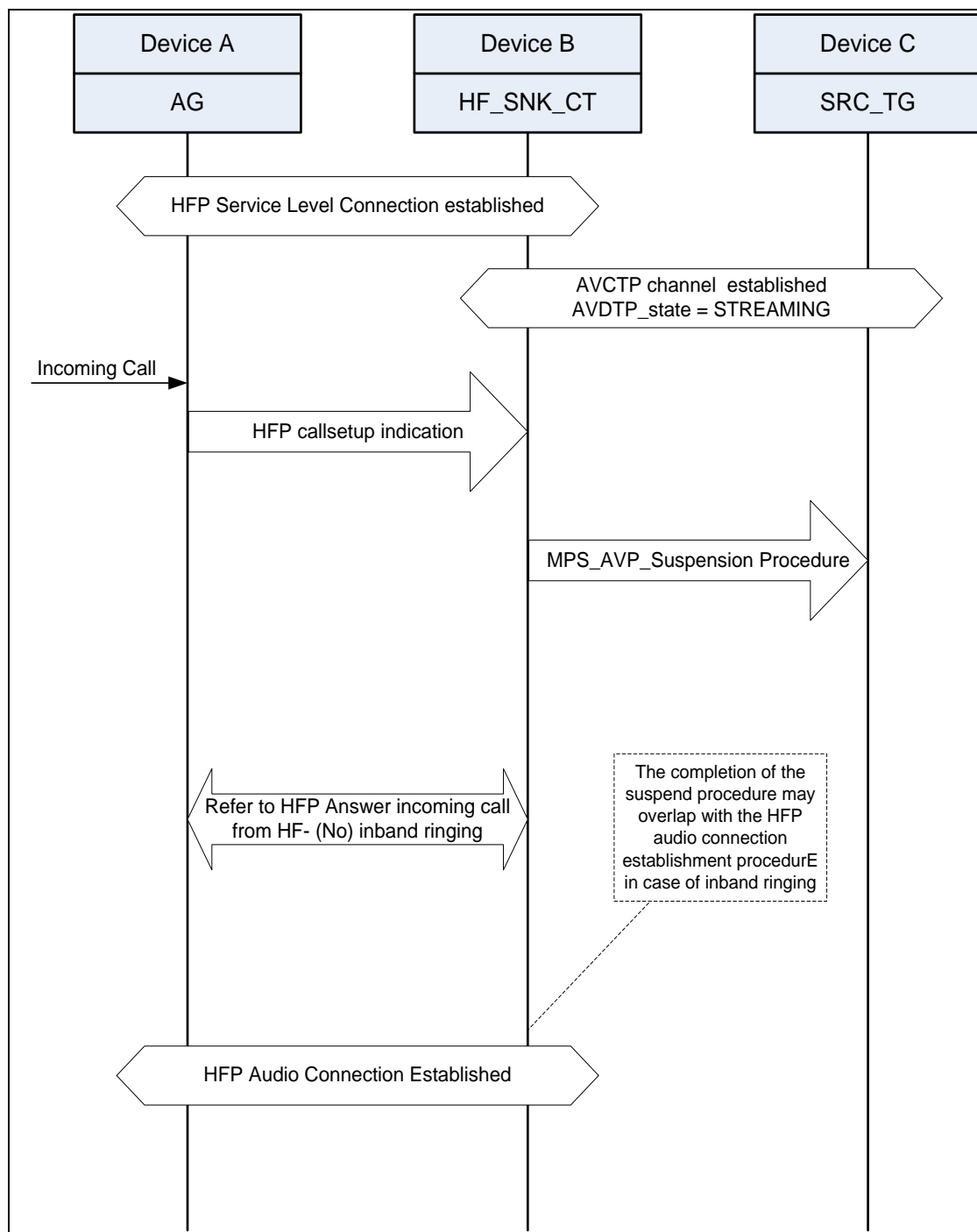


Figure 4.4: Answer Incoming Call during Audio Streaming (MPMD)

### 4.1.3 Outgoing Call during Audio Streaming (MPSD)

#### 4.1.3.1 Profile Roles

This scenario shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT
HFP-AG	HFP-HF

#### 4.1.3.2 Description

Audio streaming shall be suspended when the user initiates outgoing call on Device A or Device B.

A2DP is in **AVDTP\_state** Streaming between Device A and Device B as a pre-condition. The user takes action on Device A or Device B to initiate an outgoing call in any way permitted by the HFP specification.

When the outgoing call setup is successfully initiated, Device A shall suspend audio streaming using **GAVDP\_Suspend**. Device A shall then establish the HFP audio connection with Device B. The completion of the suspend procedure may overlap with the HFP audio connection establishment procedure.

Device A should locally pause the audio that is sent over the A2DP stream depending on the audio application. If AVRCP 1.3 or above is used in the connection, Device A shall update the play status over AVRCP.

The call setup then shall proceed as defined in HFP.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.4</a>	<a href="#">GAVDP Requirements</a>



#### 4.1.3.3 Sequence Chart

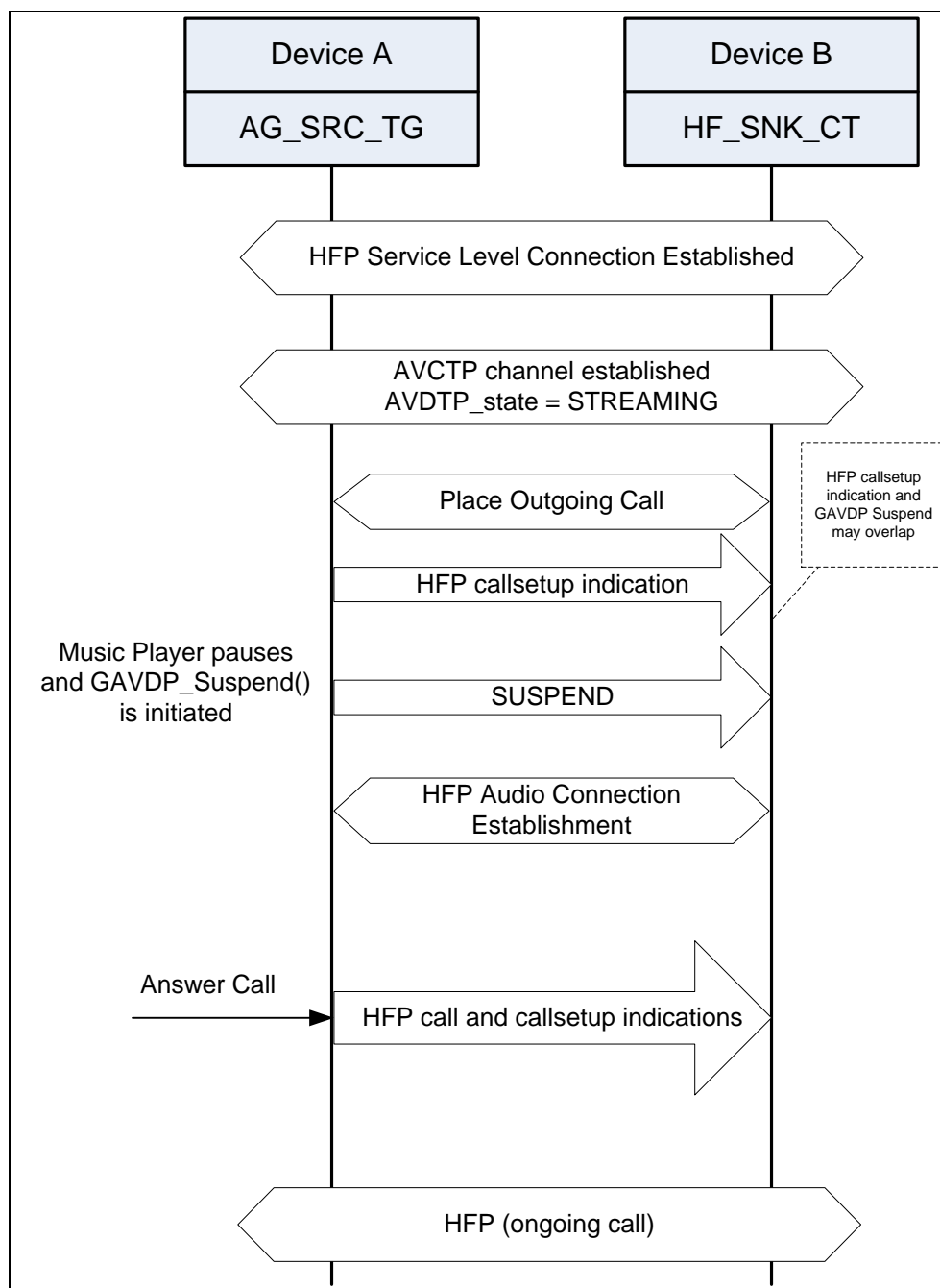


Figure 4.5: Outgoing Call during Audio Streaming (MPSD)

## 4.1.4 Outgoing Call during Audio Streaming (MPMD)

### 4.1.4.1 Profile Roles

This scenario shall apply to devices supporting the following combination of profile roles:

Device A	Device B	Device C
HFP-AG	HFP-HF	—
—	A2DP-SNK	A2DP-SRC
—	AVRCP-CT	AVRCP-TG

### 4.1.4.2 Description

Audio streaming between Device B and Device C shall be suspended when the user initiates an outgoing call on Device A or Device B.

A2DP is in **AVDTP\_state** Streaming between Device B and Device C as a pre-condition. User will take action on Device A or Device B in order to initiate an outgoing call. When the action is taken on the Device B, Device B will send an HFP call command to Device A.

Device A shall then start the call establishment procedure, notify Device B that the call setup has been successfully initiated and establish the HFP audio connection with Device B. The completion of the suspend procedure may overlap with the HFP audio connection establishment procedure.

Devices B and C shall then follow the MPS\_AVP\_Suspension procedure initiated by Device B.

The call setup then shall proceed as defined in HFP.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.4</a>	<a href="#">GAVDP Requirements</a>

#### 4.1.4.3 Sequence Chart

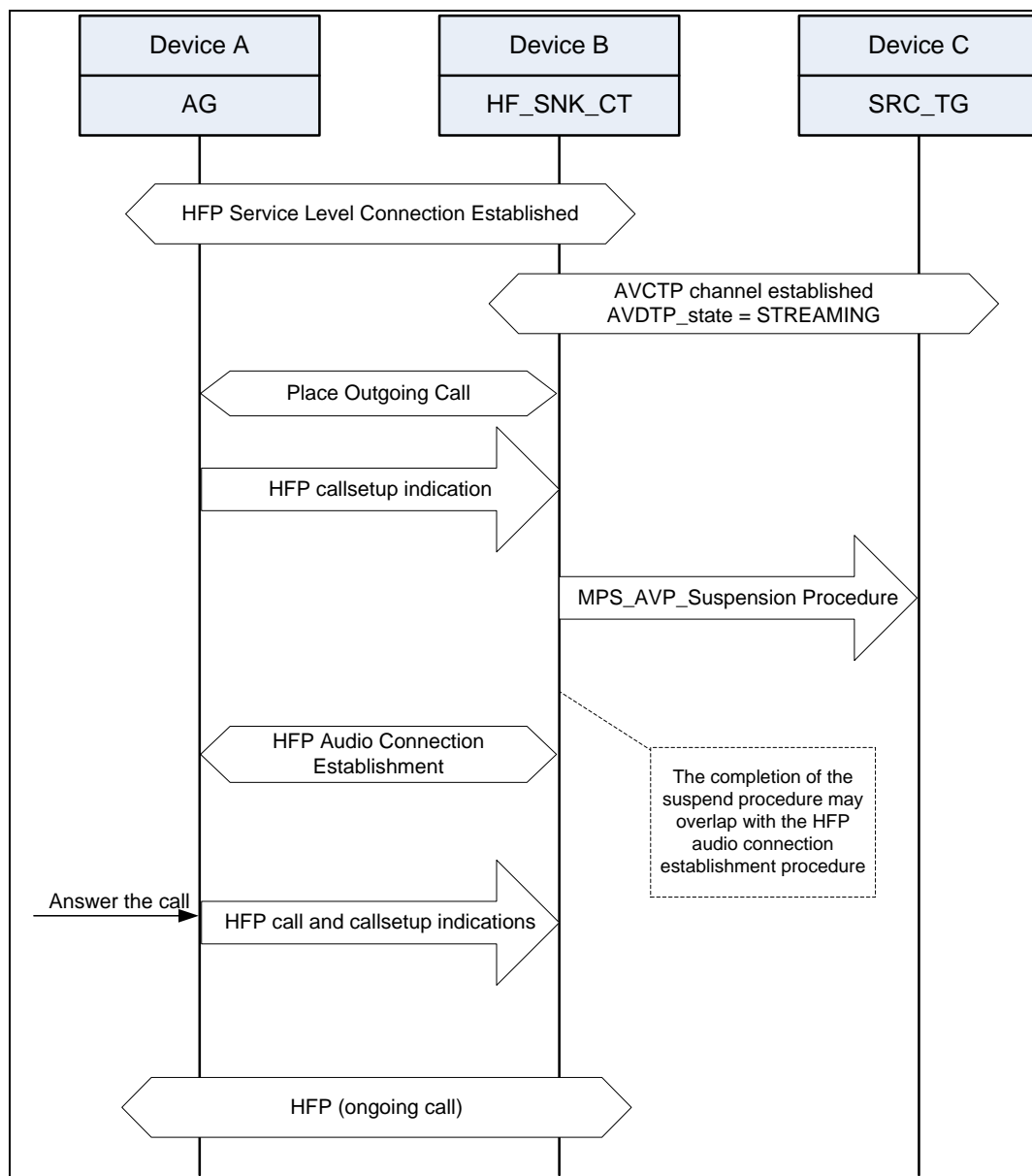


Figure 4.6: Outgoing Call during Audio Streaming (MPMD)

## 4.1.5 Reject/Ignore Incoming Call during Audio Streaming (MPSD)

### 4.1.5.1 Profile Roles

This scenario shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT
HFP-AG	HFP-HF

### 4.1.5.2 Description

Rejecting or ignoring an incoming call during audio streaming defines the scenario when an incoming call via HFP is rejected or ignored while an audio stream is ongoing via A2DP.

Initially, the HFP service level connection and the AVCTP and AVDTP channels shall be established between Device A and Device B. AVDTP shall be in **AVDTP\_state Streaming**.

Upon reception of the incoming call in Device A and its HFP callsetup indication to Device B, Device A suspends the audio stream using **GAVDP\_Suspend**. While Device A is alerting Device B, the rejecting/ignoring user interaction occurs. Device A and Device B shall behave as defined in the HFP procedures *Reject an Incoming Call from the HF* or *Rejection/Interruption of an Incoming Call in the AG* respectively, depending on which device the user interaction occurs. This shall be followed by Device A resuming the A2DP audio stream using the **GAVDP\_Start\_Streaming** procedure.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.4</a>	<a href="#">GAVDP Requirements</a>

#### 4.1.5.3 Sequence Chart

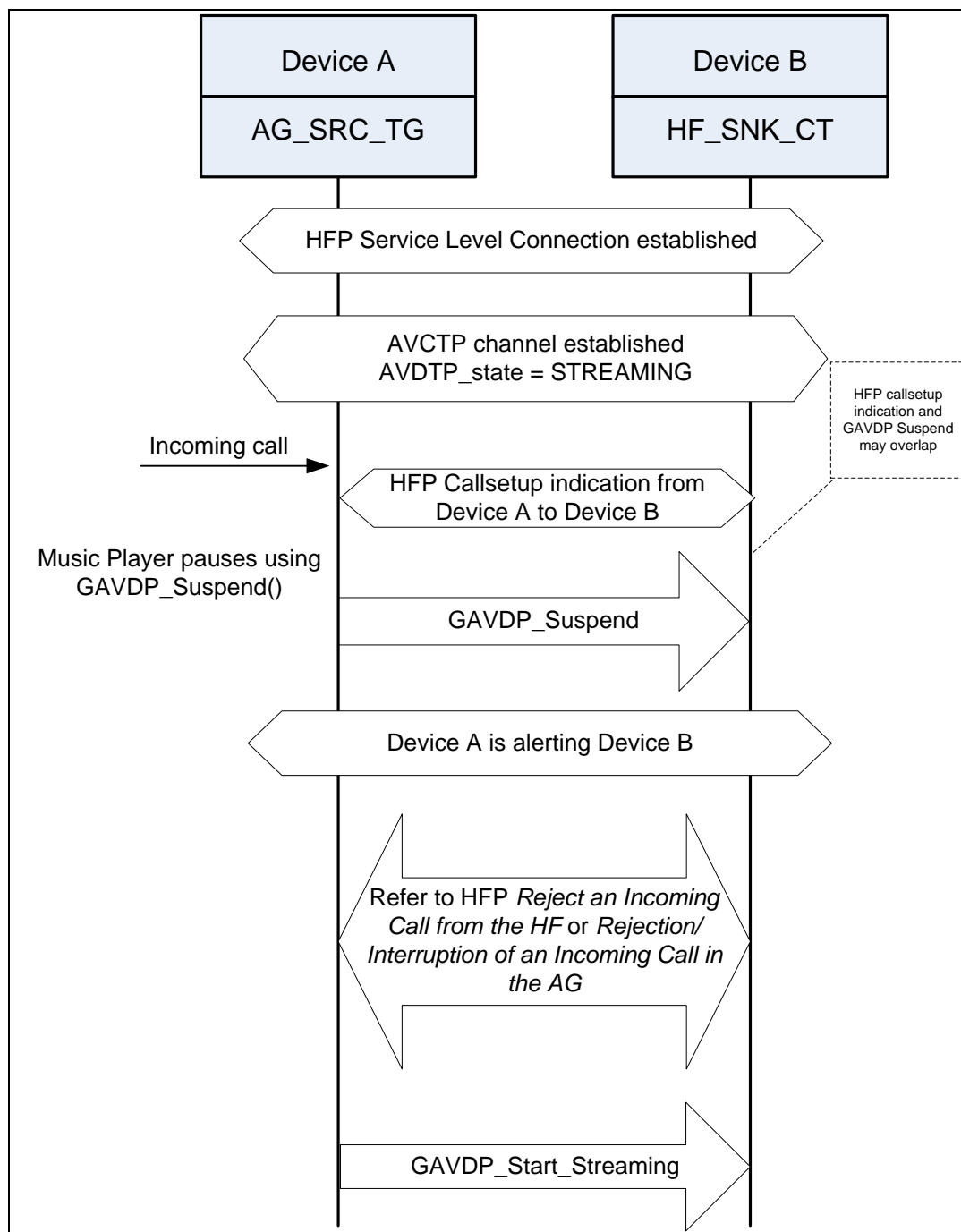


Figure 4.7: Reject/Ignore Incoming Call during Audio Streaming (MPSD)

## 4.1.6 Reject/Ignore Incoming Call during Audio Streaming (MPMD)

### 4.1.6.1 Profile Roles

This scenario shall apply to devices supporting the following combination of profile roles:

Device A	Device B	Device C
HFP-AG	HFP-HF	—
—	A2DP-SNK	A2DP-SRC
—	AVRCP-CT	AVRCP-TG

### 4.1.6.2 Description

The scenario Reject/Ignore incoming call during audio streaming (MPMD) defines the behavior when an incoming call via HFP is rejected/ignored while an audio stream is ongoing via A2DP from a third device.

Initially, the HFP service level connection shall be established between Device A and Device B. The AVCTP and AVDTP channels shall be established between Device B and Device C. AVDTP shall be in streaming state.

Upon reception of the incoming call in Device A and its HFP callsetup indication to Device B, Device B shall suspend the audio stream with Device C using the `AVP_Stream_Suspension` procedure defined in 5.1. While Device A is alerting Device B, the rejecting/ignoring user interaction occurs. Device A and Device B shall behave as defined in the HFP procedures *Reject an Incoming Call from the HF* or *Rejection/Interruption of an Incoming Call in the AG* respectively, depending on which device the user interaction occurs. This shall be followed by Device B issuing an `AVRCP_Play` command to Device C. Device C shall react confirming with an `AVRCP_Play_Response` and a `GAVDP_Start_Streaming` procedure.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
6.5	<a href="#">A2DP Requirements</a>
6.8	<a href="#">AVRCP Requirements</a>
6.4	<a href="#">GAVDP Requirements</a>

#### 4.1.6.3 Sequence Chart

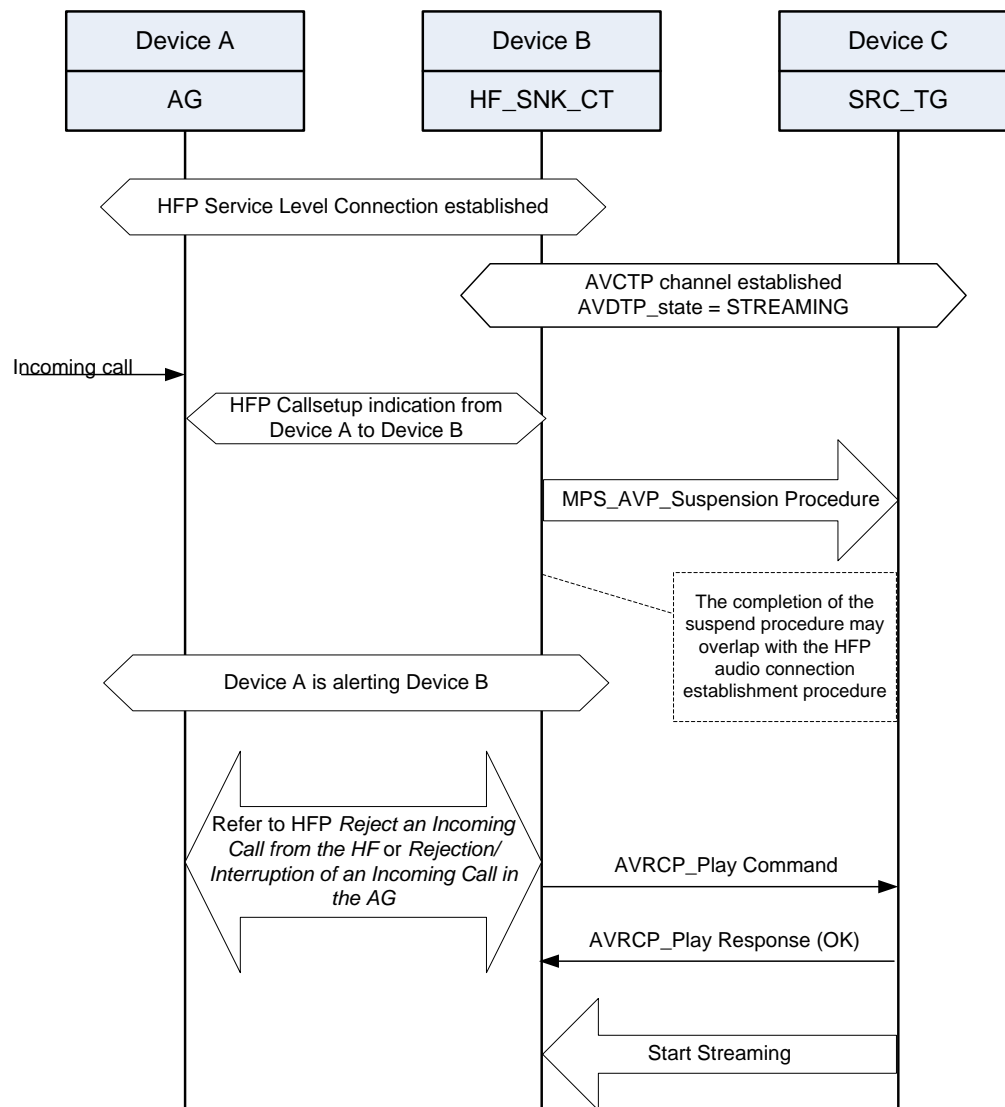


Figure 4.8: Reject/Ignore Incoming Call during Audio Streaming (MPMD)

## 4.1.7 HFP Call Termination during AVP Connection (MPSP)

### 4.1.7.1 Profile Roles

This scenario shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT
HFP-AG	HFP-HF

### 4.1.7.2 Description

The purpose of this scenario is to specify the behavior after a call has been terminated when HFP is used together with AVP. For example, a stereo headset (Device B) is connected to a device that simultaneously acts as a media player supporting Bluetooth stereo audio and a phone supporting Bluetooth hands-free calling (Device A)

The preconditions of this scenario are as follows. Devices A and B are connected using the A2DP, AVRCP and HFP profiles. An incoming or outgoing call is initiated and, if the audio stream is in the **AVDTP\_state** STREAMING, the audio stream between Device A and Device B is suspended as defined in MPS section 5.1, MPS AVP Suspension Procedure.

Device B may determine if Device A has paused the media using the AVRCP play status notification. The active call is then terminated by any means.

If the audio stream was in the **AVDTP\_state** Streaming before initiation of the HFP call the audio stream between Device A and Device B shall then be resumed by Device A initiating the **GAVDP\_Start\_Streaming** procedure. The HFP audio connection should be terminated before the stream is restarted. If the audio stream was not in the **AVDTP\_state** Streaming before initiation of the HFP call then an audio stream shall not be started by Device A upon call termination.

Using the AVRCP play status notification feature Device B may then determine if Device A has resumed the media.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
6.5	<a href="#">A2DP Requirements</a>
6.8	<a href="#">AVRCP Requirements</a>
6.4	<a href="#">GAVDP Requirements</a>



#### 4.1.7.3 Sequence Chart

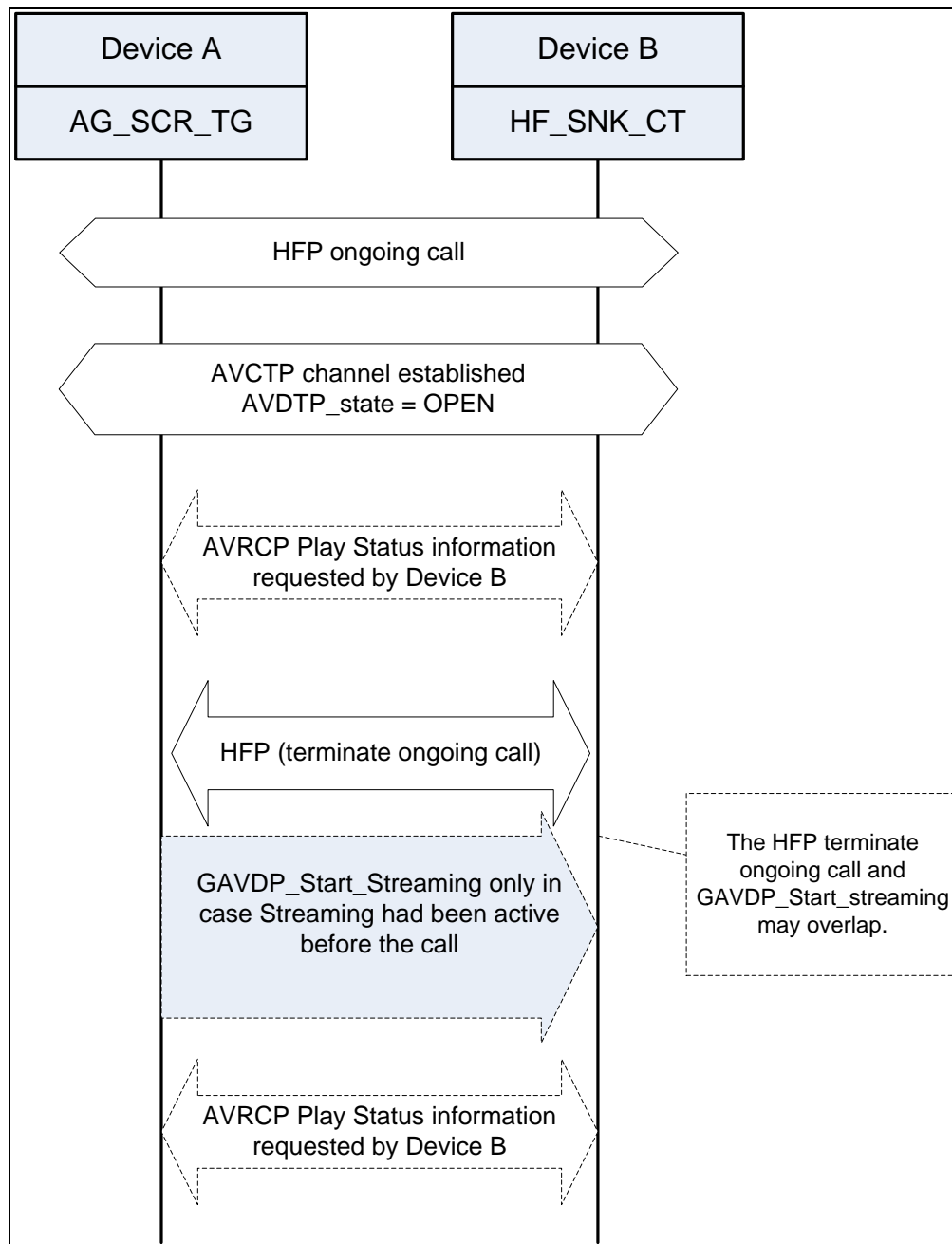


Figure 4.9: HFP Call Termination during AVP Connection (MPSD)

## 4.1.8 HFP Call Termination during AVP Connection (MPMD)

### 4.1.8.1 Profile Roles

This scenario shall apply to devices supporting the following combination of profile roles:

Device A	Device B	Device C
	A2DP-SNK	A2DP-SRC
	AVRCP-CT	AVRCP-TG
HFP-AG	HFP-HF	

### 4.1.8.2 Description

The preconditions of this scenario are as follows. An audio-rendering device such as a stereo headset (Device B) is connected to a media player (Device C) supporting Bluetooth A2DP and AVRCP and a mobile phone (Device A) supporting Bluetooth HFP. Device C is connected to Device B using the A2DP and AVRCP profiles. Device B is also connected to Device A using the HFP profile. An incoming or outgoing call is initiated and, if the audio stream is in the **AVDTP\_state** Streaming, the audio stream between Device C and Device B is suspended as defined in MPS section 5.1, MPS AVP Suspension Procedure. Device B may determine if Device A has paused the media using the AVRCP Play Status information.

The active call is then terminated by any means. If the audio stream was in the **AVDTP\_state** Streaming before initiation of the HFP call the audio stream between Device C and Device B shall then be resumed via an **AVRCP\_Play** command from Device B to Device C. Device C shall respond with an **AVRCP\_Play\_Response** message and re-establish streaming by initiating the **GAVDP\_Start\_Streaming** procedure.

If the audio stream was not in the **AVDTP\_state** streaming before initiation of the HFP call then an audio stream shall not be automatically started by the actions of Device B upon call termination unless specifically enabled by user preference or action. Please be aware that this does not define how audio sources not within the scope of Bluetooth specifications are handled, for example local audio in a car kit. Device B may determine if Device C has resumed the media by using the AVRCP Play Status notification.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
6.5	<a href="#">A2DP Requirements</a>
6.8	<a href="#">AVRCP Requirements</a>
6.4	<a href="#">GAVDP Requirements</a>

#### 4.1.8.3 Sequence Chart

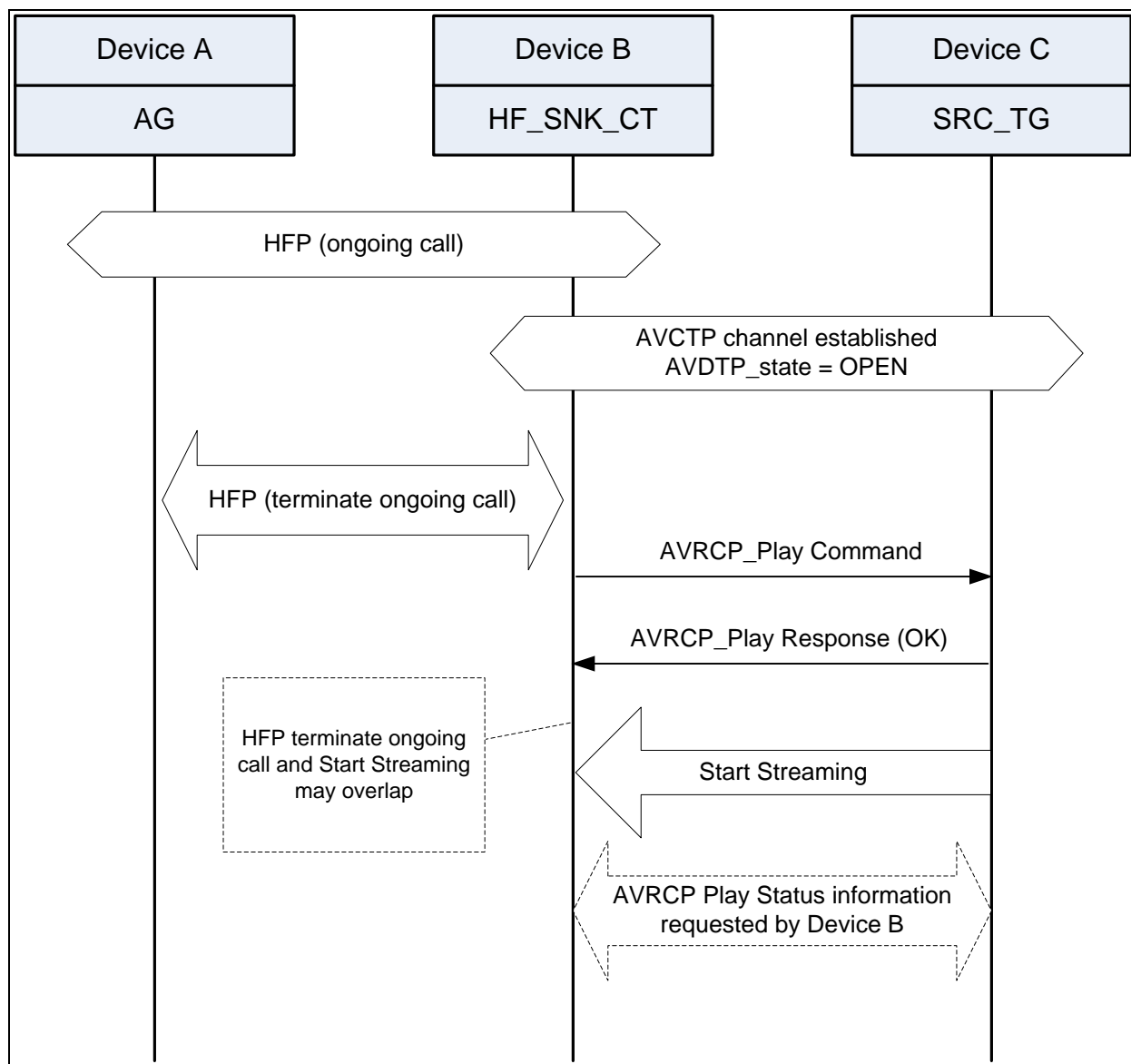


Figure 4.10: HFP Call Termination during AVP Connection (MPMD)

## 4.1.9 Press Play on Audio Player during active call (MPSD)

### 4.1.9.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
HFP-AG	HFP-HF
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT

### 4.1.9.2 Description

The purpose of this scenario is to verify that Device A shall not start audio streaming when Play button is pressed on Device A during an active call. An ongoing HFP Service Level Connection and HFP audio connection between the devices shall exist, and the AVDTP shall be in the **AVDTP\_state** Idle /Open.

Device A shall know it has an active call and prevent initiating Start Streaming when Play button is pressed on Device A.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>

#### 4.1.9.3 Sequence Chart

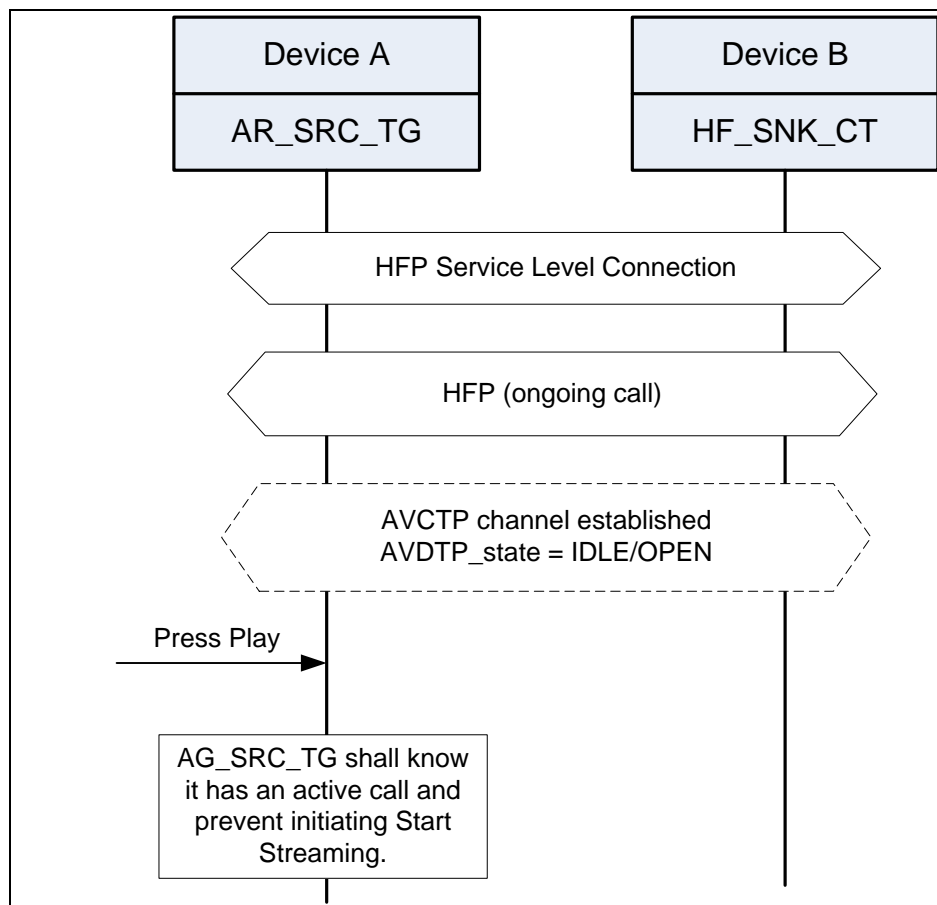


Figure 4.11: Press Play on Audio Player during active call (MPSD)

## 4.1.10 Press Play on Audio Player during active call (MPMD)

### 4.1.10.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B	Device C
HFP-AG	HFP-HF	—
—	A2DP-SNK	A2DP-SRC
—	AVRCP-CT	AVRCP-TG

### 4.1.10.2 Description

The purpose of this scenario is to verify that Device B shall pause streaming just after it accepts Start Streaming from Device C when Play button is pressed on Device C during an active call. An ongoing HFP Service Level Connection and (e)SCO between Device A and Device B shall exist, and the AVDTP between Device B and Device C shall be in the **AVDTP\_state** Idle/Open.

Device B shall know it has an active call with Device A and Device B shall first accept Start Streaming from Device C and then follow section 5.1, MPS AVP Suspension Procedure.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
6.5	<a href="#">A2DP Requirements</a>
6.8	<a href="#">AVRCP Requirements</a>
6.4	<a href="#">GAVDP Requirements</a>

#### 4.1.10.3 Sequence Chart

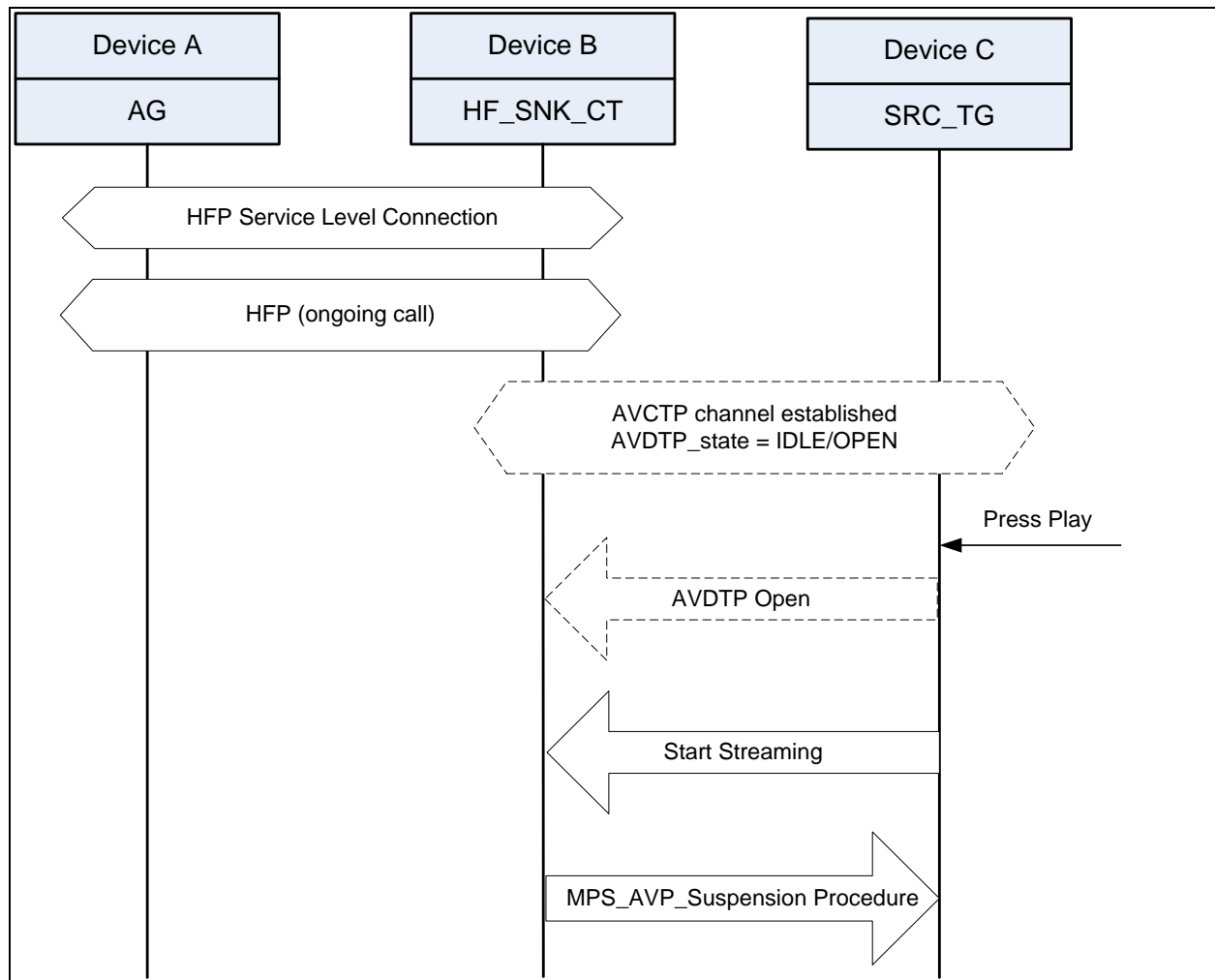


Figure 4.12: Press Play on Audio Player during active call (MPMD)

## 4.1.11 Start Audio Streaming after AVRCP\_Play (MPSD)

### 4.1.11.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT

### 4.1.11.2 Description

The purpose of the following scenarios is to describe how Device A and Device B shall start audio streaming after Device B sends an **AVRCP\_Play** command. Ongoing AVDTP and AVCTP sessions between the devices shall exist and the AVDTP shall be in the **AVDTP\_state** IDLE or OPEN.

If Device A can start audio stream after receiving **AVRCP\_Play** command, Device A shall send Start Streaming.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.4</a>	<a href="#">GAVDP Requirements</a>



#### 4.1.11.3 Sequence Chart

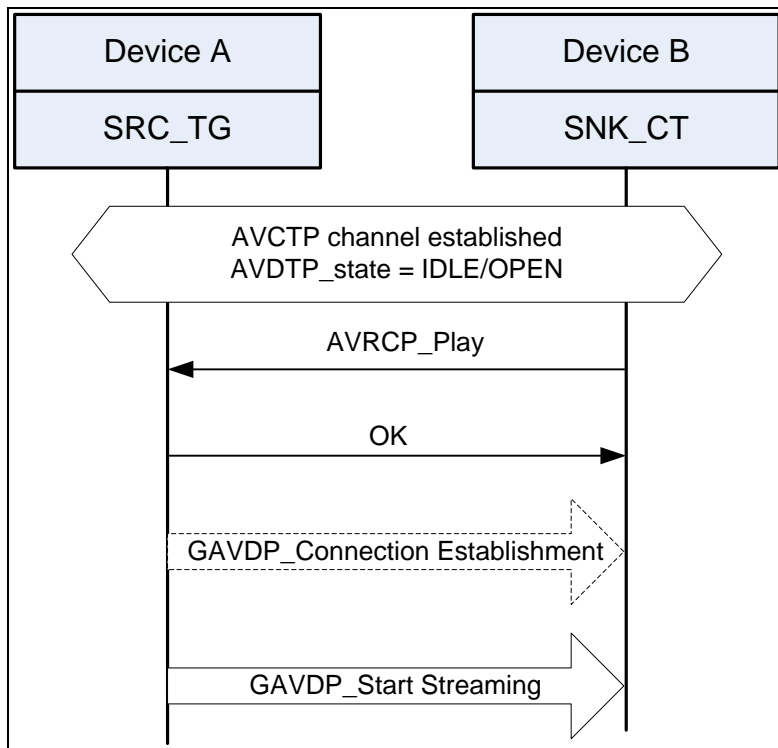


Figure 4.13: Start Audio Streaming after AVRCP\_Play (MPSD)

## 4.1.12 Suspend Audio Streaming after AVRCP\_Pause (MPSD)

### 4.1.12.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT

### 4.1.12.2 Description

The purpose of the following scenario is to describe how Device A and Device B shall suspend audio streaming after Device B sends an **AVRCP\_Pause** command. Ongoing AVDTP and AVCTP sessions between the devices shall exist and the AVDTP shall be in the **AVDTP\_state** Streaming.

Device A shall suspend the audio stream using section 5.1, MPS AVP Suspension Procedure.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
6.5	<a href="#">A2DP Requirements</a>
6.8	<a href="#">AVRCP Requirements</a>
6.4	<a href="#">GAVDP Requirements</a>

### 4.1.12.3 Sequence Chart

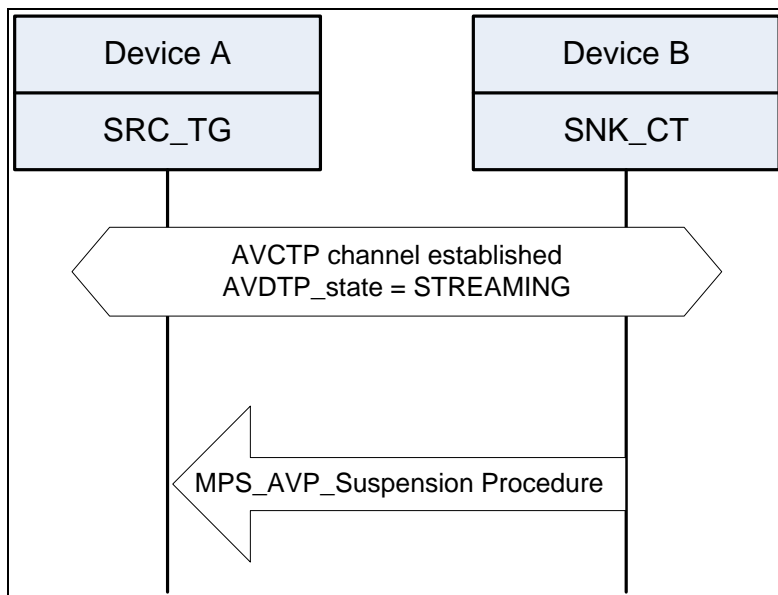


Figure 4.14: Suspend Audio Streaming after AVRCP\_Pause (MPSD)

## 4.2 DUN Scenarios

This section defines Scenarios related to the Dial Up Networking Profile (DUN). It is typically used together with HFP, A2DP and AVRCP, e.g. in an automotive environment.

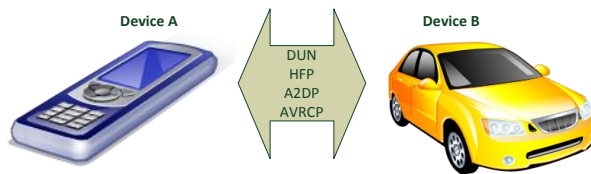


Figure 4.15: DUN related MPSD

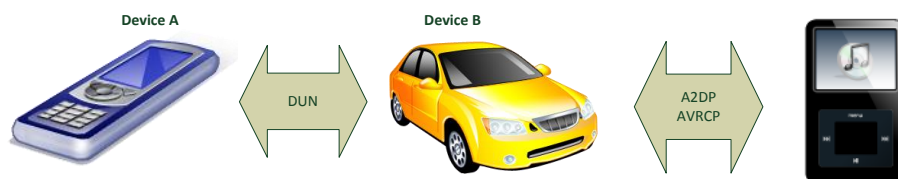


Figure 4.16: DUN related MPMD

## 4.2.1 Data communication under PSDM during active voice call

### 4.2.1.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
HFP-AG	HFP-HF
DUN-GW	DUN-DT

### 4.2.1.2 Description

The purpose of this scenario is to verify that Device B can start data communication with the remote party under Packet Switched Data Mode (PSDM) during an ongoing voice call. Before starting data communication, Device A and B have an active HFP service level connection and an active call. The DUN profile may or may not be connected.

If there is no DUN connection, DUN profile connection shall be established from Device B when Device B tries to communicate with the remote party.

During a data communication between Device B and the remote party, an ongoing voice call should be continued via HFP. In case cellular network cannot support simultaneous voice and data call, the data call might be disconnected by the network, but the DUN signaling channel connection should be maintained.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.6</a>	<a href="#">DUN Requirements</a>

#### 4.2.1.3 Sequence Chart

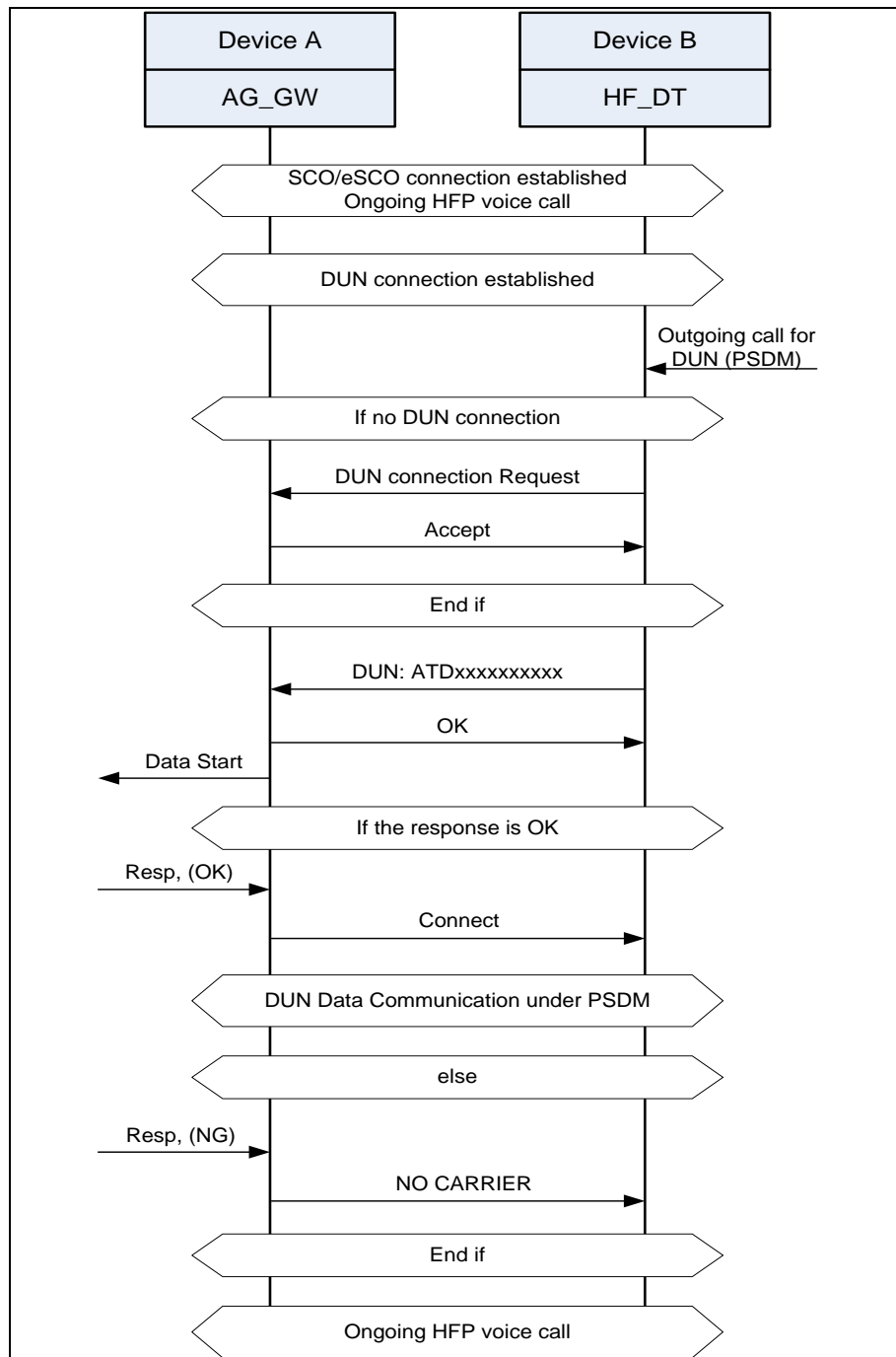


Figure 4.17: Data communication under PSDM during active voice call

## 4.2.2 Outgoing voice call during Data communication under PSDM

### 4.2.2.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
HFP-AG	HFP-HF
DUN-GW	DUN-DT

### 4.2.2.2 Description

Packet Switched Data Communication via DUN profile shall be continued when the user initiates an outgoing call on Device A or Device B.

Packet Switched Data Communication via DUN profile is active between Device A and Device B as pre-condition. The user takes action on Device A or Device B in order to initiate an outgoing voice call

Upon call connection with the remote party Device A shall notify Device B of successful voice call establishment.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.6</a>	<a href="#">DUN Requirements</a>

In case the cellular network cannot support simultaneous voice and data call, the data call may be disconnected by the network, but DUN connection should be maintained.

#### 4.2.2.3 Sequence Chart

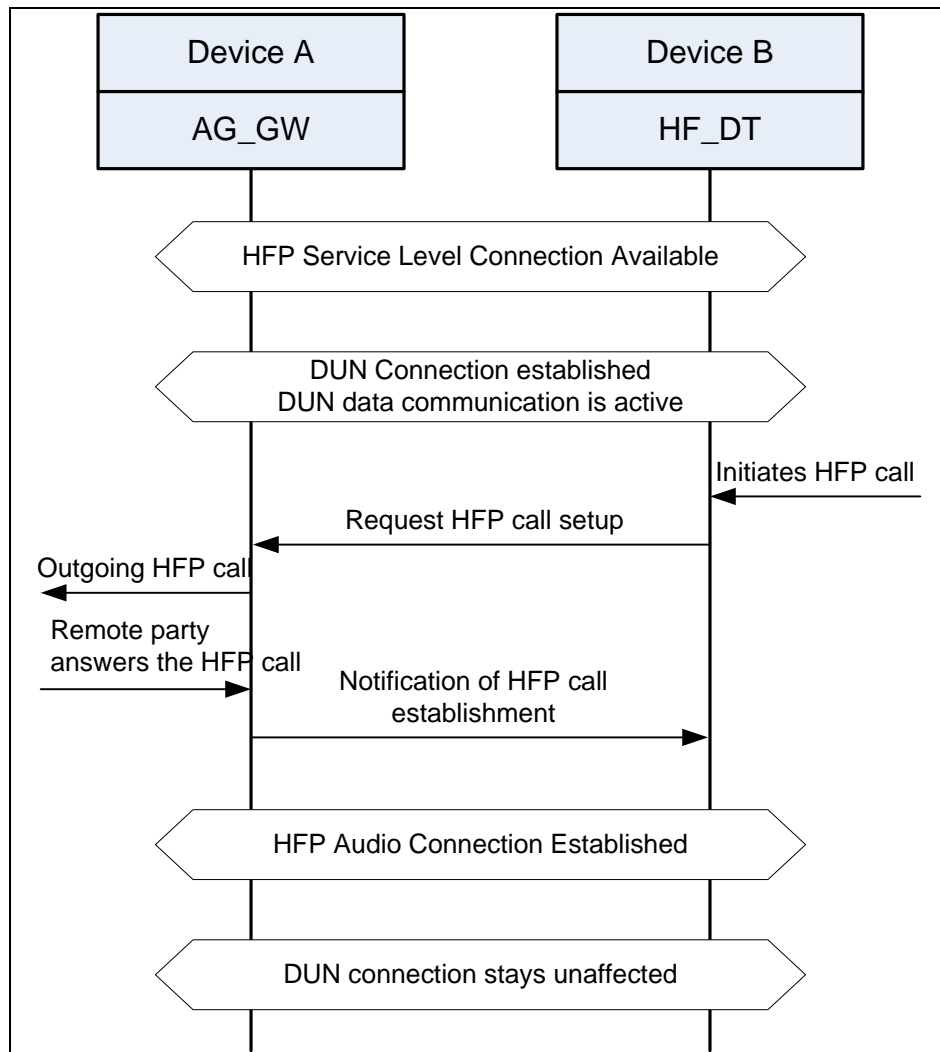


Figure 4.18: Outgoing voice call during Data communication under PSDM

## 4.2.3 Incoming voice call during Data communication under PSDM

### 4.2.3.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
HFP-AG	HFP-HF
DUN-GW	DUN-DT

### 4.2.3.2 Description

The purpose of this scenario is to verify that Device A can continue the data communication via Packet Switched Data Mode when the call comes in and Device B can answer the call. An ongoing HFP Service Level Connection between the devices shall exist; a DUN data call without audio feedback is active.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.6</a>	<a href="#">DUN Requirements</a>

The establishment of the voice call shall follow the specification in HFP.

In case the cellular network cannot support simultaneous voice and data call, the data call may be disconnected by the network, but DUN connection should be maintained.



#### 4.2.3.3 Sequence Chart

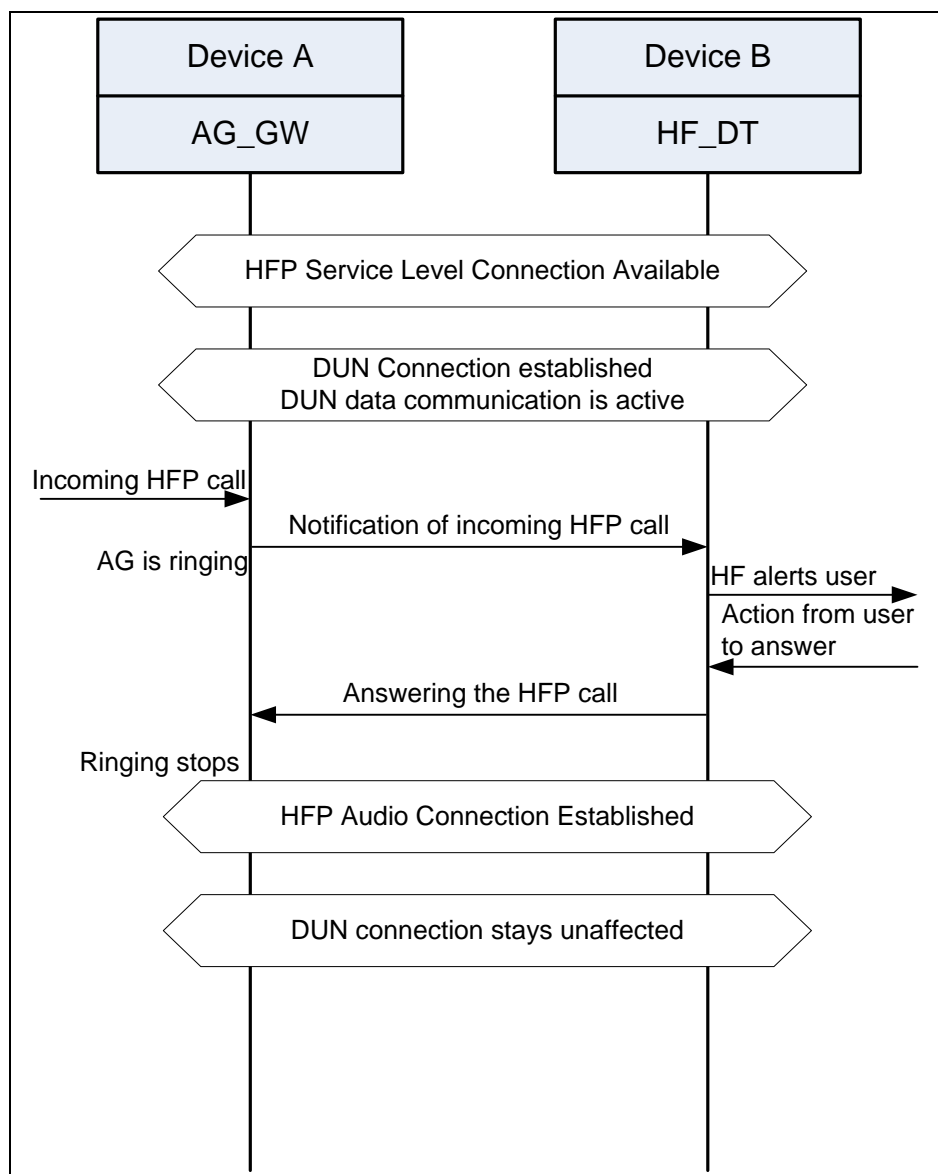


Figure 4.19: Incoming voice call during Data communication under PSDM

## 4.2.4 Start Audio Streaming during Data communication under PSDM

### 4.2.4.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT
DUN-GW	DUN-DT

### 4.2.4.2 Description

Packet Switched Data Communication via DUN profile shall be continued when the user initiates audio streaming from Device A to Device B.

Packet Switched Data Communication via DUN profile is active, AVDTP and AVCTP channels are established and AVDTP is not in `AVDTP_state` `STREAMING` between Device A and Device B as a pre-condition. The user takes action on Device A or Device B in order to initiate audio streaming. When the action is taken on the Device B, Device B will send an `AVRCP_Play` to Device A.

Device A shall then start the GAVDP start streaming procedure. For detail conditions and behaviors see section [4.1.11](#) Start Audio Streaming after `AVRCP_Play` (MPSPD).

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.6</a>	<a href="#">DUN Requirements</a>

#### 4.2.4.3 Sequence Chart

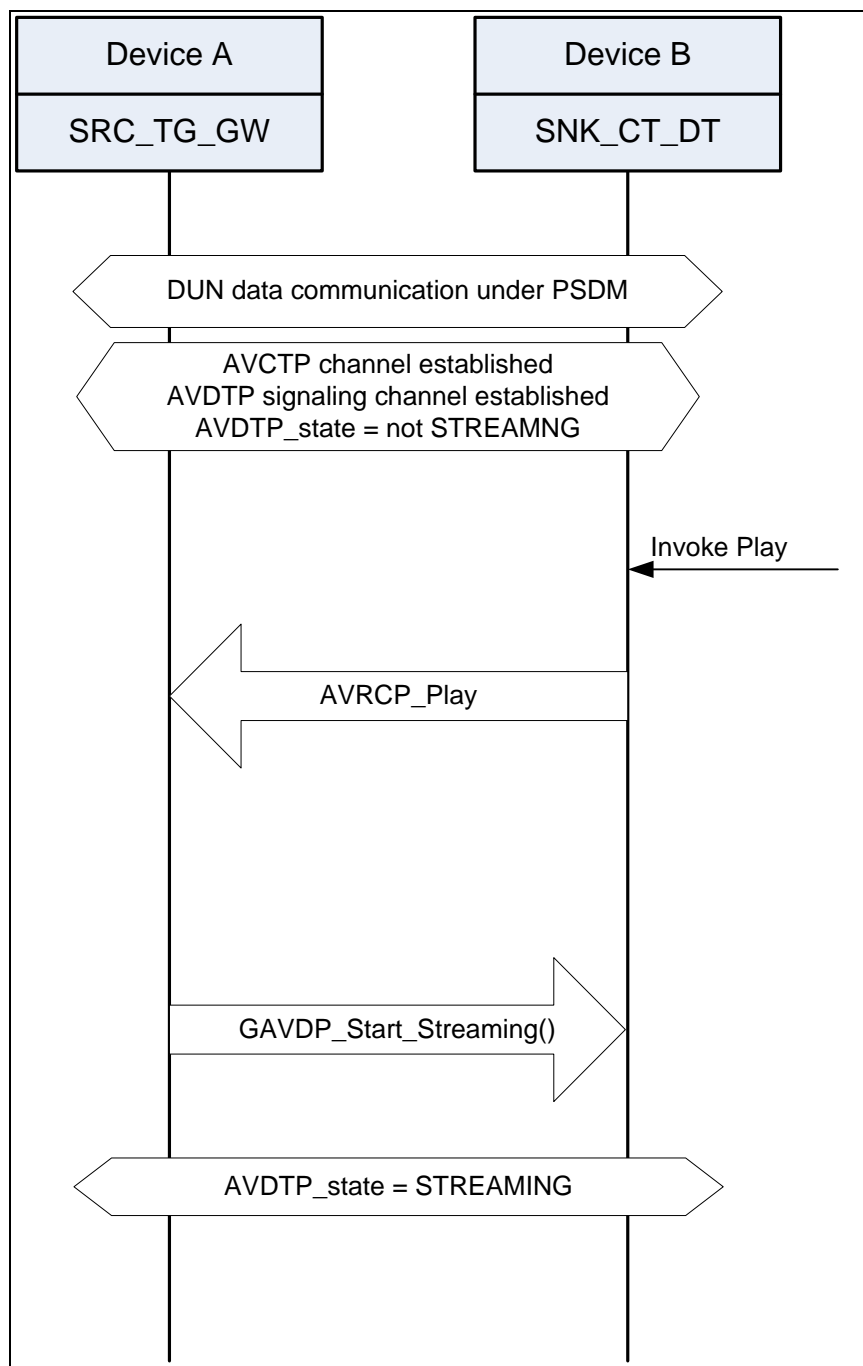


Figure 4.20: Start Audio Streaming during Data communication under PSDM

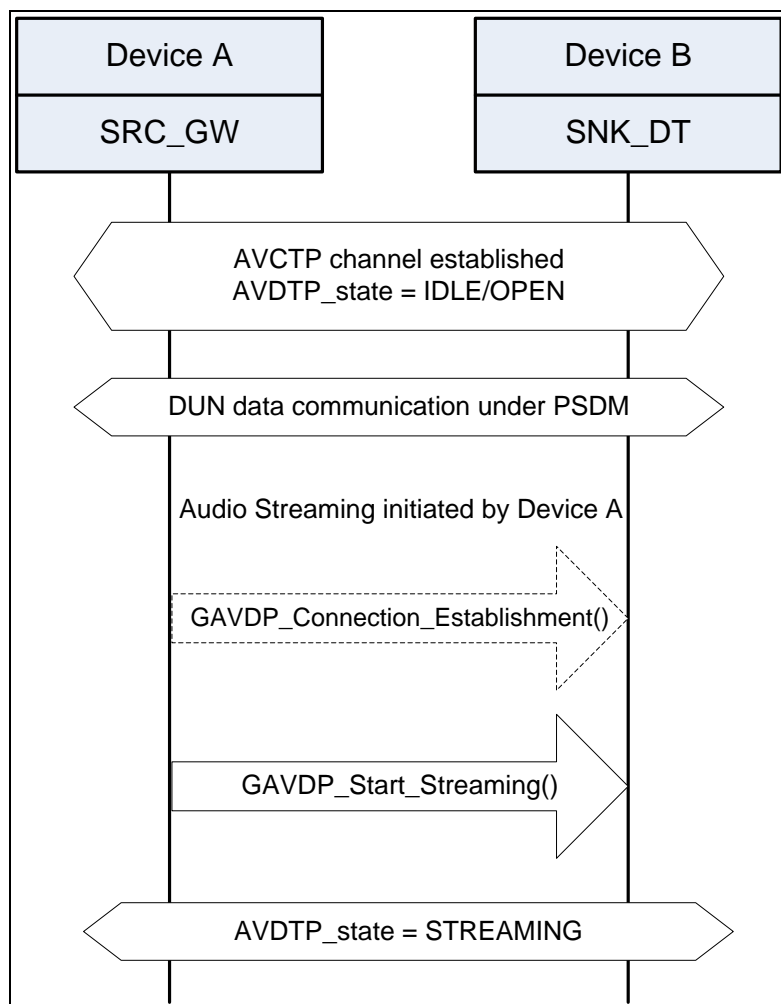


Figure 4.21: Start Audio Streaming during Data communication under PSDM

## 4.2.5 Start Audio streaming during Data communication under PSDM (MPMD)

### 4.2.5.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B	Device C
A2DP-SRC	A2DP-SNK	-
AVRCP-TG	AVRCP-CT	-
-	DUN-DT	DUN-GW

### 4.2.5.2 Description

Audio streaming should be initiated between Device A and Device B while Packet data communication is active between Device B and Device C.

Packet data communication is active between Device B and Device C as a pre-condition. The user takes action on Device A or Device B in order to initiate audio streaming.

When the action is taken on the Device B, Device B will send an **AVRCP\_Play** to Device A.

Device A shall then start the GAVDP connection establishment procedure and GAVDP start streaming procedure. For detail conditions and behaviors see section [4.1.11 Start Audio Streaming after AVRCP\\_Play \(MPSD\)](#)

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.6</a>	<a href="#">DUN Requirements</a>

### 4.2.5.3 Sequence Chart

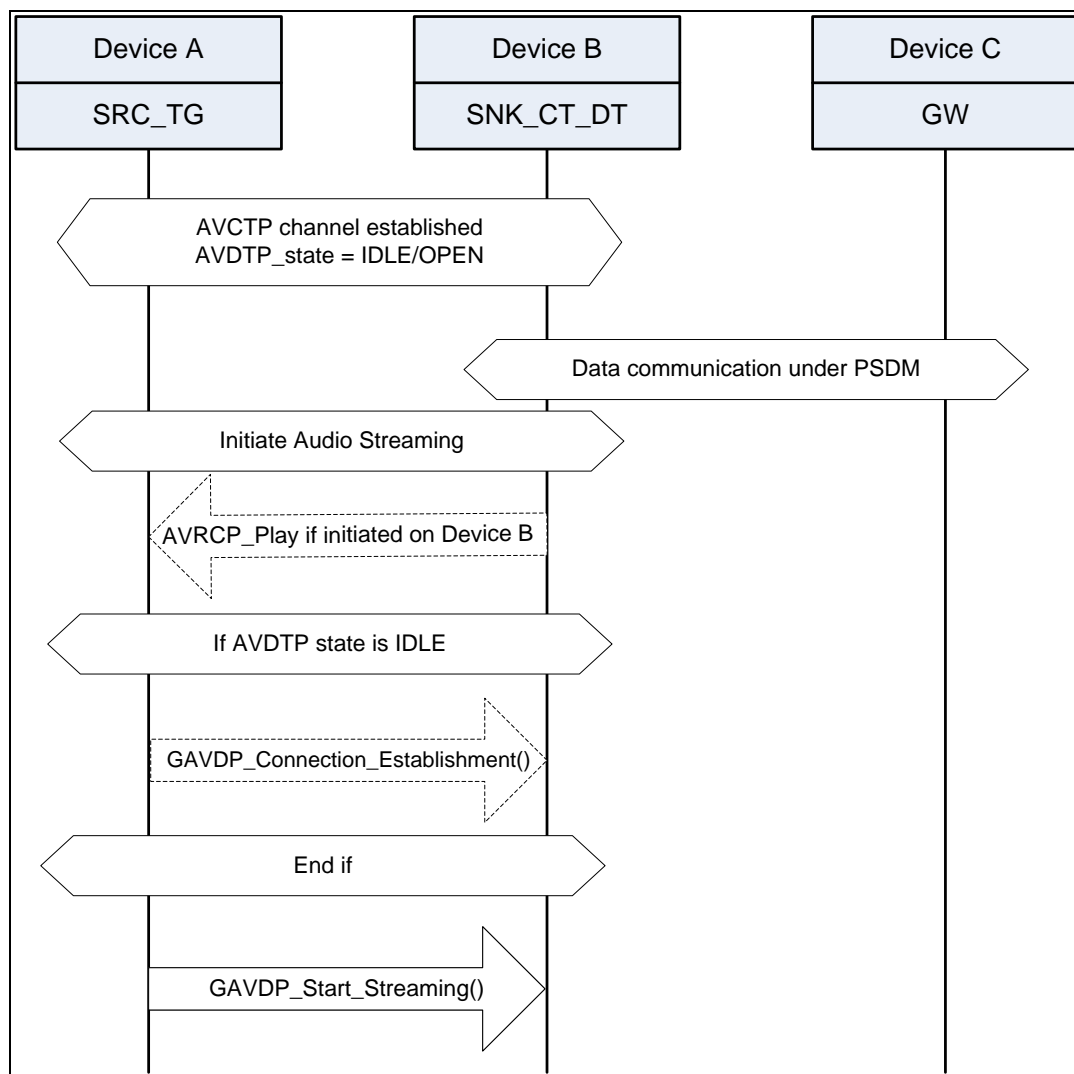


Figure 4.22: Start Audio streaming during Data communication under PSDM (MPMD)

## 4.2.6 Data communication establishment under PSDM during Audio Streaming

### 4.2.6.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT
DUN-GW	DUN-DT

### 4.2.6.2 Description

The purpose of this scenario is to ensure that audio streaming from Device A to Device B is continued when the user initiates Packet Switched Data Communication via the DUN profile.

A2DP audio is streaming between Device A and Device B as a pre-condition. User will take action on Device B in order to initiate Packet Switched Data Communication. When the action is taken on the Device B, Device B will make a connection of DUN profile if there is no connection of DUN profile.

Then Device B will start Packet Switched Data Communication.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.6</a>	<a href="#">DUN Requirements</a>

#### 4.2.6.3 Sequence Chart

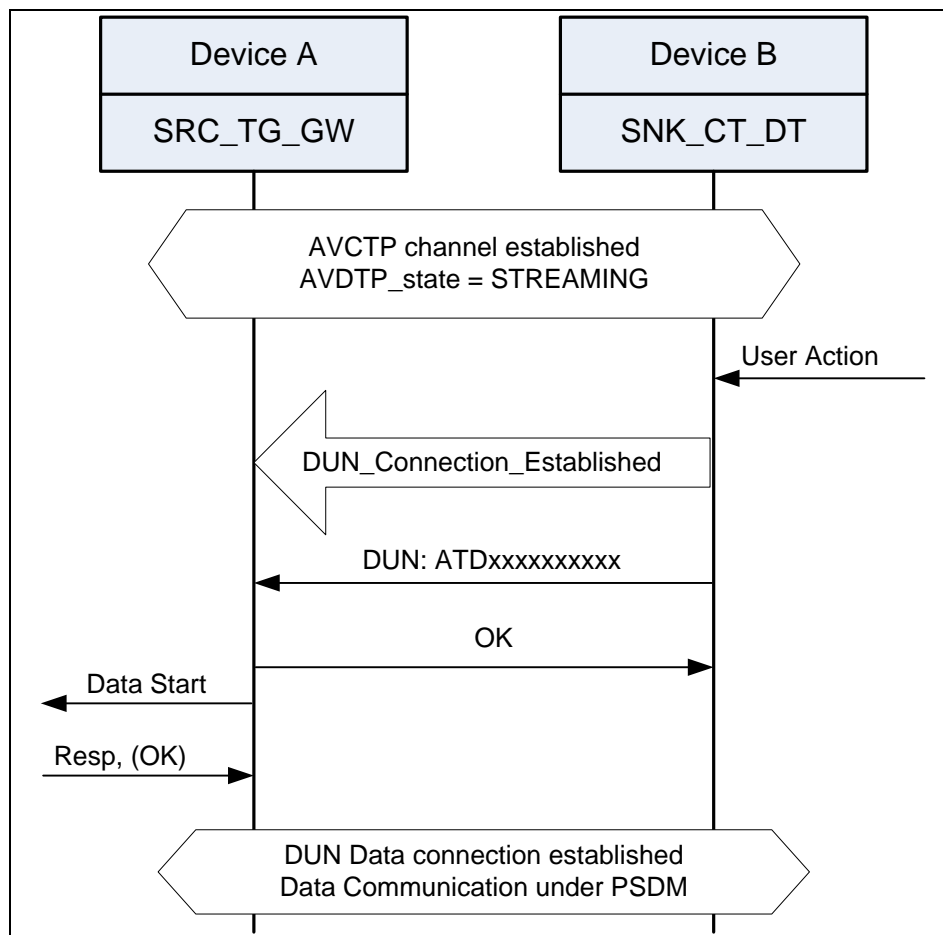


Figure 4.23: Data communication establishment under PSDM during Audio Streaming



## 4.2.7 Start Packet data communication during Audio streaming (MPMD)

### 4.2.7.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B	Device C
A2DP-SRC	A2DP-SNK	-
AVRCP-TG	AVRCP-CT	-
-	DUN-DT	DUN-GW

### 4.2.7.2 Description

Packet data communication should be initiated correctly between Device B and Device C while audio streaming is active between Device A and Device B.

Audio streaming is active between Device A and Device B as pre-condition. The user takes action on Device B in order to initiate packet data communication.

Packet data communication is initiated between Device B and Device C.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.6</a>	<a href="#">DUN Requirements</a>

#### 4.2.7.3 Sequence Chart

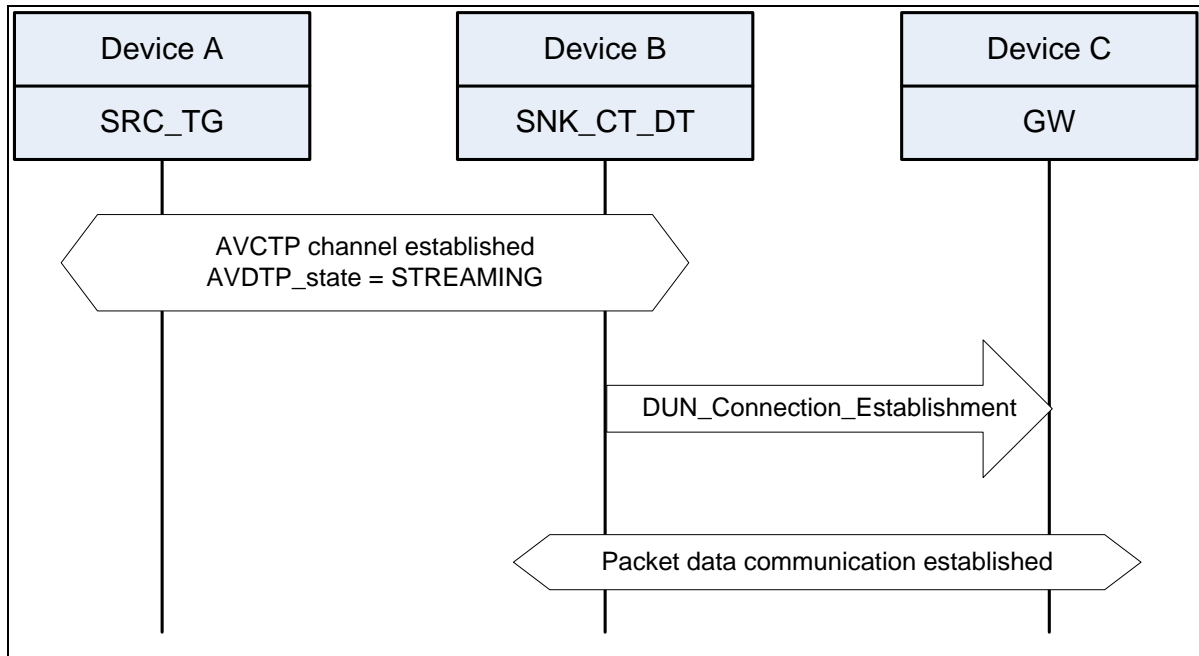


Figure 4.24: Start Packet data communication during Audio streaming (MPMD)

## 4.2.8 Terminate voice call / data call during data communication and voice call

### 4.2.8.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
HFP-AG	HFP-HF
DUN-GW	DUN-DT

### 4.2.8.2 Description

The purpose of this scenario is to verify that a voice call can be terminated without terminating data communication, and data communication can be terminated without terminating a voice call.

The initial condition for the Scenario is an HFP SLC, an active HFP call and a DUN connection being established.

When Device A receives a request to terminate an HFP voice call from Device B or the remote party terminates the voice call during data communication and voice call, the HFP voice call shall be terminated without terminating the data communication. In addition, when Device A receives a request to terminate data communication from Device B, data communication shall be terminated without terminating the voice call. The DUN connection may or may not be disconnected by Device B.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.6</a>	<a href="#">DUN Requirements</a>

#### 4.2.8.3 Sequence Chart

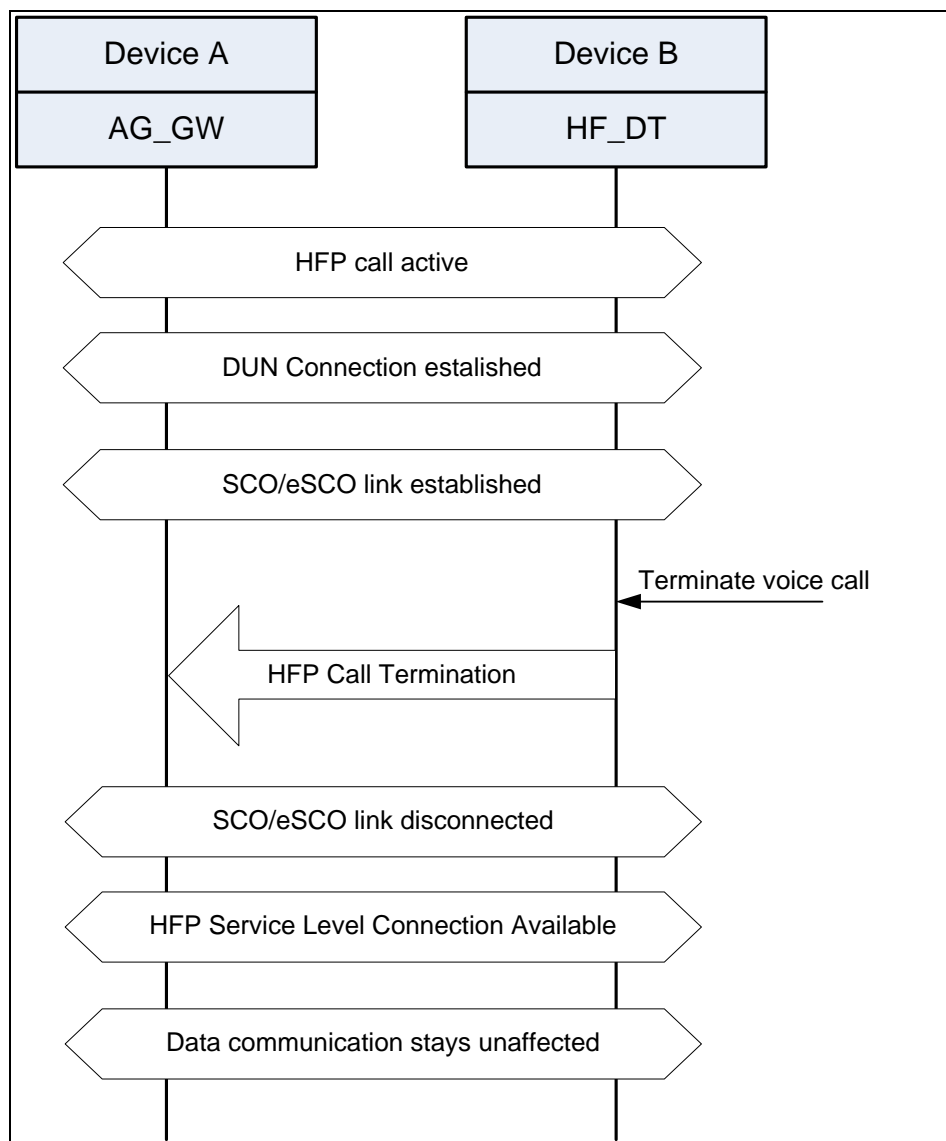


Figure 4.25: Terminate voice call / data call during data communication and voice call

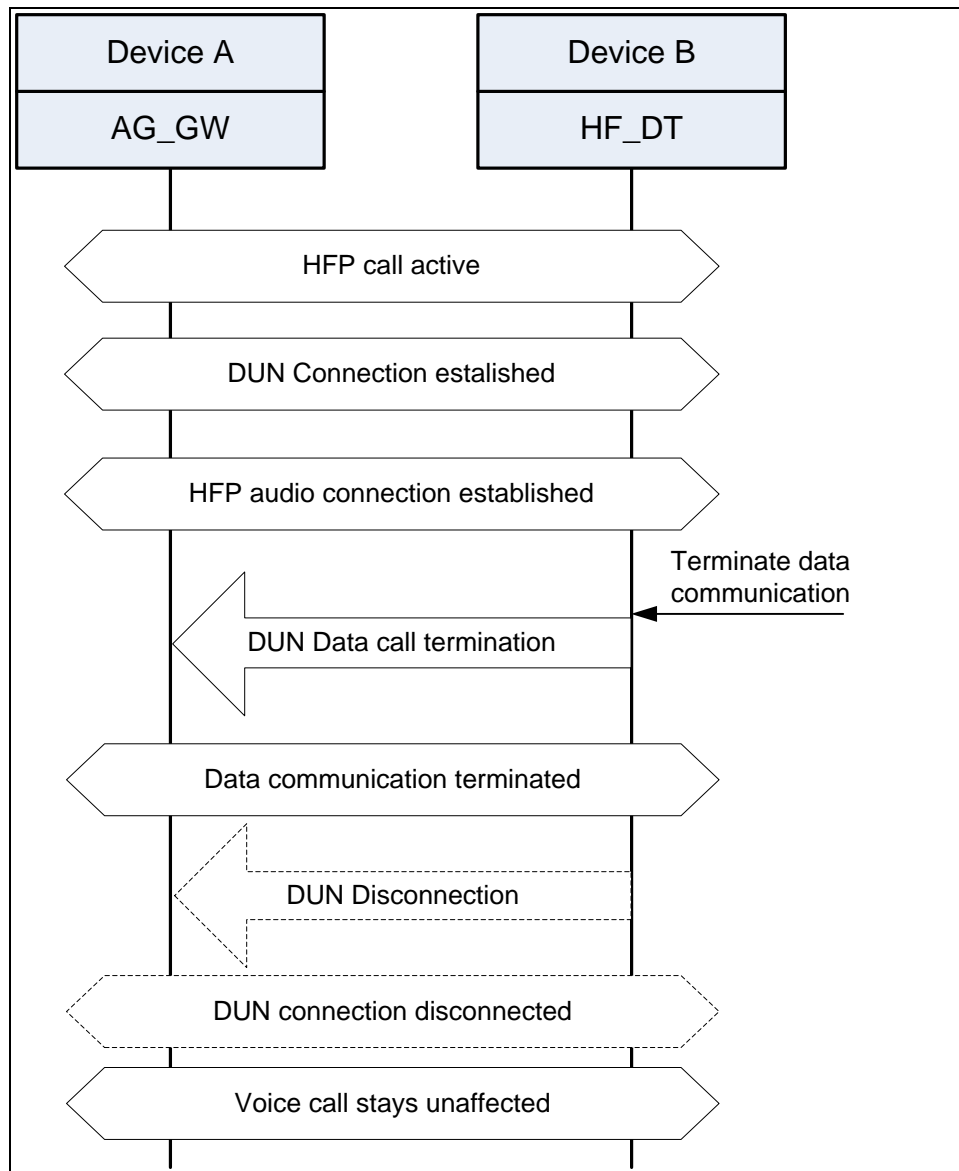


Figure 4.26: Terminate voice call / data call during data communication and voice call

## 4.3 PAN Scenarios

This section defines Scenarios related to the Personal Area Networking Profile (PAN). It is typically used together with HFP, A2DP and AVRCP, e.g. in an automotive environment.

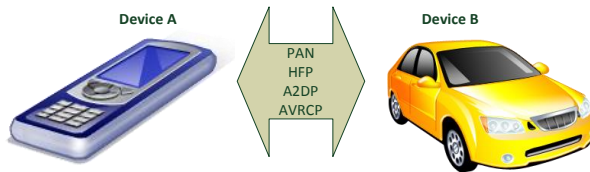


Figure 4.27: PAN related MPSD

### 4.3.1 Data communication in Personal Area Network during active voice call (MPSD)

#### 4.3.1.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
HFP-AG	HFP-HF
PAN-NAP	PAN-PANU

#### 4.3.1.2 Description

The purpose of this scenario is to verify that Device B can start data communication over a network using the PAN Network Access Point service during an ongoing voice call.

The PAN connection may be established prior or during the voice call. It is recommended for Device A to operate PAN in single user mode.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.7</a>	<a href="#">PAN Requirements</a>

During data communication by Device B over a network, an ongoing voice call shall be continued via HFP. In case the cellular network cannot support simultaneous voice and data, the data may be disconnected by the network, but the PAN connection should be maintained.

#### 4.3.1.3 Sequence Chart

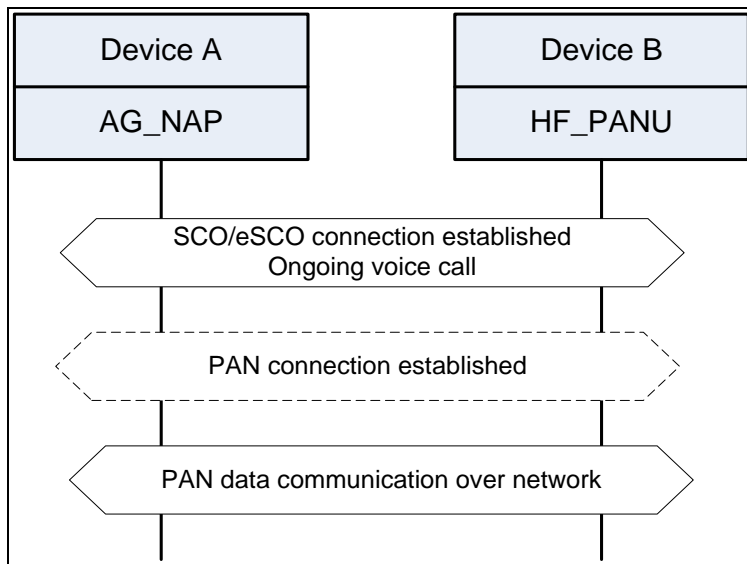


Figure 4.28: Data communication in Personal Area Network during active voice call (MPSP)

## 4.3.2 Outgoing voice call during Data communication in a Personal Area Network

### 4.3.2.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
HFP-AG	HFP-HF
PAN-NAP	PAN-PANU

### 4.3.2.2 Description

The purpose of this scenario is to verify that Device A can continue an ongoing data communication via a PAN Network Access Point when an outgoing call is established. An ongoing HFP Service Level Connection between the devices shall exist but the data communication over PAN profile shall be continued. The outgoing call shall be established as defined in [HFP].

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.7</a>	<a href="#">PAN Requirements</a>

In case cellular network cannot support simultaneous voice and data, the data may be disconnected by the network, but PAN connection should be maintained.



#### 4.3.2.3 Sequence Chart

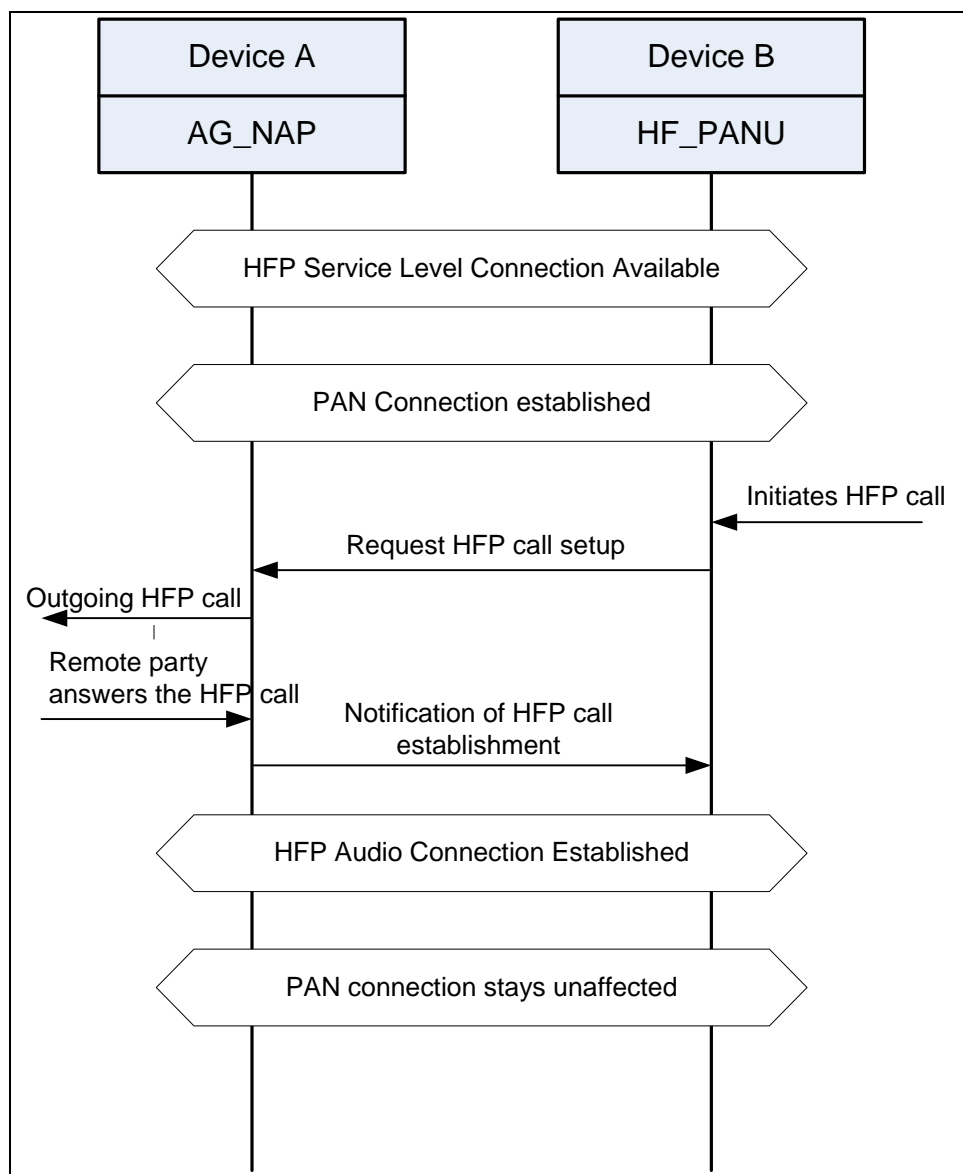


Figure 4.29: Outgoing voice call during Data communication in a Personal Area Network

### 4.3.3 Incoming voice call during Data communication in a Personal Area Network

#### 4.3.3.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
HFP-AG	HFP-HF
PAN-NAP	PAN-PANU

#### 4.3.3.2 Description

The purpose of this scenario is to verify that Device A can continue an ongoing data communication via a PAN Network Access Point when a call comes in and Device B can answer the call.

An ongoing HFP Service Level Connection between the devices shall exist and the data communication over PAN profile shall be continued during the HFP call. When the call is received on Device A, it shall behave according to [HFP].

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.7</a>	<a href="#">PAN Requirements</a>

In case the cellular network cannot support simultaneous voice and data, the data may be disconnected by the network, but PAN connection should be maintained.

#### 4.3.3.3 Sequence Chart

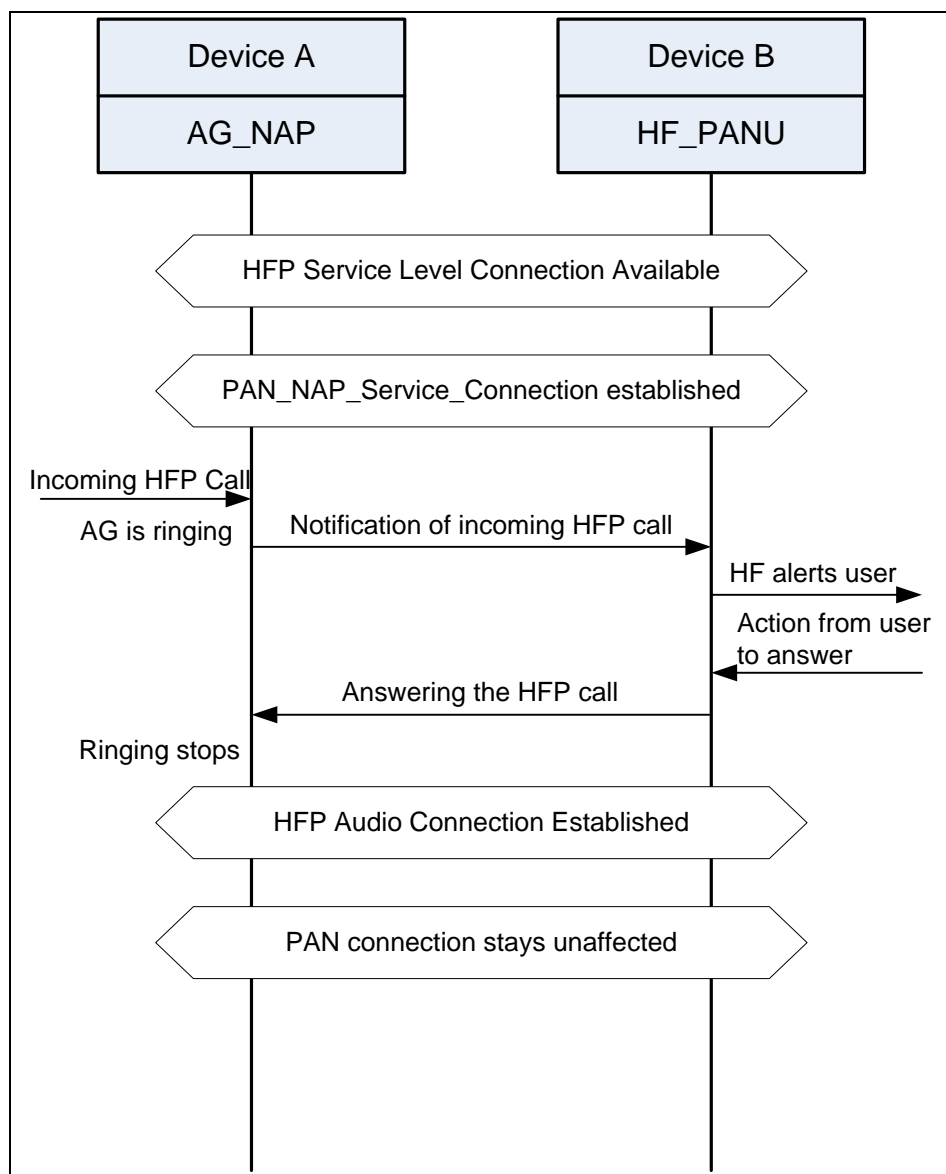


Figure 4.30: Incoming voice call during Data communication in a Personal Area Network

## 4.3.4 Start Audio Streaming during Data communication in PAN

### 4.3.4.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT
PAN-NAP	PAN-PANU

### 4.3.4.2 Description

Data communication via PAN profile shall be continued when the user initiates audio streaming from Device A to Device B.

Data communication via PAN profile is active between Device A and Device B as a pre-condition. The user takes action on Device A or Device B in order to initiate audio streaming. When the action is taken on the Device B, Device B shall send an **AVRCP\_Play** to Device A.

Device A shall then start the GAVDP connection establishment procedure and GAVDP start streaming procedure.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	<a href="#">A2DP Requirements</a>
<a href="#">6.8</a>	<a href="#">AVRCP Requirements</a>
<a href="#">6.7</a>	<a href="#">PAN Requirements</a>

#### 4.3.4.3 Sequence Chart

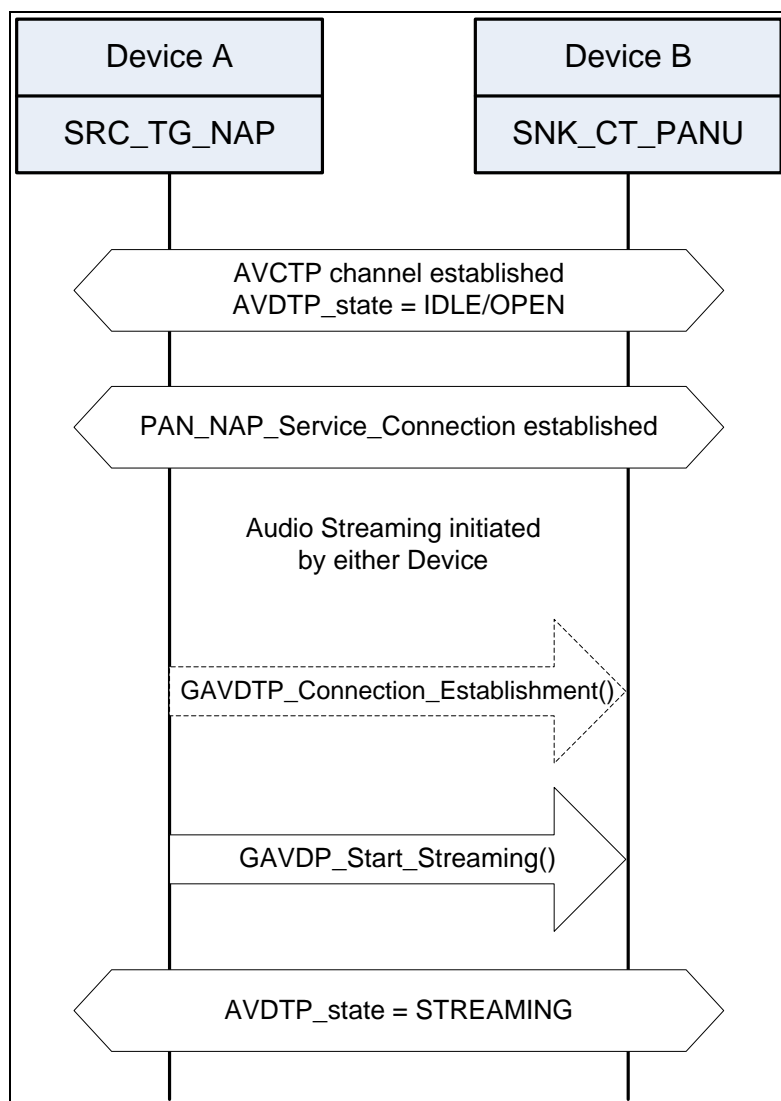


Figure 4.31: Start Audio Streaming during Data communication in PAN

## 4.3.5 Data communication establishment in Personal Area Network during Audio Streaming (MPSD)

### 4.3.5.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT
PAN-NAP	PAN-PANU

### 4.3.5.2 Description

Audio streaming from Device A to Device B shall be continued when the user initiates a connection between a PAN-PANU and the PAN-NAP.

A2DP audio is streaming between Device A and Device B as a pre-condition. The user takes action on Device B in order to initiate the PAN connection. When the action is taken on the Device B, Device B shall establish a PAN profile connection if there is no connection of PAN profile.

Then Device B shall start the data communication.

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">6.5</a>	A2DP Requirements
<a href="#">6.8</a>	AVRCP Requirements
<a href="#">6.7</a>	PAN Requirements

#### 4.3.5.3 Sequence Chart

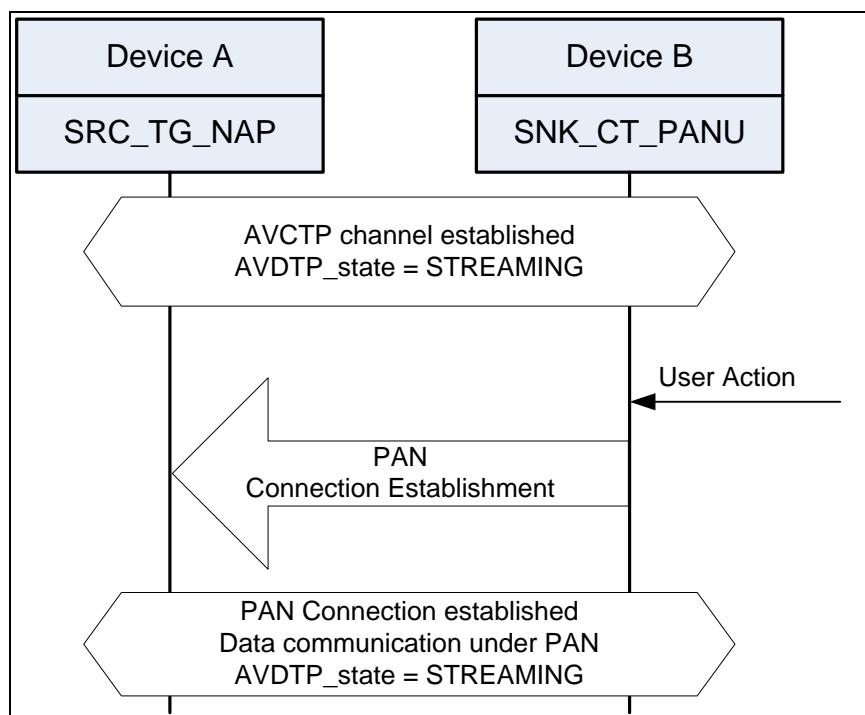


Figure 4.32: Data communication establishment in Personal Area Network during Audio Streaming (MPSP)

## 4.4 PBAP Related Scenarios

The Phonebook access profile is typically used between car kits and mobile phones to access the phonebook database of the phone from the vehicle. It is for example used concurrently with the Hands free Profile, A2DP, and AVRCP.

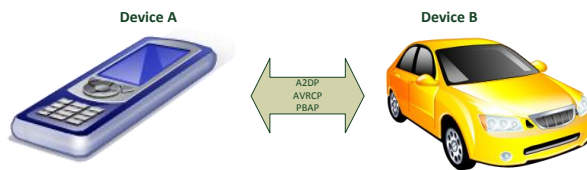


Figure 4.33: PBAP related MPSD

### 4.4.1 Phonebook Download and Audio Streaming (MPSD)

#### 4.4.1.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
PBAP-PSE	PBAP-PCE
A2DP-SRC	A2DP-SNK
AVRCP-TG	AVRCP-CT

#### 4.4.1.2 Description

This scenario specifies that during the download of a phonebook of maximum size via PBAP, a proper audio quality of the A2DP stream is maintained as described in 6.5. The following features from the individual profiles are referenced:

PBAP-PSE	PBAP-PCE	Feature
yes	Yes	Phonebook Download

A2DP-SRC	A2DP-SNK	Feature
yes	n/a	Send Audio Stream
n/a	yes	Receive Audio Stream

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
6.5	A2DP Requirements
6.8	AVRCP Requirements



## 4.4.2 PBAP and HFP Connection behavior (MPSD)

### 4.4.2.1 Profile Roles

This function shall apply to devices supporting the following combination of profile roles:

Device A	Device B
PBAP-PSE	PBAP-PCE
HFP-AG	HFP-HF

### 4.4.2.2 Description

The purpose of this scenario is to specify that a PBAP-PSE allows a PBAP connection if no HFP Service Level Connection is present:

The following MPS requirements shall apply to this scenario:

MPS Section Ref.	Feature
<a href="#">5.2.1</a>	<a href="#">Requirements for (dis-)connection behavior</a>

## 5 MPS Procedures

This chapter defines procedures that are commonly used by one or more MPS Scenarios.

MPS Section Ref.	Feature	Status	A2DP	AVRCP	HFP	PBAP	PAN	DUN
5.1	MPS AVP Suspension Procedure	C.1	✓	✓				
5.2	Profile (Dis-)Connection	C.2	✓	✓	✓	✓	✓	✓

C.1 – Mandatory if A2DP and AVRCP are supported, N/A otherwise

C.2 – Mandatory if any two profiles marked in that row are supported, N/A otherwise

### 5.1 MPS AVP Suspension Procedure

This procedure defines how to suspend an A2DP stream between two devices supporting A2DP and AVRCP.

The initiating device is an A2DP-SNK and AVRCP-CT (SNK\_CT) and the other device is an A2DP-SRC and AVRCP-TG (SRC\_TG). Throughout this document, the convention in the figure below is used to refer to this procedure in the sequence diagrams. The following steps are performed between the SNK\_CT and SRC\_TG:

SNK\_CT shall send an **AVRCP\_Pause**

SRC\_TG shall confirm the **AVRCP\_Pause**

SRC\_TG shall suspend the stream using the **GAVDP\_Suspend**. The **GAVDP\_Suspend** may occur prior to the confirmation of **AVRCP\_Pause**.

SRC\_TG should locally pause the audio that is sent over the A2DP stream depending on the audio application and shall update the play status over AVRCP.

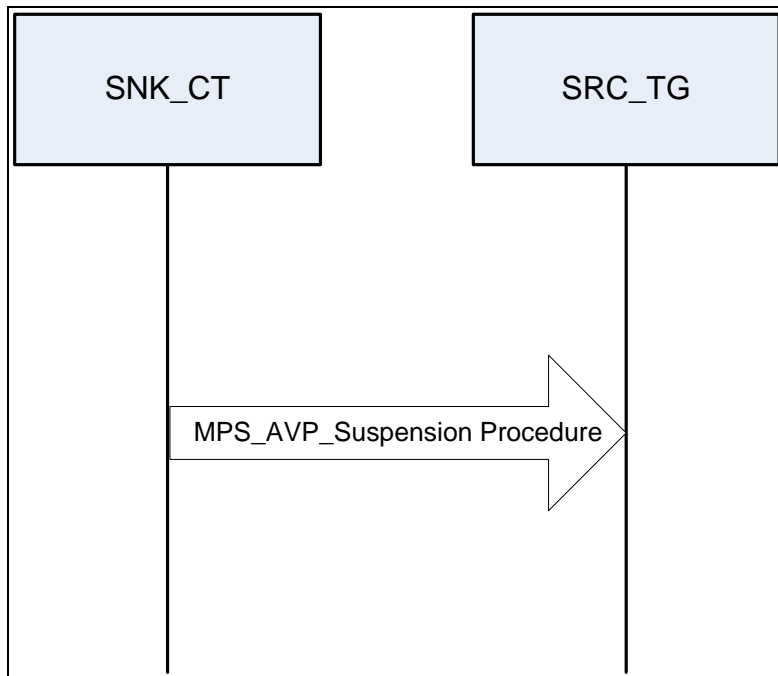


Figure 5.1: Convention for MPS AVP Suspension Procedure

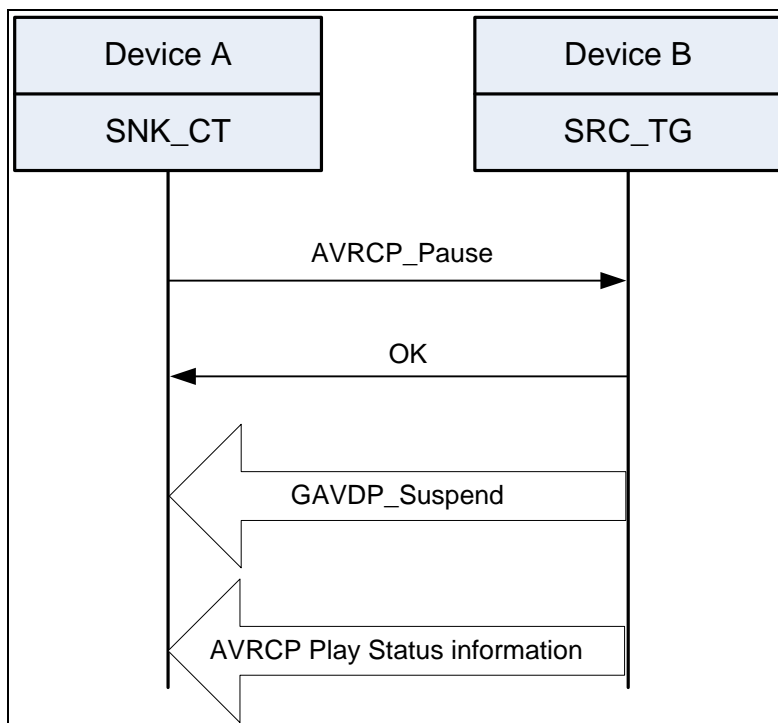


Figure 5.2: MPS AVP Suspension Procedure

## **5.2 Profile (Dis-)Connection Behavior**

This section contains recommendations related to the (dis-)connection behavior of specific profile combinations that may improve usability. However, devices following these recommendations shall still allow any other (dis-)connection order.

### **5.2.1 Requirements for (dis-)connection behavior**

There shall be no limitations in the order of establishment of profile connections other than imposed by individual profile specifications.

### **5.2.2 Recommendations and requirements on HFP+AVP (dis-)connection behavior**

The following recommendations and requirements apply to the combination of HFP, A2DP and AVRCP.

The HFP service level connection, A2DP signaling and AVRCP signaling connections should be established depending on the actions taken when the user powers on the device, performs user action to establish a connection, or due to an internal event.

The order of connection establishment should be HFP service level connection first, A2DP Signaling Channel connection next and AVRCP control channel last. In addition, the order of disconnection should be AVRCP control channel first, A2DP Signaling Channel connection next, HFP service level connection last. An existing HFP service level connection shall not be disconnected in case the A2DP or AVRCP connection fails

If both A2DP and AVRCP profiles are being connected, then the order of connection establishment should be first the A2DP signaling connection and then the AVRCP control channel. In addition, the order of disconnection should be AVRCP control channel first, A2DP Signaling Channel connection last. The AVRCP TG shall not itself automatically disconnect the A2DP connection when AVRCP is disconnected from the AVRCP CT.

## 6 Profile and Protocol Dependencies

This chapter defines the dependencies on the referred profiles and protocols. Features that are defined optional in the context of a single profile might be defined to be mandatory or conditional in the context of MPS.

MPS Section	Feature	Status
6.1	MPS SDP Record	M
6.3.1	Sniff Mode during Streaming	C.1
6.4	GAVDP Requirements	C.2

Table 6.1: Profile Dependencies

**C.1** Conditional: Mandatory to support if A2DP is supported.

**C.2** Conditional: Mandatory to support if A2DP and HFP are supported.

### 6.1 MPS SDP Record

An MPS device shall indicate all supported MPS functionality in the relevant bitmasks in the MPS SDP entry as defined below. If the bit is set in the bitmask, then the feature shall be supported as defined in the referenced section.

Any device supporting MPS shall at least be an SDP Server.

Item	Definition	Type	Value		Default
<b>Service Class ID List</b>					
Service Class #0		UUID	Unique identifiers for all devices that support MPS	M	
<b>Bluetooth Profile Descriptor List</b>					
Profile ID #0		UUID	Multi Profile Specification	M	
Parameter #0	Version	Uint16	0x0100	M	0x100
Supported Scenarios MPSP	MPS features flags	Uint64	Bitmask see Table 6.3	M	
Supported Scenarios MPMD	MPS features flag	Uint64	Bitmask see Table 6.4	C.1	
Supported Profile and Protocol Dependencies	MPS features flags	Uint16	Bitmask see Table 6.5	M	

Table 6.2: SDP Record for an MPS Device

**C.1** Mandatory if support for MPMD use cases is available

Feature Name	Position in Bitmask (LSB first)	Reference Section
Answer Incoming Call during Audio Streaming (HFP-AG_A2DP-SRC)	0	<a href="#">4.1.1</a>
Answer Incoming Call during Audio Streaming (HFP-HF_A2DP-SNK)	1	<a href="#">4.1.1</a>
Outgoing Call during Audio Streaming (HFP-AG_A2DP-SRC)	2	<a href="#">4.1.3</a>
Outgoing Call during Audio Streaming (HFP-HF_A2DP-SNK)	3	<a href="#">4.1.3</a>
Reject/Ignore Incoming Call during Audio Streaming (HFP-AG_A2DP-SRC)	4	<a href="#">4.1.5</a>
Reject/Ignore Incoming Call during Audio Streaming (HFP-HF_A2DP-SNK)	5	<a href="#">4.1.5</a>
HFP call termination during AVP connection (HFP-AG_A2DP-SRC)	6	<a href="#">4.1.7</a>
HFP call termination during AVP connection (HFP-HF_A2DP-SNK)	7	<a href="#">4.1.7</a>
Press Play on Audio Player during active call (HFP-AG_A2DP-SRC)	8	<a href="#">4.1.9</a>
Press Play on Audio Player during active call (HFP-HF_A2DP-SNK)	9	<a href="#">4.1.9</a>
Start Audio Streaming after AVRCP Play Command (HFP-AG_A2DP-SRC)	10	<a href="#">4.1.11</a>
Start Audio Streaming after AVRCP Play Command (HFP-HF_A2DP-SNK)	11	<a href="#">4.1.11</a>
Suspend Audio Streaming after AVRCP Pause/Stop (HFP-AG_A2DP-SRC)	12	<a href="#">4.1.12</a>
Suspend Audio Streaming after AVRCP Pause/Stop (HFP-HF_A2DP-SNK)	13	<a href="#">4.1.12</a>
Data communication under PSDM (DUN) during active voice call (HFP-AG_DUN-GW)	14	<a href="#">4.2.1</a>
Data communication under PSDM (DUN) during active voice call (HFP-HF_DUN-DT)	15	<a href="#">4.2.1</a>
Outgoing voice call during Data communication under PSDM (DUN) – (HFP-AG_DUN-GW)	16	<a href="#">4.2.2</a>
Outgoing voice call during Data communication under PSDM (DUN) – (HFP-HF_DUN-DT)	17	<a href="#">4.2.2</a>
Incoming voice call during Data communication under PSDM (DUN) – (HFP-AG_DUN-GW)	18	<a href="#">4.2.3</a>
Incoming voice call during Data communication under PSDM (DUN) – (HFP-HF_DUN-DT)	19	<a href="#">4.2.3</a>
Start Audio Streaming during Data communication under PSDM (DUN) – (A2DP-SRC_DUN-GW)	20	<a href="#">4.2.4</a>
Start Audio Streaming during Data communication under PSDM (DUN) – (A2DP-SNK_DUN-DT)	21	<a href="#">4.2.4</a>
Data communication establishment under PSDM (DUN) during Audio Streaming - (A2DP-SRC_DUN-GW)	22	<a href="#">4.2.6</a>

Data communication establishment under PSDM (DUN) during Audio Streaming- (A2DP-SNK_DUN-DT)	23	4.2.6
Terminate voice call / data call during data communication and voice call - (HFP-AG_DUN-GW)	24	4.2.8
Terminate voice call / data call during data communication and voice call - (HFP-HF_DUN-DT)	25	4.2.8
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Data communication in Personal Area Network during active voice call - (HFP-HF_PAN-PANU)	27	4.3.1
Outgoing voice call during Data communication in Personal Area Network – (HFP-AG_PAN-NAP)	28	4.3.2
Outgoing voice call during Data communication in Personal Area Network - (HFP-HF_PAN-PANU)	29	4.3.2
Incoming voice call during Data communication in Personal Area Network - (HFP-AG_PAN-NAP)	30	4.3.3
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Phonebook Download during Audio Streaming (A2DP-SRC_PBAP-Server)	36	4.4.1
Phonebook Download during Audio Streaming (A2DP-SNK_PBAP-Client)	37	4.4.1
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Table 6.3: Supported feature bitmask for MPSD scenarios

Feature Name	Position in Bitmask (LSB first)	Reference Section
Answer Incoming Call during Audio Streaming (HFP-HF_ A2DP-SNK_AVRCP-CT)	0	<a href="#">4.1.2</a>
Answer Incoming Call during Audio Streaming (A2DP-SRC_AVRCP-TG)	1	<a href="#">4.1.2</a>
Outgoing Call during Audio Streaming - (HFP-HF_ A2DP-SNK_AVRCP-CT)	2	<a href="#">4.1.4</a>
Outgoing Call during Audio Streaming - (A2DP-SRC_AVRCP-TG)	3	<a href="#">4.1.4</a>
Reject/Ignore Incoming Call during Audio Streaming (HFP-HF_ A2DP-SNK_AVRCP-CT)	4	<a href="#">4.1.6</a>
Reject/Ignore Incoming Call during Audio Streaming - (A2DP-SRC_AVRCP-TG)	5	<a href="#">4.1.6</a>
HFP Call termination during AVP connection -(HFP-AG)	6	<a href="#">4.1.8</a>
HFP Call termination during AVP connection -(HFP-HF_ A2DP-SNK_AVRCP-CT)	7	<a href="#">4.1.8</a>
HFP Call termination during AVP connection - (A2DP-SRC_AVRCP-TG)	8	<a href="#">4.1.8</a>
Press Play on Audio Player during active call - (HFP-HF_ A2DP-SNK_AVRCP-CT)	9	<a href="#">4.1.10</a>
Press Play on Audio Player during active call - (A2DP-SRC_AVRCP-TG)	10	<a href="#">4.1.10</a>
Start Audio Streaming after AVRCP Play Command (AVRCP-CT where the same device does <i>not</i> carry out the role of an A2DP SNK)	11	<a href="#">4.1.11</a>
Start Audio Streaming after AVRCP Play Command (A2DP-SRC_AVRCP-TG)	12	<a href="#">4.1.11</a>
Suspend Audio Streaming after AVRCP Pause/Stop (AVRCP-CT where the same device does <i>not</i> carry out the role of an A2DP SNK)	13	<a href="#">4.2</a>
Suspend Audio Streaming after AVRCP Pause/Stop (A2DP-SRC_AVRCP-TG)	14	<a href="#">4.2</a>
Start Audio streaming during Data communication under PSDM (A2DP-SRC_AVRCP-TG)	15	<a href="#">4.2.5</a>
Start Audio streaming during Data communication under PSDM (A2DP-SNK_AVRCP-CT_DUN-DT)	16	<a href="#">4.2.5</a>
Start Packet data communication during Audio streaming (A2DP-SRC_AVRCP-TG)	17	<a href="#">4.2.7</a>



Feature Name	Position in Bitmask (LSB first)	Reference Section
Start Packet data communication during Audio streaming (A2DP-SNK_AVRCP-CT_DUN-DT)	18	<a href="#">4.2.7</a>
Reserved for future use	19 - 63	

Table 6.4: Supported feature bitmask for MPMD scenarios

Dependency Name	Position in Bitmask (LSB first)	Reference Section
Sniff Mode During Streaming	1	<a href="#">6.3.1</a>
GAVDP Requirements	2	<a href="#">6.4</a>
(Dis-)Connection Order / Behavior	3	<a href="#">5.2.1</a>
Reserved	4-15	

Table 6.5 Supported Profile and Protocol Dependency Bitmask

## 6.2 L2CAP Streaming Optimization

For multi profile operation, the support of L2CAP features as defined in Table 6.6 is recommended. Implementations may use these L2CAP features in order to optimize media streaming operation.

Protocol Channel	Profile(s)	L2CAP Feature(s)
BNEP	PAN	L2CAP streaming mode
AVDTP media channel	A2DP	L2CAP streaming mode
AVDTP signaling channel	A2DP	L2CAP Enhanced retransmission mode
AVCTP control channel	AVRCP	L2CAP Enhanced retransmission mode
AVCTP browsing channel	AVRCP	Usage of L2CAP Enhanced retransmission mode shall be used as defined in AVRCP.
RFCOMM	PBAP, DUN, HFP	If L2CAP Basic Mode is used, it is recommended to use an MTU that minimizes partial Baseband Packets. For profiles using OBEX, the OBEX MTU should also be chosen to minimize partial baseband packets. This increases efficiency and enables interleaving of media packets.

Table 6.6 L2CAP Streaming Optimization

The goal of applying the above L2CAP settings is to optimize Bluetooth media streaming running concurrently to other Bluetooth profiles. Applying a smaller MTU

during Basic Mode operation will allow media packets to be interleaved with the data packets in the absence of Segmentation and Reassembly in L2CAP Basic Mode.

## 6.3 Sniff Mode Handling

For multi profile operation, the use of Sniff Mode is recommended, because it allows optimizing power consumption and multi device operation.

Several individual Bluetooth profile specifications define recommendations and requirements on the support of Sniff Mode. In general, it is implementation dependent how to combine and/or trade-off recommendations for different profiles. However, the following rules shall be adhered to when using Sniff Mode in a multi profile environment:

### 6.3.1 Sniff Mode during Streaming

When a GAVDP connection is in the Streaming state, Sniff Mode shall be used only if the sniff parameters are sufficient to allow streaming throughput with the current media CODEC configuration.

## 6.4 GAVDP Requirements

For conformance to MPS the **GAVDP\_Suspend** feature is mandatory when both A2DP and HFP are supported.

## 6.5 A2DP Requirements

When A2DP is used concurrently with any other profile the following set of requirements shall apply:

In order to achieve an acceptable audio quality, the audio stream shall be maintained, but audio quality degradation may occur. This is defined in detail in sections [6.5.1](#) and [6.5.2](#). A2DP-SRC Devices

### 6.5.1 A2DP-SRC Devices

- shall not introduce significant variance around ideal scheduling of packets over the air to deliver and/or make available a continuous supply of audio data for rendering
- may reconfigure the Media Codec to adapt to the current situation. When a stream is in the **AVDTP\_state** Streaming, it is recommended that the SRC employs Media Codec parameter changes that do not mandate the successive completion of the GAVDP procedures **GAVDP\_Suspend**, **GAVDP\_Change\_Parameters** and **GAVDP\_Start\_Streaming**. This avoids any audible interruption of the stream. Dynamic modification of the SBC bitpool parameter within the limits of the values initially negotiated for the Minimum/Maximum Bitpool Value SBC codec capabilities is an example of a preferred type of parameter change. Other forms of Media Codec reconfiguration may be carried out, but require stream suspension before reconfiguration and stream resumption after reconfiguration using **GAVDP\_Suspend** and **GAVDP\_Start\_Streaming** respectively.

### 6.5.2 A2DP-SNK Devices

- shall not introduce significant variance around ideal timing of output audio data delivery and/or availability to cause discernible discontinuities in the supply of audio data for rendering
- may reconfigure the Media Codec to adapt to the current situation, for example by adjustment of the SBC bitpool value. Reconfiguration of the Media Codec by the SNK device when a stream is in the **AVDTP\_state** Streaming state mandates the successive completion of the GAVDP procedures **GAVDP\_Suspend**, **GAVDP\_Change\_Parameters** and **GAVDP\_Start\_Streaming**.

## 6.6 DUN Requirements

When DUN is used concurrently with any other profile the following set of requirements shall apply:

- Data traffic over DUN may be slowed down in favor of other concurrent profiles
- The DUN data connection shall not be terminated due to the concurrent operation of another profile
- IP data traffic over DUN shall not be completely halted due to the operation of another profile. IP data traffic is considered completely halted when the transmission of an IP packet from the DUN DT to the DUN GW lasts longer than 1 second.
- IP data traffic over DUN may be completely halted due to external constraints, e.g. the unavailability of data traffic during active phone calls in some mobile networks)

## 6.7 PAN Requirements

When PAN is used concurrently with any other profile the following set of requirements shall apply:

Data traffic may be slowed down in favor of other concurrent profiles

- The PAN IP data connection shall not be terminated due to the concurrent operation of another profile
- IP data traffic shall not be completely halted due to the operation of another profile. IP data traffic is considered completely halted when the transmission of an IP packet from the PANU to the NAP lasts longer than 1 second.
- IP data traffic over PAN may be completely halted due to external constraints, e.g. the unavailability of data traffic during active phone calls in some mobile networks)

### 6.7.1 PAN and DUN considerations (informative)

Both PAN and DUN allow network access use cases. The following advantages apply to the PAN profile:

- Multiuser benefit (multiple clients can share the same access point)
- Better multiplexing behavior of profiles, because RFCOMM is not used

- Better performance, because no serial emulation layers like in DUN are present

## **6.8 AVRCP Requirements**

### **6.8.1 AVRCP Features**

Support of **AVRCP\_Pause** is mandatory for all devices supporting AVRCP Cat 1.

Support of the **EVENT\_PLAYBACK\_STATUS\_CHANGED** notification is mandatory for CT and TG. It will ensure that the CT knows the play back state of the media player in order to better support parallel usage of A2DP and provide a better user experience.

## 7 References

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Number	Reference
[1]	Specification of the Bluetooth System, Core Package Version 2.1 or later,
[2]	Document Naming Procedure, Bluetooth SIG (BARB Approved)
[3]	Bluetooth Documentation Review Guidelines, V10r04, 20 January 2004
[4]	ITU-T Recommendation Z.120, Message Sequence Chart (MSC)

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## 10 Appendix A – Reference of Commands, Roles and Features of Other Profiles Used in MPS

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The following table defines the references used throughout this specification that have been introduced for the purpose of better readability and maintainability of MPS.

Item	Meaning
<b>AVRCP_Pause</b>	Issue the AVRCP category 1 PASSTHROUGH commands for 'press' and 'release' in the correct order with an operation_id of pause.
<b>GAVDP_Suspend</b>	Execution of the Suspend Procedure as defined in GAVDP
<b>AVRCP_Play</b>	Issue the AVRCP category 1 PASSTHROUGH commands for 'press' and 'release' in the correct order with an operation_id of play
<b>AVRCP_Play_Response</b>	Issue the AVRCP category 1 PASSTHROUGH response ok
<b>GAVDP_Start_Streaming</b>	Execution of the Start Streaming Procedure as defined in GAVDP
<b>AVDTP_state</b>	Any of the states defined in the AVDTP state machine
<b>AVRCP-TG</b>	AVRCP TG Category 1
<b>AVRCP-CT</b>	AVRCP CT Category 1