



Qualcomm Technologies International, Ltd.



# Audio Sink Application Peer Device

## User Guide

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# Revision history

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2	JUN 2014	Minor corrections
3	JUN 2014	Minor editorial corrections
4	APR 2015	Updated for ADK 4
5	MAY 2015	Minor editorial corrections
6	AUG 2015	Updated the document with the details of new TWS features. Added the QTIL confidentiality statement and updated the document title.
7	SEP 2016	Updated to conform to QTI standards; No technical content was changed in this document revision
8	APR 2017	Update with details of new Qualcomm® aptX™ feature. Added to the Content Management System.
AJ	OCT 2017	Updated DRN to Agile numbering. No technical change.

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# 1 Peer Device mode - overview

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In Peer Device mode, two Audio Sink devices can connect and relay audio between each other.

When connected, the devices are in a Peer session during the connection. There are two types of Peer sessions:

1. TrueWireless Stereo
2. ShareMe

## **TrueWireless Stereo**

TrueWireless Stereo (TWS) Peer sessions allow two TWS enabled devices to connect to one another. Audio received at one device is relayed to the other Peer Device and rendering is synchronized. The TWS functionality is suitable for speaker applications or stereo headsets where there is no cord between the left and right ear piece and they function as a single device. See [TrueWireless stereo](#).

## **ShareMe**

ShareMe Peer sessions allow two ShareMe enabled devices to connect to one another. Audio received at one device is relayed to the second, rendering is not synchronized. The ShareMe functionality is suited for stereo headset applications as the audio is not synchronized between the peer devices. See [ShareMe](#).

## 2 Peer Device mode – generic features

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The generic features of Peer Device mode that are adopted by TrueWireless Stereo and ShareMe are:

### 2.1 Multipoint and Peer Device mode

Multipoint must be enabled for Peer Device functionality to work correctly. A Peer Device relies on using one of the available Multipoint connections to link to another Peer Device. The device can reserve a link for exclusive use by another peer device. This feature can be enabled using a GAIA command, a system event or through the configuration tool. See the *Audio Sink Application Configuration User Guide*.

### 2.2 Peer Device roles

Each peer device has one of two roles:

- **Peer Master:** The Peer Master is the Peer Device whose audio source is relayed.
- **Peer Slave:** The Peer Slave is the Peer Device that receives relayed audio from a Peer Master.

#### 2.2.1 Peer Device role configuration

Each Peer Device can be configured to support a particular Peer Device role, [Table 2-1](#) outlines the configuration roles for a Peer Device.

**Table 2-1 Configuring Peer Device roles**

Role	Description
Audio Sink	When enabled, the Peer Device is able to adopt the Peer Slave role
Audio Source	When enabled, the Peer Device is able to adopt the Peer Master role

**NOTE** By default a Peer Device supports both roles. See the *Audio Sink Application Configuration User Guide*.



## 2.3 Peer Device states

Table 2-2 describes Peer Device states.

**Table 2-2 Peer Device states**

State	Description
Peer Inquiry Mode	Peer Device is searching for another Peer Device in Discoverable mode
Peer Discoverable Mode	Peer Device is discoverable to other Peer Devices performing inquiry
Peer Device Connectable	The Peer Device is waiting to be connected to another Peer Device
Peer Device Connected	Two Peer Devices are connected in a Peer Session

## 2.4 Peer Device events

Table 2-3 describes the Audio Sink application events explicitly handled when Peer Device mode is active.

**Table 2-3 Audio sink application events for Peer Device mode**

Audio Sink Application Event	Description
Peer Session Inquire	Start Peer Inquiry mode
Peer Session Conn Disc	Start Peer Discoverable mode
Peer Session End	Disconnect the peer devices ending the Peer Session
Establish Peer Device Connection	Make a connection request to the paired Peer Device

## 2.5 Supporting multiple Bluetooth audio sources in Peer Device mode

Peer Devices can only support connections with up to two Bluetooth Audio Source devices, therefore:

- In a Peer Session: It is only possible to connect a single Bluetooth Audio Source to each device.
- When not in a Peer Session: A Peer Device can connect to two Bluetooth Audio Sources. However, if a link has been reserved for the exclusive use by a Peer Device then only one Bluetooth Audio Source can connect.

**NOTE** If no Peer Session is in place and the Peer Device is connected with two Bluetooth Audio Sources, it is not possible to initiate a TWS session.

## 2.6 Vendor specific Peer Device AVRCP commands

Along with the standard set of AVRCP commands, additional vendor-specific AVRCP commands have been implemented to support Peer Sessions, see [Table 2-4](#).

**Table 2-4 Vendor-specific AVRCP commands for Peer Device mode**

OPID	Command	Description
0x0	AVRCP_PEER_CMD_NOP	No Operation
0x1	AVRCP_PEER_CMD_PEER_STATUS_CHANGE	Relay availability status change from a Peer
0x2	AVRCP_PEER_CMD_TWS_AUDIO_ROUTING	Set which audio channels a peer renders
0x3	AVRCP_PEER_CMD_TWS_VOLUME	Not used (reserved for future use)
0x4	AVRCP_PEER_CMD_AUDIO_CONNECTION_STATUS	Update the connection status of the audio source to the peer
0x5	AVRCP_PEER_CMD_UPDATE_AUDIO_ENHANCEMENT_SETTINGS	Update the audio enhancement settings to the peer
0x6	AVRCP_PEER_CMD_UPDATE_USER_EQ_SETTINGS	Update the audio EQ settings to the Peer device
0x7	AVRCP_PEER_CMD_UPDATE_TRIM_VOLUME	Set the trim volume a peer should use
0x8	AVRCP_PEER_CMD_REQUEST_USER_EQ_SETTINGS	A TWS Peer Slave can request that the TWS Peer Master sends the EQ settings that should be active at both devices

## 2.7 GAIA with Peer Devices

For Peer Devices that support GAIA and are participating in a Peer Session as the Peer Master, certain GAIA commands can be used to control both devices in the Peer Session. These commands are received at the Peer Master and relayed to the Peer Slave using a custom AVRCP command.

[Table 2-5](#) lists GAIA commands actioned in this way.

**Table 2-5 GAIA commands supported by Peer Device mode**

GAIA Command	Description
GAIA_COMMAND_TOGGLE_BASS_BOOST_CONTROL	Toggle Bass Boost On/Off
GAIA_COMMAND_SET_BASS_BOOST_CONTROL	Explicitly turn Bass Boost On/Off
GAIA_COMMAND_SET_USER_EQ_PARAMETER	Set a single parameter in Multiband User EQ
GAIA_COMMAND_SET_USER_EQ_GROUP_PARAMETER	Set a group of Multiband User EQ Parameters
GAIA_COMMAND_TOGGLE_USER_EQ_CONTROL	Toggle Multi-Band User EQ On/Off
GAIA_COMMAND_SET_USER_EQ_CONTROL	Enables or disables the User-configured parametric equalizer

**Table 2-5 GAIA commands supported by Peer Device mode (cont.)**

GAIA Command	Description
GAIA_COMMAND_TOGGLE_3D_ENHANCEMENT_CONTROL	Toggle 3D Enhancement On/Off
GAIA_COMMAND_SET_3D_ENHANCEMENT_CONTROL	Explicitly turn 3D Enhancement On/Off

**NOTE** Other GAIA commands such as volume control and device trim control are handled by the Peer but are not relayed to the Peer Slave.

## 2.8 Supported A2DP codecs in Peer Device mode

During an active Peer Session, support of A2DP codecs is limited, see [Table 2-6](#).

**Table 2-6 Peer Device mode supported A2DP codecs**

Codec	TrueWireless Relay Support	ShareMe Relay Support
SBC	Yes	Yes
aptX	Yes	Yes
MP3	Yes	Yes
AAC	Yes	No*
aptX Low Latency	No	No
Faststream	No	No
* If a Bluetooth Audio Source opens an AAC media channel with a ShareMe Peer Device, the ShareMe Peer Device closes the media channel and requests the Bluetooth Audio Source to use one of the supported codecs.		

**NOTE** (1) A Peer Device that is not participating in a Peer Session is capable of supporting all the enabled optional A2DP codecs listed in [Table 2-6](#), dependent on configuration.

(2) It is possible to connect Audio Sources to the two individual TWS devices using different codecs for each connection, but the link between the TWS devices must use the same codec as the Audio Source that is playing audio. If this changes then the incompatible links are dropped while the codec is changed. Whether the device reconnects all the links or just the incompatible link is configurable. Refer to the *Audio Sink Application Configuration User Guide*.

## 2.9 Audio prompts in Peer device mode

If configured, audio prompts are played on the local device and are not relayed during a Peer Session.

Audio prompts are configured as for normal Audio Sink applications. Refer to the *Audio Sink Application User Guide*.

## 2.10 Peer Device pairing

Before two Peer Devices can connect and begin a Peer Session, they must complete Peer Device pairing. See sections:

- [Peer Device pairing modes](#)

- [Peer Discoverable mode](#)
- [Peer Inquiry mode](#)
- [Peer Device pairing procedure](#)

## 2.10.1 Peer Device pairing modes

[Table 2-7](#) describes the pairing modes supported in Peer Device mode.

**Table 2-7 Peer device pairing methods**

Pairing Mode	Supports	Description
Temporary	TWS and ShareMe	No pairing information is retained when the Peer session ends. However, attempts to recover from a link loss situation are made.
Standard	TWS and ShareMe	Pairing information is stored in the normal way. An entry is used within the device's PDL. This entry can drop of the end of the list if too many pairings with other devices are made.
Permanent	TWS Only.	Pairing information is protected and permanent. Performing the “clear paired device list procedure” does not remove the pairing information.  The pairing information can only be overwritten by pairing another TWS device.

**NOTE** (1) The default pairing mode used by ShareMe mode is Temporary.

(2) The default pairing method used by the TWS mode is Permanent.

(3) The active pairing mode can be modified through configuration. Refer to the *Audio Sink Application Configuration User Guide*.

## 2.10.2 Peer Discoverable mode

Peer Discoverable mode makes the Peer Device discoverable to other Peer Devices. Peer Discoverable mode can be started by triggering the `Peer Session Conn Disc` user event.

## 2.10.3 Peer Inquiry mode

Peer Inquiry mode allows a Peer Device to discover and pair with Peer Devices. Peer Inquiry mode can be started by triggering the `Peer Session Inquire` user event.

Peer Inquiry mode provides a configurable way to limit which discovered devices are paired. see below.

Both Limited Discoverable mode and General Discoverable mode are supported for Peer Device inquiries. This is configurable, refer to the *Audio Sink Application Configuration User Guide*.

### Limiting discovered devices

A two-stage filtering process can be used to determine if a discovered Peer Device is suitable to be paired with:

- **Device ID:** If selected as a device filter, the first three records of a remote Peer's Device ID, that is the Vendor ID Source, Vendor ID, and Product ID are matched against the local Peer's Device ID. If a match is found, then a connection is allowed.
- **Peer Device SDP Record:** This SDP record contains a 128-bit UUID that is used to identify Peer Device support.  
If selected as a device filter, the remote Peer's UUID is matched against the local Peer's UUID. If a match is found, then a connection is allowed.

Both filters are optional, see the *Audio Sink Application Configuration User Guide*.

## 2.10.4 Peer Device pairing procedure

The procedure required to pair two Peer Devices is described as below:

1. Place one Peer Device into Peer Discoverable mode, see [Peer Discoverable mode](#).
2. Place the other Peer Device into Peer Inquiry mode, see [Peer Inquiry mode](#).
3. The Peer Device in Peer Inquiry mode discovers and pairs with the Peer Device in Peer Discoverable mode.
4. When paired, the Peer Devices are connected and the Peer Session begins.

## 2.10.5 Peer Device version

All Peer devices support version 3.0 as legacy version.

## 2.11 Ending a Peer Session

At any time during a Peer Session the session can be ended using the `Peer Session End` user event.

**NOTE** Ending Peer Sessions does not affect connections between the Peer Devices and their connected Bluetooth Audio Sources.

## 2.12 Peer Device link loss

When link loss is detected during an active Peer Session the default behavior is for the Peer Master to become connectable and the Peer Slave starts link loss recovery.

In a TWS use case with two Audio Sources connected, one to each of the Peer Master and Peer Slave, if a link loss occurs between the Peer Slave and its Audio Source during an active Peer Session then the Peer Slave becomes connectable and the Audio Source is responsible for link-loss recovery.

Alternatively the link loss recovery method can be configured so that in both use cases the Peer Master and Peer Slave start link loss recovery.

**NOTE** QTIL recommends using the default behavior to prevent audio artifacts in the active audio stream during a link loss.

## 3 TrueWireless stereo

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TWS is a feature that allows two Qualcomm® BlueCore™ based devices to connect to each other and relay A2DP based audio synchronously. The two connected devices are known as Peer TWS Devices and connect in a Peer TWS Session, during the connection.

### 3.1 TrueWireless support for Bluetooth transports

For TWS devices to achieve synchronized rendering of an audio source, an A2DP connection is used to distribute the audio data while an AVRCP connection is used to send and receive control commands.

The vendor-specific Peer Device AVRCP commands supported for TWS Peer Sessions are listed in [Vendor specific Peer Device AVRCP commands](#).

### 3.2 TrueWireless audio sources

TWS Devices support the Audio Sources listed in [Table 3-1](#). Audio sources that can be relayed to the TWS Peer Device are explicitly listed.

**Table 3-1 TWS audio sources**

Audio Source	Audio Relayed to TWS Peer
SCO (call audio)	No
A2DP Audio	Yes
USB Audio	Yes
Wired Analog Audio	Yes
Wired I <sup>2</sup> S Audio	No
SPDIF Audio	No
FM Receive	No
No Active Source	No

**NOTE** [Table 2-6](#) lists the supported A2DP codecs for TWS and lists that are relayed to the TWS Peer.

### 3.3 TrueWireless audio routing

TWS devices support automatic and manual audio source selection modes described in: [TrueWireless automatic audio source selection](#) to [TrueWireless audio rendering](#).

- [TrueWireless automatic audio source selection](#)
- [TrueWireless default routed source](#)
- [TrueWireless audio rendering](#)
- [TrueWireless permitted audio rendering](#)

#### 3.3.1 TrueWireless automatic audio source selection

TWS Automatic Source Selection mode routes audio sources based on a priority system. The highest priority source is always routed whenever available. Sources are routed as soon as they become available and when their priority is higher than the currently routed source.

SCO-based audio connections are not supported between Peer devices, so it is not possible to relay HFP call audio between Peer devices but it is rendered locally with highest priority.

The priority of each audio source that can be shared between peer devices is listed in [Table 3-2](#).

**Table 3-2 Priority list for audio sources in TWS Automatic Source Selection mode**

Priority (1 is Highest)	Audio Source
1	A2DP Audio
2	USB Audio
3	Wired Audio (analog)
4	No Active Source

**NOTE** When TWS automatic routing is active, the user can switch to TWS Manual Mode using any of the Audio Sink application events listed in [Table 3-3](#).

#### 3.3.2 TrueWireless manual audio source selection

TWS Manual Source Selection mode is a manual audio routing process. The user must explicitly select the audio source to be routed. Audio sources can be routed by generating the Audio Sink application events listed in [Table 3-3](#).

**Table 3-3 Events used to control audio source selection for TWS Manual Source Selection mode**

Audio Sink Application Event	Audio Source Routed
Select Audio Source Next	The next audio source is routed (based on priority list, i.e. if A2DP audio source was active, USB audio source becomes active)
Select Audio Source Analog	Wired Audio (Analog) is routed
Select Audio Source USB	USB Audio Source is routed

**Table 3-3 Events used to control audio source selection for TWS Manual Source Selection mode (cont.)**

Audio Sink Application Event	Audio Source Routed
Select Audio Source AG1/ Select Audio Source AG2	A2DP Audio Source is routed
Select Audio Source None	Switch to TWS Automatic Source Selection mode

### 3.3.3 TrueWireless default routed source

When the TWS device has been powered on, the TWS Default Routed Source is selected. [Table 3-4](#) lists the available selections for setting the TWS Default Routed Source.

**Table 3-4 TWS default routed source**

TWS Default Routed Source	Description
Automatic	Automatically detects the active audio source, see <a href="#">TrueWireless automatic audio source selection</a>
Analog	Selects the Analog audio source
USB	Selects the USB audio source
A2DP	Selects the A2DP audio source

The TWS Default Routed Source is configurable, see *Audio Sink Application Configuration User Guide*.

### 3.3.4 TrueWireless audio rendering

When a TWS Peer Session has been established, the TWS Audio Rendering configuration allows the Peer Master to dictate the audio that is rendered by both the Peer Master and Peer Slave devices. [Table 3-5](#) lists the available rendering options for TWS Devices.

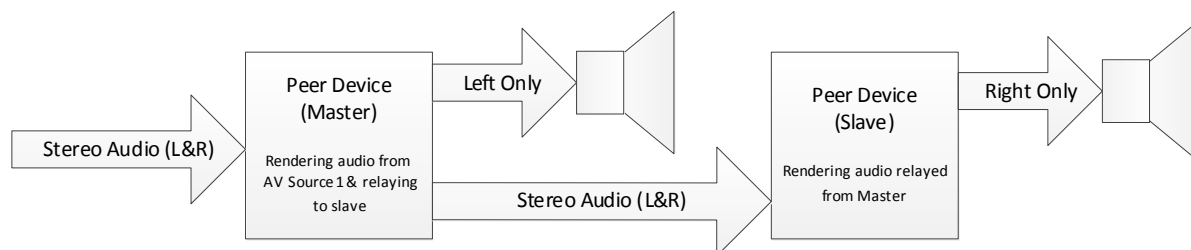
**Table 3-5 TWS rendering options**

Render	Description
Stereo	Both Left and Right channels are rendered
Left Only	Only the Left channel is rendered
Right Only	Only the right channel is rendered
Downmix	The Left and Right channels are mixed together then rendered

[Figure 3-1](#) outlines an example TWS audio rendering use case where the Peer Master renders the left audio channel and the Peer Slave renders the right audio channel. The stereo audio stream received



at the Peer Master is relayed to the Peer Slave without modification and the Peer Slave only renders the right audio channel.



**Figure 3-1 Example TWS audio rendering use case**

**NOTE** (1) The rendering options are configurable, refer to the *Audio Sink Application Configuration User Guide*.

(2) TWS Audio Rendering configuration is used only while Peer Sessions are active.

### 3.3.5 TrueWireless permitted audio rendering

When the user changes an audio rendering mode using the `Change TWS Audio Routing` event, the next permitted audio rendering mode is selected. If no rendering modes are configured to be permitted then the `Change TWS Audio Routing` event is ignored. Any change in the TWS audio rendering is persists across power cycles. The permitted audio rendering modes are configurable, refer to the *Audio Sink Application Configuration User Guide*.

## 3.4 TrueWireless volume control

TWS Volume is synchronized between the Peer Master and the Peer Slave, i.e.:

- Changing volume at the Peer Master updates the volume at both the Peer Master and the Peer Slave.
- Changing volume at the Peer Slave updates the volume at both the Peer Master and the Peer Slave.

**NOTE** (1) Bluetooth Audio Sources streaming audio to the Peer Master are not informed of the volume updates if they do not support AVRCP Absolute Volume Control (introduced in AVRCP v1.4).

(2) Volume changes at the Peer Slave are sent to the Peer Master and to the streaming Bluetooth Audio Source when the Bluetooth Audio Source supports AVRCP Absolute Volume Control.

### 3.5 TrueWireless device trim

Device Trim is used to fine tune the volume level output of individual speakers to match the required levels, see [Table 3-6](#).

**Table 3-6 User events to control TWS device trim**

Event	Audio Source Routed
TWS Master Device Trim Volume Up	Increase the trim level of the Peer Master
TWS Master Device Trim Volume Down	Decrease the trim level of the Peer Master
TWS Slave Device Trim Volume Up	Increase the trim level of the Peer Slave
TWS Slave Device Trim Volume Down	Decrease the trim level of the Peer Slave

**NOTE** (1) The Device Trim for both the Peer Master and the Peer Slave can only be modified from the Peer Master.

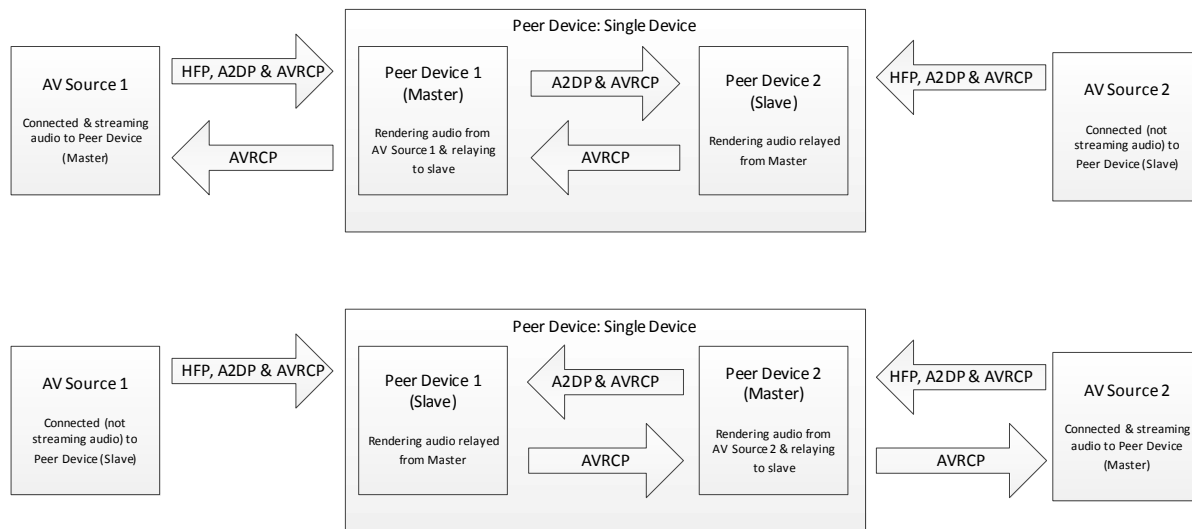
(2) The default TWS Device trim levels can be pre-configured so a default trim level is used, to configure these values, see the *Audio Sink Application Configuration User Guide*.

(3) A maximum and minimum trim level setting is provided to prevent the volume of the TWS slave device being adjusted with too large a range. To configure these values, see the *Audio Sink Application Configuration User Guide*.

### 3.6 TrueWireless Single Device mode

In TWS Single Device mode, two TWS Devices in an active Peer Session can operate as if they were a single audio device and both devices can control the active Bluetooth Audio Source device using AVRCP commands.

[Figure 3-2](#) outlines typical Single Device mode use cases.



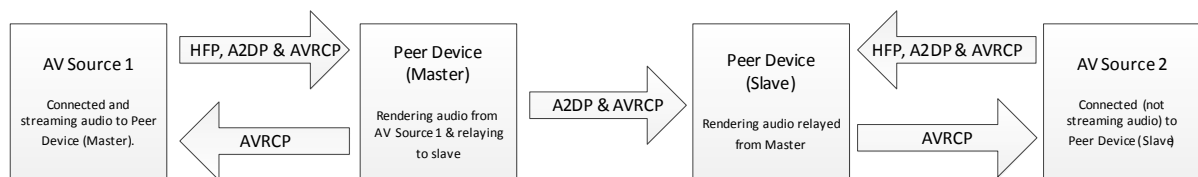
**Figure 3-2 Peer Device Single Device mode**

For TWS Single Device mode:

- By default, AVRCP commands issued on the TWS Slave are sent to the active Bluetooth Audio Source by the Peer Master.
- Configuration options allow AVRCP commands to be sent from the Slave to its connected Bluetooth Audio Source.
- Powering off the Peer Master also powers off the Peer Slave.
- Powering off the Peer Slave also powers off the Peer Master.
- When a call is received on either Peer Device:
  - It is only possible to answer a call on the Peer Device that is actually receiving the call.
  - If audio is streaming, it is stopped on both devices.
  - The Peer Master has priority when routing a call.

### 3.7 TrueWireless Separate Device mode

In TWS Separate Device mode, two TWS Devices in an active Peer Session can operate independently, but audio sharing between the devices is still available. [Figure 3-3](#) outlines a typical use case for Separate Device mode.



**Figure 3-3 Peer Device Separate Device mode**

For Separate Device mode:

- AVRCP commands issued on the Peer Slave are never sent to the Peer Master and onto the active Bluetooth Audio Source.
- Powering off the Peer Master does not cause the Peer Slave to power off.
- Powering off the Peer Slave does not cause the Peer Master to power off.
- When a call is received on the Peer Master:
  - It is only possible to answer the call using the Peer Master.
  - Upon answering the call, if audio is streaming, the Peer Master stops relaying audio to the Peer Slave. The call audio then takes priority at the Peer Master.
- When a call is received on the Peer Slave:
  - It is only possible to answer the call using the Peer Slave.
  - Upon answering the call, if audio is streaming, the Peer Slave requests the Peer Master to stop relaying audio but the Peer Master continues rendering audio from the AV Source. The call audio takes priority at the Peer Slave.

**NOTE** Compatible settings need to be maintained on Peer Master and Peer Slave TWS devices.

## 3.8 TrueWireless S aptX Default mode

aptX in TWS will operate in a single channel decoder mode when used in a compatible TWS configuration. This aptX decoder mode is transparent to the user and requires no setup. It has the advantage of reduced DSP utilization since only one channel is decoded by the aptX codec.

If the TWS device is designed to only have a single channel output, then the aptX default mode must be configured in the aptX Decoder DSP Project Properties. This default mode is used when a TWS Master is connected to an AG, but the TWS Slave is not connected. The default mode is important to consider with regard to the specific features enabled by the aptX License key.

This default mode does not affect the TWS configuration when a TWS link is connected between a Master and a Slave. The default modes are listed in [Table 3-7](#).

**Table 3-7 TWS aptX Default Modes**

Default Mode (when Slave is not connected)	Audio Decoded
Stereo	Stereo audio will be decoded.
Left Only	The Left channel of the stereo audio will be decoded.
Right Only	The Right channel of the stereo audio will be decoded.

## 4 ShareMe

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ShareMe allows audio received only from an A2DP Source to be relayed to another Peer Device that also supports ShareMe. The audio is rendered by both devices but rendering is not synchronized between the two Peer Devices.

**NOTE** [Table 2-6](#) lists the supported A2DP codecs for ShareMe and lists that are relayed to the ShareMe Peer.

### 4.1 ShareMe volume control

The volume level between connected ShareMe devices is not synchronized, i.e:

- Changing volume at the Peer Master does not update the volume of the Peer Slave.
- Changing volume at the Peer Slave does not update the volume of the Peer Master.

**NOTE** Bluetooth Audio Sources that do not support AVRCP Absolute Volume Control are not informed of volume updates made by the Peer Master.

### 4.2 ShareMe remote peer controls AV source

By default, during an active ShareMe Peer Session, only AVRCP commands issued by the ShareMe Master can be sent to the Bluetooth Audio Source.

The **Remote Peer Controls AV Source** feature allows a ShareMe Slave to send AVRCP commands to the Bluetooth Audio Source via the ShareMe Master. Sections [Remote peer controls AV source disabled](#) to [Remote peer controls AV source enabled](#) describe this feature.

#### Remote peer controls AV source disabled

When the **Remote Peer Controls AV Source** feature is disabled, a subset of AVRCP commands controls the relay stream. The available commands that can be sent from the ShareMe Slave to the ShareMe Master to control the relay stream are defined in [Table 4-1](#), other commands are ignored.

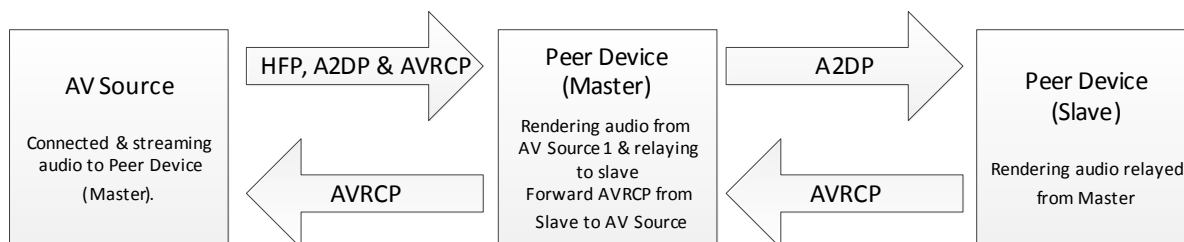
**Table 4-1 AVRCP commands used to control ShareMe relay streams**

AVRCP Operation ID	Description	Action
0x44	AVRCP Play	Start relaying immediately or as soon as an audio stream becomes available
0x45	AVRCP Stop	Stop relaying audio and prevent audio from being relayed when an audio stream becomes available
0x46	AVRCP Pause	Stop relaying audio and prevent audio from being relayed when an audio stream becomes available

### Remote peer controls AV source enabled

When the **Remote Peer Controls AV Source** feature is enabled, the ShareMe Master forwards AVRCP commands received from the ShareMe Slave to the Bluetooth Audio Source.

Figure 4-1 shows how the ShareMe Slave device is able to send AVRCP commands to the Bluetooth Audio Source using the ShareMe Master when **Remote Peer Controls AV Source** is enabled.



**Figure 4-1** ShareMe AVRCP control

# 5 Broadcast Audio

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Broadcast Audio is a feature that allows two or more BlueCore-based devices to engage in a multi-speaker shared audio experience. It enables one device to broadcast audio to other compatible devices so they play in synchronization. The audio is rendered to each of the receivers using CELT codec over CSB stream. For details see the *Audio Sink Application Broadcast User Guide*.

## 5.1 Broadcast Audio modes

At any time a Broadcast Audio enabled device must be in one of two modes:

- Broadcaster mode
- Receiver mode

### Broadcaster mode

- The device that transmits the music is termed a broadcaster.
- In Broadcaster mode the user is expected to connect back from an AG or use an establish SLC user event for connection.
- Only one AG connection is supported in Broadcaster mode
- HFP connection to the AG is not supported in Broadcaster mode.

### Receiver mode

- The device that receives audio from a broadcaster.
- Switching to Receiver mode disconnect all audio sources, and AG connections.
- Receiver mode does not support any wired audio routing, or AG connections.

A devices Broadcast Audio mode can be toggled by user triggered events, see [Broadcast Audio events](#). These cause a cold restart which disconnects any existing Bluetooth links.

## 5.2 Broadcast Audio events

[Table 5-1](#) describes the Audio Sink application events explicitly handled when Broadcast Audio mode is active.

**Table 5-1 Audio sink application events for Broadcast Audio**

Audio Sink Application Event	Description
BA Switch to Receiver	Switch to receiver mode
BA Switch to Broadcaster	Switch to broadcaster mode
BA Switch to Normal	Switch regular speaker mode
BA Start Association	Initiate association between broadcaster and receiver
BA CSB toggle	Turns broadcast audio on and off at the broadcaster end

## 5.3 Broadcast Audio device switching

There are three modes available for the user when Broadcast Audio is enabled in the build configuration:

- Normal Speaker mode
- Broadcaster mode
- Receiver mode

By default sink application in speaker configuration when running with broadcast audio enabled, boots into Normal Speaker mode which is a regular speaker configuration. The user can then switch to either a Broadcaster or Receiver mode configuration using the available user events, see [Broadcast Audio events](#).

### 5.3.1 Normal Speaker mode to Broadcast mode

When switching from Normal speaker mode to Broadcaster or Receiver modes the switching procedure is:

- The user initiates a mode switch to Broadcaster or Receiver using the designated user events, See [Broadcast Audio events](#).
- The sink application stores this mode change request to the dedicated Broadcast mode user PS Key (PSKEY\_USR5).
- The sink application sends itself a Power Off user event, to power off the speaker by disconnecting any existing Bluetooth connections and stop any audio routing.
- The sink application also sends an internal reboot request which causes a cold restart of the application.
- On reboot the sink application reads PSKEY\_USR5 and depending on the stored mode (Broadcaster or Receiver) initializes the required configurations.



### 5.3.2 Broadcast mode to Normal Speaker mode

- The user initiates a mode switch to Normal mode using the designated user event. See [Broadcast Audio events](#).
- The sink application stores this mode change request to PSKEY\_USR5.
- The sink application first powers off the current Broadcast mode (Broadcaster or Receiver Power off).
- On completion of Broadcast mode Power off, the regular Power off event is triggered by the application, shutting down the sink application.
- This is followed by a cold restart of the application.
- On reboot the sink application reads PSKEY\_USR5 and initializes the Normal Speaker mode configuration.

## 5.4 Broadcast Audio device association

For a receiver to start receiving audio from broadcaster it has to be first associated with it. The association process involves both the broadcaster and receiver device going into Association mode for a period of 30 seconds during which time security information is exchanged over a Bluetooth low energy link. A Broadcaster can be associated with multiple receivers, however a receiver can only be associated with one broadcaster at any one time. See the *Audio Sink Application Broadcast User Guide*.

## 5.5 Broadcast Audio sources

[Table 5-2](#) lists the audio sources supported by the Broadcaster role and shows which of these can be relayed to the receiver device.

**Table 5-2 Broadcast Audio sources**

Audio Source	Audio sent to Receiver
SCO (call audio)	No
A2DP Audio	Yes
USB Audio	Yes
Wired Analog Audio	Yes
Wired I2S Audio	No
SPDIF Audio	No
FM Receive	No
No Active Source	No

## 5.6 Broadcast Audio supported codecs

[Table 5-3](#) lists the A2DP codecs supported in Broadcaster mode when connecting to an audio source device. The broadcaster uses CELT codec for rendering audio to the receivers.

**Table 5-3 Support codec list in Broadcaster mode**

Audio Codec	Supported in the Broadcaster
SBC	Yes
AAC	Yes
aptX	No
MP3	No
aptX Low Latency	No
Faststream	No

**NOTE** It is possible to connect the remote device using other codecs supported in Speaker mode but while in Broadcaster mode it can only connect using the codecs listed in [Table 5-3](#).

## 5.7 Broadcast Audio volume control

The volume level between the associated broadcast audio devices behaves as follows:

- Changing volume at the Broadcaster updates the volume of the associated Receivers.
- Volume updates sent to Receiver act on top of Receiver's default volume setting.
- Changing volume at the Receivers does not update the volume of the associated Broadcaster.

## 5.8 Broadcast Audio power control

During an active Broadcast Audio session, only the Power off command issued by the Broadcaster can be sent to associated receivers, for example:

- Powering off a Broadcaster in an active Broadcast Audio session causes the associated receivers to Power off.

## 5.9 Audio prompts supported by Broadcast Audio

In a Broadcast Audio mode only a limited set of audio prompts are supported, these are:

- Power on
- Power off
- BA switching to Broadcaster
- BA switching to Receiver

## 5.10 Broadcast Audio automatic source selection

Broadcaster automatic source selection routes audio sources based on a priority system. The highest priority source is always routed whenever available. Sources are routed as soon as they become available and when their priority is higher than the currently routed source. Broadcast Audio uses the same priority for audio sources as Speaker mode, but skips sources that are not supported in Broadcast mode.

HFP is disabled while in Broadcast Audio mode, so SCO-based audio connections are not supported.

Table 5-4 lists the priority of Broadcast Audio codecs.

**Table 5-4 Priority for audio sources in Broadcast Audio**

Priority (1 is Highest)	Audio Source
1	A2DP audio
2	USB audio
3	Wired audio (analog)
4	No active source

## 5.11 GATT support in Broadcast Audio

The Broadcast Audio mode only supports a proprietary 16-bit Broadcast Data service and no other Bluetooth Low Energy technology services are supported. Therefore, there is no GAIA support in the speaker while operating in Broadcast Audio mode.

# Document references

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Document	Reference
<i>ADK Build Scripts XML Definitions User Guide</i>	80-CT541-1/CS-00346862-UG
<i>ADK Applications Configuration Architecture Overview</i>	80-CU111-1/CS-00400589-TO
<i>ADK Application Configuration System</i>	80-CT548-1/CS-00400610-UG
<i>Audio Sink Application Configuration User Guide</i>	80-CT439-1/CS-00236868-UG
<i>Audio Sink Application Broadcast Audio User Guide</i>	80-CF419-1/CS-004067726-UG

# Terms and definitions

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Term	Definition
A2DP	Advanced Audio Distribution Profile
AAC	Advanced Audio Coding
ADK	Audio or Application Development Kit
AG	Audio Gateway Device
AVRCP	Audio/Video Remote Control Profile
BlueCore	Group term for the range of QTIL Bluetooth wireless technology ICs
Bluetooth	Set of technologies providing audio and data transfer over short-range radio connections
DSP	Digital Signal Processor
EQ	Equalizer
FM	Frequency Modulation
GAIA	Generic Application Interface Architecture
I <sup>2</sup> S	Inter-Integrated Circuit Sound
ID	Identifier
MP3	MPEG-1 or MPEG-2 Audio Layer III Coding
PCM	Pulse Code Modulation
PDL	Paired Device List (same as Trusted Device List)
SBC	Sub-band Coding
SCO	Synchronous Connection-Oriented
SDP	Service Discovery Protocol
SPDIF	Sony/Philips Digital InterFace
TWS	TrueWireless Stereo
USB	Universal Serial Bus
UUID	Universally Unique Identifier