

**IMDA Guidelines for Broadcasters  
Release for Industry Review**

**January 10, 2013**

**by  
Internet Media Device Alliance, Inc.  
24 Woodbine Avenue, Suite 12  
Northport, NY 11768  
+1 631 262 6940**



## Introduction

The IMDA's mission is to develop and promote a set of open, interoperable standards and device profiles to maximize the growth of a global consumer market in Internet-connected media devices.

The IMDA Encoding Guidelines are intended as a recommendation to broadcasters for the streaming of encoded audio to cars and other mobile devices. Those encoding guidelines match the IMDA Device Automotive Profile 1 and therefore, enable a reliable, convincing quality listener experience. The encoding guidelines are tailored specifically for varying and bandwidth-constrained conditions of a moving vehicle where Internet radio complements traditional forms of analog or digital radio and competes with other forms of media such as local music playback. These guidelines, developed in a joint effort by IMDA members and partners from the broadcast, mobile and automotive worlds, include recommendations on audio codecs and bitrates, transport formats, metadata and playlists.

The document contains a list of relevant recommendations based on the organization's previous work on device profiles and metadata [1], and is augmented by additional items that the organization deemed to be important for broadcasters. The recommendations are grouped by the following areas:

1. Live streams
2. On-demand content
3. Metadata
4. Applications.

## 1. Recommendations for live streaming to cars

Cars while driving are usually connected to the Internet through a mobile network such as 2G EDGE, 3G UMTS or lately 4G LTE. In a stationary situation they can also be connected through WiFi networks. The bandwidth availability in a moving vehicle over a mobile network can vary substantially influenced by factors such as location, network, the number of concurrent users in a cell, handover between cells as well as other outside factors. Studies<sup>1</sup> have shown the effects of this on latency, buffering and suitable media bit rates. For broadcasters who need to offer a reliable user experience, it's important to provide a service that can work under extremely constrained- as well as under ideal network conditions. Two major factors are decisive for the perceived quality of a program, the chosen audio codec with its corresponding bitrate as well as the transport method combined with an intelligent buffer management.

### 1.1. Audio Codecs

#### 1.1.1. HE-AAC

Even though the IMDA Device Automotive Profile 1 defines 3 mandatory audio codecs, namely HE-AACv2 and its subsets [6], mp3 and WMA, which need to be supported by certified car radios, the encoding guidelines are a best-practice orientation for broadcasters and therefore, only recommend the most efficient audio codec, HE-AACv2, for use in Internet radio streaming to cars. The codec combines bit rate compression efficiency with excellent audio quality and is already a proven codec for mobile streaming to handsets. Typical bit rates for mobile streaming with HE-AACv2 range from 32 kb/s to 96

---

<sup>1</sup> A Study of Network Performance with Application to Adaptive HTTP Streaming. Ingo Hofmann, Nikolaus Faerber, Harald Fuchs, Fraunhofer Institute for Integrated Circuits, Erlangen, Germany



kb/s with a sweet spot at 48 kb/s. The codec can also be operated at bitrates as low as 24 kb/s for stereo but that's not a recommended operation mode.

### **1.1.2. Extended HE-AAC**

Extended HE-AAC (xHE-AAC) provides an upgrade to the AAC audio codec family. It provides significantly improved music and speech quality at bit-rates as low as 16 kb/s for stereo but also provides transparency at typical HE-AAC bitrates. At the same time, the Extended HE-AAC decoder profile ensures compatibility with legacy HE-AAC streams – a standards compliant Extended HE-AAC decoder decodes HE-AACv2 as well as Extended HE-AAC bit streams. Broadcasters and consumers benefit from increased quality of service, better speech intelligibility and full music fidelity. Broadcasters only need a single encoding for any content and programming. Carmakers benefit from robust connectivity and a consumer audio experience that no other form of radio can offer. Extended HE-AAC is a mandatory part of the IMDA Device Automotive Profile 1, therefore the IMDA recommends to consider Extended HE-AAC as an option for streaming to IMDA certified car radios.

### **1.1.3. Legacy Codecs**

#### **1.1.3.1. MPEG-1 Audio Layer 3 (MP3)**

This codec is supported by the vast majority of devices and can therefore be considered to be a good fall-back in case that a given device does not support AAC audio. For streaming through mobile networks though, a bitrate of 96kbps should not be exceeded. A broadcaster should be aware that this is only a lower quality encoding and is encouraged to use the better suited HE-AACv2 as stated above.

#### **1.1.3.2. Windows Media Audio (WMA)**

A small number of devices only support Windows Media Audio. The IMDA therefore does not consider this codec to be essential in the future.

### **1.1.4. Surround sound**

In case the broadcaster is planning to stream surround audio, the IMDA recommends to use the MPEG Surround codec. MPEG Surround (MPS) is a low bitrate multi-channel extension to the AAC and HE-AAC audio codec and offers a way to differentiate Internet radio services by enhancing the audio quality experience to surround in a seamless, cost-efficient manner.

MPS has already been adopted in various applications, where bandwidth constraints so far have prevented the vast adoption of surround sound. Due to the codec's built-in surround headphone mode, it also opens up surround sound to rear-seat entertainment systems or other mobile devices that are able to make use of multi-channel audio using common stereo headphones. Legacy playback devices that have been shipped with AAC or HE-AAC stereo decoders will decode the surround bitstream in conventional stereo quality. Since MPS is also standardized for classical broadcasting systems such as DAB+, or ISDB-Tmm, hybrid devices can make use of the same audio decoder for Internet radio streams as well as for traditional broadcast signals.

In case that MPEG Surround is used with HE-AAC, a total bitrate between 64-128 kbps is recommended.

## **1.2. Suggested streaming setup**

The following combination of configuration parameters should be considered as general guidance for streaming to cars. Listed in the table below are different bitrate categories, ranging from very low bitrates to premium bitrates.



## IMDA Guidelines for Broadcasters

If not all configurations can be provided in parallel, the following guideline shall be used: For the moving car environment we recommend the low configuration to enable smooth, high quality playback of the internet radio. In addition, the very low anchor should be provided, so the device can switch over in case of very bad network conditions. The medium and high categories serve to provide very high quality streams in case of good network conditions. Premium presents the highest quality but might not be smoothly receivable through today's mobile networks. For mobile networks we recommend the medium configuration to provide very high quality if the network conditions allow it.

Bitrate	Codec	kb/s
---------	-------	------

### Stereo

Very low	xHE-AAC (mono)	from 8
	xHE-AAC	from 16
	HE-AACv2	24
Low	HE-AAC	48
Medium	HE-AAC	96
High	AAC-LC	192
Premium	AAC-LC	320

### Surround

Low	HE-AAC+MPS	64
Medium	HE-AAC+MPS	128
High	AAC-LC+MPS	192
Premium	AAC-LC+MPS	320

This table contains the recommendations for a streaming setup which uses Shoutcast/Icecast transport (see below).

For backwards compatibility to devices which only support MP3 the following table contains the corresponding recommendations. Mind that the categories low and very low are not included, since the degradation in quality would be too high. Therefore, this table should really just be seen as a means to enable compatibility to older devices.

	Codec	kb/s
--	-------	------

### Stereo

medium	MP3	96
high	MP3	192
premium	MP3	320



### 1.3. Transport Schemes

#### 1.3.1. SHOUTcast/Icecast

In terms of transport schemes, SHOUTcast [7] and its open source variation Icecast,[8] are the de-facto standards for Internet radio streaming today and are required as mandatory transport formats in the IMDA Device Automotive Profile 1. Many legacy streams are based on SHOUTcast or Icecast and can be re-used also for automotive streaming as long as the audio codec and bit rates are suitable.

##### 1.3.1.1. HE-AACv2

For the transport of HE-AACv2 streams over SHOUTcast or Icecast, the following settings are mandatory: as container format for HE-AACv2 ADTS [10] has to be used with a HE-AAC frame length of 1024.

The audio codec type is defined in SHOUTcast or Icecast during connection setup through a special content-type field in the so-called Icy Parameters . For HE-AACv2 content-type: audio/aacp must be used.

##### 1.3.1.2. Extended HE-AAC

For Extended HE-AAC Streams, support for LATM/LOAS is mandatory [11, paragraph 1.7] and shall be used as transport stream over Shoutcast/Icecast.

For Shoutcast/Icecast signaling of Extended HE-AAC the special mime type audio/ExtendedHeAac shall be used. This mime type shall be transmitted in the content-type field together with the Icy parameters. content-type: audio/ExtendedHeAac shall be used.

### 1.4. Playlists

The IMDA recommends using the M3U playlist format to support failover between multiple Shoutcast/Icecast servers. This mechanism can also be used to include pre-roll advertisements before Live Streaming commences.

### 1.5. Consider Adaptive Streaming

The IMDA Automotive Device Profile 1 mandates the support for adaptive streaming, notably Apple HTTP Live Streaming and MPEG-DASH on the device side. Accordingly, the IMDA recommends to support these technologies on the content provision side as well, as it considers them to become increasingly important in the future. As the technology matures, we expect to update these guidelines with recommendations for suitable bitrates and provide details about the transport.

### 1.6. Support Service Following

Broadcasters should provide the appropriate metadata allowing Internet Media devices to switch seamlessly between different delivery channels of the same content. This is especially useful in a mobile (e.g., in-car) environment, where the reception quality of broadcast channels as well as data channels tends to vary rapidly.

The IMDA recommends to support Service Following as follows:

- Publish your metadata using the IMDA Service Identification (SI) XML format and associate each deliver channel (transport in the SI document) with its associated station (called brand in the SI



document). This allows a receiving device to group all channels under one single station name, thus implementing a Universal Dial.

- In the same SI document, describe the coverage area of the individual broadcast signals using the `transport/media/stream@physical` XML node attribute. This allows the receiving device to compare its own location with the various coverage areas, thus deducing which signal source has the highest chance to deliver the content in good quality given the device's current location.

In addition, in case that RadioDNS is supported, associate channels with stations using the RadioEPG mechanism.

## 2. Recommendations for on-demand content

### 2.1. General remarks on availability

The IMDA observes an increasing trend towards listening on-demand content. As an example, the monthly usage figures for Germany's SWR3 iPhone application indicate that, compared with live radio listening, the usage of on-demand content such as the 'latest news by one touch of a button' increased around 150% since the publication of the app in 2009.

Accordingly, the IMDA recommends to make programmes available on-demand - ideally, in case that they are not produced live, ahead of their regular broadcast transmission. This procedure greatly enhances a given programme's accessibility in a mobile environment, where it could be prefetched and played back quasi-synchronously with the live programme, thus giving the illusion of a live broadcast.

### 2.2. Modern audio codecs, container and transports

The IMDA recommends to use codecs for on-demand audio as already described for live content, namely HE-AACv2 and its subsets. Again MP3 may be considered as fallback to be compatible with older devices.

The same categories as listed in the tables above apply for on-demand recommendations. Since progressive download is commonly used for on-demand content, the network constraints also influence the playback of on-demand streams. To enable a smooth, gapless playback in a mobile environment the same recommendations as for live content should be applied.

Note that the on-demand container format for each codec is different from its streamed counterpart: for MP3, the MP3 file container is used, whereas for HE-AACv2 and its subsets, the MP4 file format should be used. For audio only the MP4 file name typically ends on ".m4a". The audio files should be made available via the HTTP protocol, allowing the use of progressive downloads.

## 3. Other recommendations regarding Metadata

### 3.1.1. Regarding the IMDA Metadata guidelines

The IMDA publishes the Service Identification for Broadcasters & Aggregators [1] guidelines in an attempt to standardize the industry of Internet Radio, in the first instance, and establish a working framework for future media services.



The Service Identification describes a way for a broadcaster, or media organization, to expose their data in XML form to a hardware or software solution run by a third party. The data from the media organization contains details of itself, its brands and its brands' transport methods.

Not only is this technical information but also editorial information allowing the solution to correctly categorize and expose brands to the audience, and to allow a solution to evaluate appropriateness of brands to criteria supplied where the solution includes some search functionality or automated browsing features.

In order for an organization to make available this data to others, the IMDA recommends the organization to follow the Service Identification specifications included in this document so that common understanding, ease of repurposing and avoidance of publishing data in different formats for different solutions is achieved. This provides benefits for both the media organization and the solution provider.

The following sections highlight a selection of the recommendations made in the document. For further details and many more recommendations, please refer to the document itself.

### **3.1.2. Describe your organization**

Use the organization document to provide organization title, description, logo, location and target area.

Use appropriately formatted images.

The IMDA Service Identification for Broadcasters & Aggregators [1] recommends to provide logos for organizations and stations in various sizes and aspect ratios. For details on recommended and mandatory formats, please refer to the document, specifically to the [organisation|brands/brand]/logos XML node.

### **3.1.3. Describe your stations**

Use the brands document to provide brand title, description, genre, logo and language.

### **3.1.4. Provide location details**

This will help the device to present the station in a geographic context, for example by distinguishing between local, regional, national and international stations.

### **3.1.5. Describe the technical details on how to receive your station**

Use the transports document to provide media type, physical availability, url and audio codec.

### **3.1.6. Include both IP and broadcast sources**

It is possible to describe IP streams as well as other sources for the same signal, such as FM, satellite and digital radio signals. The IMDA recommends associating these signals with coverage areas to support service following as described above.

### **3.1.7. Link your station to other services**

Use the manifest document to provide information on how to map EPG and Podcast sources to the stations described in the brands document.

### **3.1.8. Link EPG information to stations**

Use the IMDA Service Identification for Broadcasters & Aggregators [1] to link your EPG data with their associated stations (called brands in the SI document). This can be accomplished via the manifests XML node of type epg. Please refer to the document for details.



### 3.1.9. Link Podcast content to stations

Use the IMDA Service Identification for Broadcasters & Aggregators [1] to link your podcasts with their associated stations (called brands in the SI document). This can be accomplished via the manifests XML node of type podcast. Please refer to the document for details.

### 3.1.10. Use the IMDA Central Discovery System

The IMDA recommends to use its Central Discovery System (CDS) [5] to notify interested parties about changes made to published metadata. This is especially useful for information that is frequently subject to change, such as EPG and Podcast information.

But the mechanism also greatly improves the chances that updates to logos, station names, stream URLs etc are propagated to a large number of devices in a fast and efficient manner.

Note that the service is free to use for broadcasters and that the CDS is only used to propagate notifications about metadata changes, not the metadata itself. The latter always stays on the broadcaster's servers and is therefore not under the IMDA's control.

## 4. Recommendations on using applications

### 4.1. RadioDNS

The IMDA recommends using the RadioDNS mechanism to support two different applications: RadioVIS and RadioTag.

### 4.2. RadioVIS

Radio functionality is often included in devices with color displays capable of showing texts and images.

The RadioDNS project [2] defines the RadioVIS [3] application which, in conjunction with the RadioDNS linking mechanism, allows the transmission of slideshow images and text to support audio services carried over multiple audio delivery protocols such as VHF/FM and IP.

### 4.3. RadioTAG

The RadioTAG application [4] defines an application for capturing listener interest in what they are hearing on the radio.

The process creates a "tag", a collection of metadata that uniquely references a point in time to a specific audio service on a specific audio device. The generation of the tag would be from user interaction with a device through a simple interface at, or close to, the moment of interest.



### References

- [1] IMDA Service Identification for Broadcasters & Aggregators, <http://www.imdalliance.org/metadata/spec/serviceid/v2.2>
- [2] RadioDNS project  
<http://radiodns.org/>
- [3] RVIS01 V1.0.0 (2009-09), “An application to enhance broadcast audio services with IP-delivered visuals.”, [http://radiodns.org/wp-content/uploads/2009/12/RVIS01\\_1.0.0.pdf](http://radiodns.org/wp-content/uploads/2009/12/RVIS01_1.0.0.pdf)
- [4] RTAG01: Technical Specification, v0.6.1 (2009-06-15).  
<http://radiodns.org/wp-content/uploads/2009/03/rtag011.pdf>
- [5] IMDA Central Discovery System, <http://www.imdalliance.org/central-discovery-system/>
- [6] Standards in a Nutshell “ MPEG-4 high-efficiency AAC coding”, Jürgen Herre, Martin Dietz
- [7] <http://www.shoutcast.com>
- [8] <http://www.icecast.org>
- [9] IMDA Automotive Profile 1, “Internet Radio in the Automobile”
- [10] International Standard Information technology, “Generic coding of moving pictures”, MPEG2 Part7
- [11] International Standard Information technology “Coding of audio-visual objects” Part 3: Audio ISO/IEC 14496-3

### License

The IMDA is publishing this specification under the GNU General Public License version 3 and the GNU Free Documentation License version 1.3. We feel that it is important that access to this is not limited, and allows any organization to make use of it. We have made every effort not to include references to other types of licensed specifications – where this simply hasn't been possible we clearly sign post areas, which you need to pay special attention to.

- GNU General Public License version 3 -

Copyright (C) 2010 Internet Media Device Alliance

This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option) any later version.



## IMDA Guidelines for Broadcasters

This program is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU General Public License for more details.

You should have received a copy of the GNU General Public License along with this program. If not, see <http://www.gnu.org/licenses/>. For questions please contact the Internet Media Device Alliance (IMDA) Program Manager at +1 631 261 5536 or send an email to [info@imdalliance.org](mailto:info@imdalliance.org)

- GNU Free Documentation License version 1.3 -

Copyright (C) 2010 Internet Media Device Alliance

Permission is granted to copy, distribute and/or modify this document under the terms of the GNU Free Documentation License, Version 1.3 or any later version published by the Free Software Foundation; with no Invariant Sections, no Front-Cover Texts, and no Back-Cover Texts. A copy of the full license is available at the following location: <http://www.gnu.org/copyleft/fdl.html>