



# AirPlay

## Product Definition Specification

### -Audio Streaming Devices

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Apple



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# Introduction

AirPlay lets you wirelessly stream what you're listening to on your iOS device, iTunes or OS X computer to any AirPlay-enabled accessory connected to the network.

With an AirPlay-enabled accessory, users can:

- stream audio to any room in the house
- choose which AirPlay accessories they want to play audio on
- stream audio to a variety of AirPlay accessories

AirPlay includes a number of Apple technologies to allow for a complete music streaming experience for the user.

# Requirements

## User requirements for using AirPlay

### Hardware

AirPlay requires a device running iOS version 4.3.3 or greater, iTunes version 10.2.2 or greater, or OS 10.8.0 or greater to act as an audio source.

AND

An AirPlay accessory with built-in or external speakers.

### Network

AirPlay requires a wired or wireless TCP/IP network connection between the source and accessory. The AirPlay-enabled accessory must reside on both the same local network and subnet as the AirPlay source device.

Wired networks require:

- a minimum of 100BaseT connection

Wireless networks require:

- an access point compatible with 802.11b/g, 802.11n, or 802.11ac

## AirPlay accessory requirements

All AirPlay accessories must incorporate the following features and requirements.

### Product features

AirPlay accessories must include the following:

- a network connection
- a built-in speaker or audio output capability
- a product status indicator
- a network status indicator
- the ability for the user to perform a firmware update

AirPlay accessories must **not**:

- repeat or rebroadcast the AirPlay audio stream to any devices or components, other than to:
  - speakers attached to the AirPlay-enabled accessory via internal or external wiring, PCB traces, etc.
  - speakers wirelessly attached to the AirPlay-enabled accessory in a manner designed for single-zone use only (i.e. multi-zone support is not permitted)
- background or render the audio in an inaudible way while the device is in an alternate mode

AirPlay accessories are encouraged not to use proprietary wireless technologies in the product that overlap with the international Wi-Fi spectrum.

### **Network requirements**

All AirPlay accessories must support a wired or wireless network connection and Bonjour, Apple's service discovery protocol. Devices must also support changing the Bonjour name to a user defined value. The default name of all devices must be unique out of the box.

AirPlay accessories that support wireless networks must also:

- support 802.11b/g, 802.11n, or 802.11ac
- complete Wi-Fi certification (see Certification requirements)

### **Implementation requirements**

All AirPlay accessories must meet the following implementation requirements:

- incorporate the Apple Authentication Coprocessor
- meet all applicable requirements documented in the MFi Accessory Interface Specification

### **Certification requirements**

AirPlay accessories must complete the following certification requirements:

- Wi-Fi Alliance "Wi-Fi certified" program
- Wi-Fi Multimedia (WMM) certification
- MFi program certification

NOTE: Pre-existing MFi program certification on an accessory is not sufficient for AirPlay accessory certification.

# AirPlay Setup Experience

## Getting started

- 1) Install the latest version of iTunes on a Mac or PC.
- 2) Connect all necessary cables to the AirPlay accessory.
- 3) Connect the AirPlay accessory to power.
- 4) Connect the AirPlay accessory to the network (see Network configuration).

## Network configuration

Joining the network is the first touch point the consumer will have with your AirPlay product. As such, it is important that thought is put into the best way to get your product onto the network.

AirPlay products must minimally support the use of a Bonjour HTTP record and a web based configuration page that is compatible with the Safari browser on Mac, PC, iPhone, iPod touch and iPad. Any additional methodologies to improve the user experience of joining the network are encouraged. Additional methodologies must support Mac OS and iOS, though other operating systems are allowed.

If the AirPlay product includes a Wi-Fi interface, it must be configurable via that interface. Specifically, when configuring using a wireless methodology it is required that the AirPlay accessory operate as an Access Point in its unconfigured state instead of in Ad-Hoc mode for greater ease of use and product compatibility. While in configuration mode, the product must also expose Apple's Wireless Accessory Configuration (WAC) feature to the user according to that feature's functional requirements.

Both configuration options are required to allow configuration of the AirPlay product via WAC on iOS and OS X devices that support that feature, and via a web interface for older iOS, OS X and Windows products that do not support WAC.

iOS 5 onward provides the ability for the AirPlay accessory to gain access to the user's current wireless network credentials through the iPod Accessory Protocol (iAP). The use of this feature is detailed in the MFi Accessory Interface Specification under the heading "Wi-Fi Network Login Sharing." Be aware that the use of this feature requires the AirPlay accessory to include a button or other manual way of triggering the feature. Automatic triggers are not allowed.

When configuring the product on any network interface, it is required that the AirPlay accessory be pre-configured to use DHCP but allow for manual IP address assignment on the setup page.

## Network configuration example for wireless networks

- 1) Turn on or reset the AirPlay accessory.

The AirPlay accessory creates a default network with a unique network name such as “PRODUCT\_1234”.

- 2) From an iOS7 device’s Wi-Fi Settings page select the device.
- 3) Verify that the target network and accessory name are assigned as you desire.
- 4) Optionally assign a PIN lock to the accessory.
- 5) Click “Next”.
- 6) The accessory will confirm its connection to the desired network.

## Network configuration example for wired networks

- 1) Connect the AirPlay accessory to the local network router using an Ethernet cable.
- 2) The AirPlay accessory joins the network, obtains an IP address using DHCP, and is ready to be seen from the iTunes user interface.

# Power States and Product Availability

While the audio stream session is active, the AirPlay accessory must remain in a power state that allows it to play audio and receive TCP and UDP packets. When the AirPlay accessory is in a low-power state, it must continue to maintain its Bonjour advertisements, respond to Bonjour queries, and accept TCP connection requests to start an audio stream session.

If the AirPlay accessory is in a power state that is too low to allow full compliance with the above requirements, it must cleanly deregister its Bonjour record and power down its Wi-Fi radio. No other network functions are permitted in such a low power state (HTTP web serving, etc.).

# Bonjour

The AirPlay accessory must only advertise its Bonjour service when that service is actively available. This means that a device which is in a mode where it cannot accept an AirPlay stream, it must not advertise its service. Additionally, when a device is powered down it must deregister its Bonjour service on the network. By broadcasting its Bonjour service, the AirPlay accessory is indicating it is actively prepared and capable of accepting an AirPlay stream at that time.

## Model Name

All products must have a vendor defined model name. This name should be unique within the vendors' product line.

Field: am=<Vendor model name>

example: am=AppleTV2,1

## Metadata Support

AirPlay accessories that choose to implement metadata must declare their support in their Bonjour record. You must not declare any metadata support unless you plan to actively display that data to the end user.

field: md=<Metadata Supported>

- 0 Text;            If set, textual metadata supported
- 1 Artwork;        If set, artwork metadata supported
- 2 Progress;       If set, progress metadata supported

example: md=0,1,2

## Firmware Version

All products must indicate the firmware version that the AirPlay accessory is based upon.

field: fv=<AirPlay Firmware Version>.<MCU Firmware Version>.<Vendor Custom>

Products must declare the version of the AirPlay code base that their technology provider has supplied in the <AirPlay Firmware Version> field. For accessories based on the POSIX source release, this field can be found in the third field of the release number of the POSIX source drop, and is composed of the letter "p" followed by a number. For example, for the POSIX source drop release "AirPlay Audio POSIX Receiver 190.9.p7", the value of the <AirPlay Firmware Version> field is "p7". For accessories based on the Microchip DM8XX module, this field value will be provided by the technology provider and is composed of the letter "s" followed by a number.

If a product has a separate MCU, they must declare the version of the firmware in the <MCU Firmware Version> field. If no MCU is used, this field should be filled with a 0. The product

may include whatever other firmware versioning information desired in the <Vendor Custom> field. If no custom data is used, this field should be filled with a 0.

example: fv=p101.0515.0

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# Web Interface

AirPlay products must support the use of a Bonjour HTTP record and a web based configuration page that is compatible with the Safari browser on Mac, PC, iPhone, and iPad. Any additional methodologies to configure user settings are allowed. The required list of features accessible through this web configuration page are Friendly Product Name, Wi-Fi Network, Network Passphrase, Product PIN, DHCP Setting, Manual IP Settings, and Firmware Update.

## **Friendly Product Name**

User assignable name

## **Wi-Fi Network**

Selection of available networks

## **Network Passphrase**

Input of the associated network passphrase

## **Product PIN**

Set a password to prevent others from streaming to your AirPlay accessory

## **DHCP Setting**

Ability to turn DHCP on/off

## **Manual IP Settings**

Ability to manually configure the network interface

## **Firmware Update**

Ability to initiate a firmware update for the product

# Firmware Update

All devices are required to be firmware updatable in the field. All firmware that affects the AirPlay functionality in a product must be updatable. This includes but is not limited to: volume control, transport controls, Bonjour, and input switching.

In the case where an AirPlay accessory's firmware update is not successful, the device must not advertise a Bonjour service unless it is in a state where that service can be fully supported.

AirPlay accessories must minimally be able to upgrade from a locally stored file on the customer's computer through a web based configuration page that is compatible with the Safari browser on both Mac and PC. AirPlay accessories cannot require WAN connectivity for this firmware upgrade method. Accessories can optionally support other upgrade methodologies as long as they do not require specialized tools. Additional methodologies must include Mac OS or iOS support, though other operating systems are allowed. AirPlay devices which choose to use a computer application to update their firmware must minimally include support for Mac OS.

# AirPlay Accessory User Interface

## Required product user interface

### Product UI - All Products

Products must minimally show a unique status indication for an active network connection, a network connection problem, and a critical firmware issue. All other status indications are optional. Please see table UI Status Indicators.

### UI Status Indicators

	Status Indicator
Required	Network connection
	Network problem
Optional	Critical firmware problem
	Source input label
	AirPlay stream in progress

### Product UI - GUI Enabled Products

Products which use a GUI are highly recommended to include the AirPlay logo as defined in the document: AirPlay Logo Guidelines for Made for iPod Licensees. Products may not use any imagery other than the AirPlay logo to represent the AirPlay feature. Text indicators are considered to be valid alternatives for the status indicators required of all AirPlay products. Please see table Suggested Text Indicators.

## Suggested Text Indicators

Condition	Message
Network connection	“Successfully connected to [NETWORK NAME].”
Network problem	“Cannot connect to [NETWORK NAME]. Please try again.”
Critical firmware problem	“Please reset device by [RESET METHOD].”
Source input label	“AirPlay”

## Optional product user interface

### Metadata Display

#### Metadata requirements

AirPlay accessories with display capability may choose to display information about the currently-playing song. When choosing to support metadata, the device must minimally support the Song title. The user must also be given the option to cycle through Song title, Artist name, and Album name. Metadata is transmitted using UTF-8 and the display must be able to faithfully represent all UTF-8 characters transmitted.

It is highly recommended that the accessory support both the Song title and Artist name as a minimum display set on all visible user interfaces. The AirPlay accessory is required to display any metadata they choose to implement faithfully. All devices with limited display capabilities must scroll a piece of metadata that is too long for its display, ensuring the user can see the entirety of that piece of metadata.

Devices which choose to display metadata for sources other than AirPlay must include metadata display for the AirPlay source as well.

All Metadata not listed as required can be implemented as an option in the AirPlay accessory.

Metadata field
Album name
Album artwork
Artist name
Elapsed time
Song title
Total Time

### Album artwork display requirements

Album artwork is only permitted for display on full color screens. The product must be able to render JPEG and PNG images up to at least 512kB in size. If an AirPlay stream reports that it has no associated Album artwork or the Album artwork transmitted is not in a file format the AirPlay accessory can render, the accessory must render a placeholder image in place of the missing album artwork. The placeholder image used is at the discretion of the AirPlay accessory.

iTunes does not cross convert Album artwork so it is recommended that accessories support as many image formats as possible. Common image file formats are: JPEG, PNG, GIF, BMP, JPEG2000, TIFF, and PICT.

## Transport controls

Transport controls are optional for AirPlay accessories. AirPlay accessories choosing to implement transport controls MUST minimally implement Play/Pause toggle (or Play & Pause individually), Next track, and Previous track.

### Play/Pause toggle

Toggles the playback state of the currently playing track in iTunes. Other endpoints in the network will retain their ON/OFF settings and audio stream state as previously set.

#### Play

Starts playback of the currently selected track in iTunes. The AirPlay accessory that initiated the play event must be enabled as a playback endpoint (if not previously enabled in iTunes the command will have no effect). Other endpoints in the network will retain their ON/OFF settings as previously set.

#### Pause

Pauses the playback of the currently playing track in iTunes. Other endpoints in the network will retain their ON/OFF settings and audio stream state as previously set.

#### Stop

Stops the playback of the currently playing track in iTunes. If you are in the middle of playback, the song time will reset to the start of the track. Other endpoints in the network will retain their ON/OFF settings and audio stream state as previously set.

### Next track/Previous track

Skips to the next/previous track in the current playlist of iTunes. Has no effect if there is not a currently selected “now playing” track in iTunes. Previous track command automatically skips to the start of the song if more than 3 seconds of the currently playing track has passed.

## Shuffle and Repeat State Controls

Shuffle and repeat controls are optional for AirPlay accessories. AirPlay accessories choosing to implement either shuffle or repeat MUST additionally implement the other command.

### Shuffle toggle

Advances the iTunes shuffle setting from its current state to the next in the progression (... shuffle all songs, shuffle off ...)

### Repeat toggle

Advances the iTunes repeat setting from its current state to the next in the progression (... repeat all songs, repeat single song, repeat off ...)

## Volume Controls

Volume controls are optional for AirPlay accessories. AirPlay accessories choosing to implement volume controls in their product MUST implement both local and remote volume controls and volume state must be communicated both directions. The device must respect the volume setting as commanded by the AirPlay stream and any local volume control should be applied immediately upon the AirPlay accessory and the new volume level reported back to the AirPlay source.

Volume is communicated as a floating-point dB attenuation value where 0.0 is full volume and -144.0 is completely muted. The practical volume range utilized for the AirPlay stream has a basis of -30dB to 0dB with a special cased mute level of -144dB (linear volume of 0) in order to avoid infinities. The following equations can be used to convert between a dB value and a linear volume:

$$\begin{aligned} \text{linear volume} &= \text{pow}(10, \text{dB} / 20) \\ \text{dB value} &= 20 * \log_{10}(\text{linear volume}) \end{aligned}$$

The AirPlay accessory must map the communicated volume range to its own full scale range. Additionally, the AirPlay accessory must implement volume control at the final gain stage available to it in order to minimize audio quality loss through the system.

### Local volume control

Controls the output volume of the local AirPlay accessory immediately upon action. The AirPlay accessory's new volume level MUST be reported back to the AirPlay server immediately upon setting the system volume.

### Remote volume control

Controls the output volume of the local AirPlay accessory from a remote location. Upon receiving a remote volume setting the AirPlay accessory should send the actual volume set to the server.

### Mute volume control

All accessories are required to support a true, no volume Mute audio level communicated by the AirPlay streaming protocol by a value of -144dB.

Accessory manufacturers can optionally decide to implement a Mute function within their Accessory. The operation of the mute function should bring the volume level down to -144dB when engaged and back to the pre-mute level when disengaged. It is the responsibility of the Accessory to remember the pre-mute level when entering the mute function and to ensure both that it returns to this level and that it reports the proper level to the AirPlay server when disengaging.

Further, any volume up or down commands that the Accessory receives from the user should disengage the mute function and then act upon the pre-mute level. The exception to this rule is when a volume level is commanded by the AirPlay stream itself. In this case the Accessory

should cancel the mute function but set the return volume to that which has been dictated by the AirPlay stream.

## Products with multiple inputs

### Playback Prevention

If the AirPlay accessory receives an audio stream, it must automatically switch its audio input source to the audio stream. The AirPlay accessory is required to always be available to accept an AirPlay stream as long as it is in the power mode to do so. This means that an explicit user action selecting the speaker as an output must always interrupt the current activity and start the AirPlay activity.

#### Allow

The device allows AirPlay audio playback to begin. This is the default state of an AirPlay accessory.

#### Prevent

The device prevents AirPlay audio playback from beginning. This state is only allowed during an accessory source switch. The state must be set back to Allow immediately upon completing the source switch.

### Audio Source Switching

AirPlay accessories are not required to have multiple modes or inputs other than AirPlay. AirPlay accessories choosing to implement multiple inputs or modes **MUST** automatically switch audio input source to the AirPlay stream if the device receives an audio stream. If an audio stream session is active and the audio input source is changed to an alternate source, the AirPlay accessory **MUST** send a deselection of the AirPlay accessory output path to iTunes. Similarly, if an audio stream session is inactive and the audio input source is changed to the AirPlay source, the AirPlay accessory **MUST** send a selection of the AirPlay accessory output path to iTunes. Audio source switching away from the AirPlay input must be triggered by an explicit user interaction. Actions such as docking an iPod should not be considered explicit whereas pressing play on that iPod after it has been docked is an explicit action.

#### Available

The device is on the AirPlay input.

#### Busy

The device is on any source other than AirPlay.

# User Documentation

User documentation, both Quick Start Guides and User Manuals, must include methodologies for using Mac OS to set up and maintain the AirPlay accessory. It is recommended to include instructions on how to use iOS to set up and maintain the AirPlay accessory.

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# Special Considerations for Adapter Products

- Only proprietary connectors must be used
- All points listed in the above feature specification must be strictly complied with for the product as a whole
- The UI for the AirPlay function must be of equivalent quality and detail as other functions included in the product
  - All AirPlay setup must be able to be adjusted through the product UI as equivalent to other product features
  - The AirPlay feature must be clearly labeled in the product UI when in use
- Firmware update for the product must be capable for updating the full system image including the UI
- Any adapter must be included in-box with the product and must not be packaged or sold separately