IMDA-AUTOMOTIVE PROFILE 1, REV 2

Internet Radio in the Automobile
IMDA Automotive Profile 1

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Introduction

This document outlines the Internet Media Device Alliance [IMDA] Automotive Profile 1 specification.

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.

Automotive Profile 1 is the IMDA's baseline Internet Media profile. It defines the minimal set of features of an IMDA-approved Automotive Profile 1 device for Internet radio.

The goal of Automotive Profile 1 is, in line with the IMDA's objectives, to promote greater understanding and adoption of Internet Media Devices and associated technology. To achieve this goal, the IMDA has been careful to be as inclusive as possible both of existing devices and existing broadcast setups.

Automotive Profile 1 does not attempt to describe comprehensively all possible Internet Media Device features and broadcast setups, or even all desirable ones. It is the hope of the IMDA that the inclusive nature of this Profile will encourage its adoption and promote the concept of standards in Internet Media Devices, and that the release of future profiles by the IMDA will help create a feature rich, highly interoperable ecosystem for digital content.

Part 1 of Automotive Profile 1 provides the *mandatory baseline requirements* for Internet radio in the automobile. The initial release of this document focuses on Part 1. To be clear, the initial release of this document is complete regarding Part 1.

Part 2 of Automotive Profile 1 provides *optional baseline features* for Internet radio in the automobile to assure that broadcasters can provide services to listeners in a way that is viable for the broadcaster and provide a substantially enhanced listening experience for Internet radio in the automobile. Part 2 will be outlined in the initial release of this document. Items may be added or deleted from Part 2 as the IMDA try to achieve consensus. A future release will more fully address these topics once industry consensus has been reached. To be clear, the initial release of this document is not complete for Part 2.

1. Part 1: IMDA Baseline Auto Profile Requirements (Mandatory)

An Automotive Profile 1 Internet Radio is a Media Device which can reproduce audio provided via broadcast (terrestrial or satellite) radio, Internet streaming or via file play lists. It therefore needs to be able to connect to broadcast radio transmitters as well as to the internet as an Internet Protocol [IP] connected consumer electronics device or in vehicle device (such as a head unit) that can discover, connect to, decode and play back live Internet Radio broadcasts.

1.1 General

1.1.1 Play audio streams

The device shall be able to receive and play audio streams being transmitted by an Internet radio station.

1.1.2 Play Stereo Streams

The device shall have the capability to play stereo streams either through 2 channels or as a down-mix of the 2 channels.

Devices presenting Mono audio shall down-mix Stereo signals, i.e., must not simply discard one channel.

For testing purposes, the streams provided by the IMDA Certification Stream Test Directory [IMDA Cert] shall be used.

1.1.3 Update Radio Station directory

The device shall be able to maintain a station list and be able to update it, when changes occur.

Note: This can e.g. be done by either updating/maintaining the list locally on the device or by updating/maintaining the list on servers which power the directories for the device.

1.1.4 Playback Playlists

It is common practice amongst Internet Radio broadcasters to use playlists of Streams to support failover between multiple servers and to include pre-roll advertisements before Live Streaming commences.

Automotive Profile 1 compliant devices shall support the playlist formats listed in this section.

The device shall try to play all playable items in a playlist, regardless of playback failure, up to a limit of ten consecutive playback failures is required.

Note: In the certification test requirements, the IMDA will provide a test playlist that will fail 10 times, so this can be confirmed.

Note: Resources referenced in a playlist may themselves be playlists and the devices should be able to interpret them.

1.1.4.1 M3U/pls Playlist

The device shall have the capability to play M3U/pls Playlist streams [IMDA M3U], [IMDA PLS].

For testing purposes, the streams provided by the IMDA Certification Stream Test Directory [IMDA Cert] shall be used.

1.1.4.2 ASX

The device shall have the capability to play all ASX streams [IMDA ASX].

For testing purposes, the streams provided by the IMDA Certification Stream Test Directory [IMDA Cert] shall be used.

1.1.4.3 New line separated list of URLs as plain text

The device shall have the capability to handle all-new-line-separated lists of URLs like a list of plain text streams.

For testing purposes, the lists provided by the IMDA Certification Stream Test Directory [IMDA Cert] shall be used.

1.2 Transport

1.2.1 HTTP

The device shall implement an HTTP client as specified in [HTTP]. The device shall handle HTTP 301 and 302 redirections as described in the HTTP 1.1 specification [HTTP] section 10.3. The device shall attempt to redirect a minimum of 7 times.

Redirection shall be tested using at least the streams provided by IMDA Certification Stream Test Directory [IMDA Cert].

1.2.2 Shoutcast/Icecast

The device shall be able to receive and play an audio stream from Shoutcast/Icecast compatible streaming servers. The exact requirements for interoperability are detailed in Annex A.5, which is therefore mandatory.

1.2.3 Adaptive Streaming over HTTP

1.2.3.1 MPEG-DASH

The device shall have the capability to select and play bit streams that can be dynamically switched using MPEG-DASH protocols [DASH].

Note: A more detailed description of DASH together with further references can be found in Annex A6.

1.2.3.2 Apple HLS

The device shall have the capability to select and play bit streams that can be dynamically switched using Apple HLS protocols.

The HLS specification can be found at [HLS].

1.3 Codecs

1.3.1 MP3

The device shall have the capability to play MPEG-1 Audio Layer [MP3] streams.

For testing purposes, the streams provided by the IMDA Certification Stream Test Directory [IMDA Cert] shall be used.

Note: Signaling of MP3 is defined for Shoutcast/Icecast through the use of mime types. It is done in the content-type field which is transmitted together with the Icy parameters (see A.5.1.1). For MP3 *content-type: audio/mpeg* is used.

1.3.2 Extended HE-AAC bit streams

The device shall have the capability to play Extended HE-AAC streams.

Extended HE-AAC streams include Extended HE-AAC [MPEGD USAC], HE-AAC v2, HE-AAC and AAC-LC (see Definitions in Annex A.1.2).

For testing purposes, the streams provided by the IMDA Certification Stream Test Directory [IMDA Cert] shall be used.

1.3.2.1 HE-AAC, HE-AAC v2 and AAC-LC

Automotive Profile 1 compliant devices shall be able to parse the ADTS bitstream format [Coding of audio-visual objects] [MPEG2 Part7]. They shall implement an HE-AAC decoder capable of handling a frame length of 1024.

Note: The ADTS container is typically used in conjunction with the Shoutcast/Icecast transport protocol to carry live HE-AAC streams.

Note: If Shoutcast/Icecast is used as transport protocol *content-type: audio/aac* is used in the response header during connection setup (see A.5.1.1) to signal AAC-LC, and *content-type: audio/aacp* is used to signal HE-AAC and HE-AACv2 respectively.

In case of HE-AAC v2 a HE-AAC v2 the decoder (see Definitions in Annex A1.2) shall detect its presence and decode it properly.

1.3.2.2 Extended HE-AAC

Support for LATM/LOAS is mandatory ([MPEG4 Audio], paragraph 1.7) and shall be handled by the device, if used as transport stream.

Note: A plain LATM/LOAS stream is used in conjunction with the Shoutcast/Icecast transport protocol to carry live Extended HE-AAC streams.

Note: If Shoutcast/Icecast is used as transport protocol, *content-type: audio/ExtendedHeAac* is used in the response header during connection setup (see A 5.1.1) to signal an Extended HE-AAC stream. Although *audio/ExtendedHeAac* is a special mime type, current Shoutcast/Icecast servers will pass it on to the connected players without change.

1.3.3 Windows Media Audio (WMA) bit streams

The device shall have the capability to play Windows Media Audio [WMA] version 9 streams.

For testing purposes, the streams provided by the IMDA Certification Stream Test Directory [IMDA Cert] shall be used.

Automotive Profile 1 compliant devices shall be able to decode ASF streams [ASF]. (Note: WMA streams are usually delivered in an ASF container.)

Automotive Profile 1 compliant devices shall support playback from Windows Media Servers that support streaming over HTTP.

Devices which do not support RTSP/MMS shall implement Protocol Rollover to negotiate the playback of the stream over HTTP. Specifically, they shall be able to process a stream URL that is prefixed with the MMS moniker (mms://) and negotiate playback of that stream where HTTP streaming is available.

Note: Devices are not required to use HTTP if other preferred transports are available.

Devices should be able to process a stream URL that is prefixed with the MMS moniker (mms://) and negotiate playback of that stream over HTTP where the server supports it.

Note: Support for video streams or Digital Rights Management is not required.

Note: WMA streams are commonly transported in a number of formats, but the IMDA's research indicates that the majority of Windows Media Servers in operation support Protocol Rollover [WMPR], allowing their content to be accessed via HTTP. Windows Media servers use extensions to the HTTP protocol to facilitate this; the extensions are described in Microsoft's Windows Media HTTP Streaming Protocol [WMSP] .

Note: The IMDA acknowledges that the streaming of WMA content over [RTSP] and, less commonly, over the MMS protocol [MMS] is possible. Because of the deprecated status of the MMS protocol and the relative complexity of implementing RTSP, the IMDA feels that neither transport is suitable for inclusion in this Profile.

Recommendation: Some broadcasters use Microsoft's Intelligent Streaming to allow multi-bitrate transmission. The default behavior of devices that do not implement Intelligent Streaming is to play the lowest bitrate stream. It is recommended that the device manufacturers implement Intelligent Streaming to improve the user experience.

2. Part 2: IMDA Baseline Auto Profile optional Features (Recommended)

2.1 Service Following

2.1.1 Objective

Broadcasters would like to assure that the infrastructure in the car for radio assures station following.

Automotive OEMs want to offer devices with optimal functionality while minimizing driver's distraction, e.g. reducing the need to search for radio stations.

Users want to receive broadcast information independently from the bearer, i.e., independently of whether the desired content is transported to the user via analogue/digital broadcast or IP radio. While receiving the desired station, the content shall be reproduced at best audio quality, good continuity and at minimum cost.

Service Following extends the station service area beyond its terrestrial signal by finding the best possible signal. This is done by trading off a number of influencing parameters, depending on the capability of the receiver.

2.1.2 Manual Service Following

In this mode, the receiving device is capable of receiving broadcast radio as well as IP streaming, but does not change from broadcast to IP reception or vice-versa without the user action. The user decides which bearer he wants to select.

The user selects a station in broadcast radio mode if

a) the desired station is in reach via a broadcast radio station (analog or digital broadcast radio) and

b) the reception quality is on an acceptable level

The user selects a station in IP streaming mode if

a) the desired station is not in reach of broadcast radio with desired quality level or

b) the user wants to receive other audio content not distributed over broadcast and

c) the IP station can be received via an internet connection at accepted cost and quality

2.1.3 Automatic Service Following

If a listener enjoys a local station from the terrestrial signal and drives out of the station's service area, the device will automatically start to stream the same service via IP, and vice versa.

Varying time delays due to (e.g.) digital processing, data rates or buffering will need to be taken into account in assuring a smooth transition between different modes of listening. Notification mechanisms will need to be developed for listeners on capped data tariffs from mobile carriers.

Prerequisite for a seamless audio transition between broadcast and IP is that both carry exactly the same audio content.

2.1.4 Constraints to Service Following

This possibility to blend seamlessly between different bearers is limited by the buffering capabilities of the device. It is suggested to support at least 60 seconds of buffering, thus allowing the IP signal or the broadcast signal to be delayed by up to 1 minute.

2.1.5 Automatic Service Following via RadioDNS

In this Service Following mode, the device is considered a Broadcast Radio in the first place. A user would typically expect to receive (terrestrial or satellite) broadcast radio. As such, the audio playback delay is expected to be in line with analog or digital radio devices.

Roaming into and out of the coverage range of a broadcast station the switch occurs e.g. when the car leaves its home location or drives into a shaded region (e.g. tunnel). Service Following is supported to occasionally roam away from broadcast radio into uncovered areas, and eventually returning back. Furthermore it is supported to fill broadcast reception gaps.

In order to maintain the broadcast radio character, the streaming delay shall typically be shorter than in pure IP streaming mode.

To enable service following, a device needs to know the details on how the radio station broadcasts and streams – frequencies, PI/SID codes, stream URLs etc. The primary way of discovering metadata when using RadioDNS is to use the broadcast radio parameters to do a DNS lookup and then contact the broadcaster‘s server directly to retrieve the so-called XSI file. The XSI file is a single XML file which is almost identical in format to the SI file defined in DAB EPG. See ETSI EN 301 700 (V1.1.1 (2000-03) for reference. This file provides information on services (name, description, logo URLs etc), including the bearer (ServiceID) information.

The ServiceID is defined in [RadioEPG] and an example would be id=”dab:ce1.C185.c479.0” mime=”audio/aacp” offset=”3000” cost=”10”/>.

The bearer information defines how the service is carried (FM, DAB, Stream…), the location information (frequency, PI, SID, URL etc) and a time offset to help receivers understand the relative timing shifts.

The complete set of RadioDNS documentation can be found at [RadioDNS].

2.1.6 Automatic Service Following via IMDA

In this Service Following mode, the device is considered an Internet Radio in the first place. A user expects to receive a radio station no matter what media is used to make the content accessible. Priority lies on favorite station reception with minimum disturbance or interruptions. As is the case when dealing with stationary internet radio, the user accepts and is used to typical IP radio delays. Roaming into and out of a home location is normal and broadcast coverage is fading in and out at irregular times due to high mobility. Yet, delivery over broadcast radio is essential to minimize cellular usage in home locations and thus to save cost and cellular data budget.

Thus, a radio device frequently needs to evaluate which bearer it should use in order to get a reliable signal. This decision process can be supported by the broadcaster by specifying the geographic coverage of it terrestrial radio signals as specified in [IMDA SI].

2.1.7 Automatic Service Following via other aggregators

Some OEMs may choose to follow other means to consolidate and update a given Service Following data base. The Service Following principle should however be compliant with the methods outlined above.

2.2 MPEG Surround

2.2.1 Objective

Support MPEG Surround (MPS) as a low bitrate multi-channel extension to the AAC and HE-AAC audio codec [MPEG4 Audio].

2.2.2 Technical Details

2.2.2.1 Description

In [MPEG4 Audio], the extension_payload is defined as a mechanism for the transport of extension data inside AAC payloads. MPEG Surround data [MPEG surround] are transported inside the extension data of type EXT_SAC_DATA. Extension payloads reside inside the downmix AAC elementary stream, which means HE-AAC with MPEG Surround data can be transported in one elementary stream.

IMDA Auto Profile 1 Devices supporting multi-channel via MPEG Surround should be able to decode the full multi-channel Audio Image (MPS-baseline profile Level 4), while IMDA Auto Profile 1 “stereo-only devices” (without MPEG Surround decoders) shall skip the unknown extension data and play the Mono or Stereo downmix.

Rear-seat, headphone-equipped devices could make use of the MPEG Surround binaural headphone mode for multi-channel audio rendering over common stereo headphones (MPS-baseline profile Level 1).

2.2.2.2 Container

Part 1 of this document already states the support for the ADTS container format as for HE-AAC Streams (see 2.4.2), as mandatory.

2.2.2.3 Signaling Format for Shoutcast/Icecast

To maintain compatibility with the existing Shoutcast infrastructure, the same signaling as defined for HE-AAC (see 2.5.2.1) is used here. If MPEG Surround is present in the extension_payload, an HE-AAC decoder (see Definitions in Annex A2.2) which supports MPEG Surround can detect its presence and decode it properly. So no explicit signaling of MPEG Surround is needed.

2.3 Audio Playback of Podcast and On-demand Content

2.3.1 Objective

Media organizations often make their programmes available on-demand. The goal is to provide their listeners with the latest news, radio plays, features or background reports independently of the original broadcast. In addition, “Podcast-only-stations” that don’t offer a live program are enabled to provide their content, too.

It is helpful to differentiate between two different types of downloadable content, as each type should be treated differently, both technically as well as in terms of its presentation on the device:

2.3.1.1 Transient Audio-on-Demand content

These are short-lived items which are replaced by constantly recurring updates of the same category – such as the latest weather forecast, traffic bulletin or news bulletin. From a listener’s point of view, these short audio segments help to get a quick update on what’s currently happening or has recently happened. Technically, this means that the device only needs to reference the latest version of the respective audio-on-demand file.

2.3.1.2 Persistent Audio-on-Demand content

These are long-lived items such as radio plays, features, educational podcasts and background features whose interest value does not expire, or only expires gradually over time. Technically, this means that the device should present several (or even all) episodes of the associated programme, e.g. by referencing a podcast feed.

2.3.2 Technical Details

2.3.2.1 MP3 Container

No special container format is necessary for mp3 content.

2.3.2.2 MPEG4 Container

The ISO Base Media File Format [MPEG4 Part12] can be used for on-demand content, which is encoded as AAC-LC, HE-AAC or HE-AACv2. Hence, Automotive Profile 1 compliant devices with on-demand functionality should be able to handle ISO Base Media File Format.

2.4 Media Player Support

2.4.1 Objective

The goal is to provide to compliant devices the capability to playback content from the existing ecosystem of DLNA certified server devices (Digital Media Player, DMP, profile according to December 2011 DLNA Guidelines), as well as the capability to be controlled by DLNA certified controller devices (Digital Media Renderer, DMR, profile according to December 2011 DLNA Guidelines). In the first case, listeners will be able to seamlessly discover, and browse their audio content available in their home network.

In the second case, listeners will be able to control their Device through their mobile phone or tablet computers.

3. Automotive Device Profile 1 Capability Classes

Automotive Device Profile 1 defines three different capability classes, linked to devices which are predominantly used in the consumer or automotive space.

3.1.1 Automotive Device Profile 1 Capability Class A

A vehicle equipped with an automotive device class A supports all the mandatory base line requirements of Automotive Device Profile 1. It is capable of receiving broadcast radio as well as IP Radio, supports all required codecs as well as dynamic streaming and can play music from playlists. Broadcast radio may be FM and/or AM, DAB, HD Radio, DRM, satellite radio, etc… IP streaming is supported via internet access, in a mobile environment typically via cellular network. Playlists are reproduced from files provided to a player either via local storage device and/or via cellular network.

These devices are sometimes referred to as “Hybrid Radios”.

When restricted to capability class A, the transition between operation modes happens under manual control. Accordingly, automatic bearer selection is not supported, neither via RadioDNS nor via IMDA-SI. Automatic Service Following as described above is thus not supported either.

Devices of Class A may be portable phones, PDAs or tablet PCs which are primarily intended for stationary use but which are temporarily connected to a car e.g. via Bluetooth.

3.1.2 Automotive Device Profile 1 Capability Class B

A vehicle equipped with an automotive device class B is capable of everything defined for Class A, i.e., it supports Auto Profile 1 mandatory features. In addition, it supports Automatic Service following. Typical Class B devices use the RadioDNS-based Service Following, making use of the SI and PI information received through the broadcast channel to lookup the URL for IP streams to bridge broadcast radio reception (see 2.1.5).

A Capability Class B device links the received broadcast channel to internet URLs to retrieve additional information and/or to switch audio over to IP streaming, applying DNS lookup.

Optionally, Class B devices may seek to minimize delay before blending between signals through suitable time alignment methods e.g. through audio wave matching and/or RadioDNS offset information.

Class B has only limited support for mobility, i.e., would not be expected to use the DASH protocol, GPS location to match its own position to broadcasters' reception area polygons or utilize the full set of information provided by IMDA-SI.

Typically, feature-rich portable devices or low-/mid tier automotive market segments would be Class B devices.

3.1.3 Automotive Device Profile 1 Capability Class C

A vehicle equipped with a Class C automotive device is capable of everything defined for Class B. In addition it supports Automatic Service Following via IMDA (see 2.1.6) and thus comprises mobility support as required for higher end automotive applications.

A Class C device links received broadcast channels to internet streams but also finds broadcast streams linked to a received IP stream, using the following methods:

- matching wave forms of received IP streams to local broadcast streams in reach and/or
- matching its own geolocation to broadcasters' coverage areas outlined via polygons.

4. Glossary

Adaptive Streaming over HTTP: *Description of technologies which allow adaptive streaming for the delivery of the best possible audio quality at any given bit rate under varying network conditions.*

Audio Interface: *Wired and/or wireless audio output, e.g. audio jack, A2DP Bluetooth, proprietary connections*

CBR: *Constant Bitrate: During analogue to digital encoding or during conversion of one previously encoded file to another codec encoded file the bit rate represents the amount of data stored about the audio per each time unit. Bit rate is measured in number of bits per second - bps, in audio codecs this is usually at the thousands of bits (kilo-bits) per second rate: kbps, or higher. The bit rate is affected by the sampling rate (see) of the input signal, the codec's internal encoding algorithms and the compression within a codec's algorithm. There are also variable bit-rate and constant bit-rate versions of some codecs. Most common are constant bit-rate codecs where consumption of the data by a decoder is handled in a constant rate, variable means that the consumption happens in varying rates*

Container: *Container is a wrapper format which defines the way data is stored/streamed where as it does not specify or imply on the data themselves. Container is used to identify and package (or interleave) different data types.*

DASH: *Dynamic Adaptive Streaming over HTTP.*

Internet Radio Station: *An audio Live Stream provided by a broadcaster.*

Live Stream: *A Stream whose content is encoded / generated in real time and made available immediately or with a (usually but not necessarily) fixed time delay.*

Playlist: *In general Playlist is a list of songs or streams and the list is governed by certain pre-defined framework. In the context of this document Playlist is a list of Stream/Live stream.*

Standard vocabulary: *(e.g. must, should, may) used by IETF and also other standardization organisations: http://www.ietf.org/rfc/rfc2119.txt*

Stream: *An IP delivered byte stream that encodes audio content using a codec, possibly packaged in a container, access to which may need to be negotiated by some protocol.*

Universal Dial*: The ability of a receiver or system to store a single set of radio presets that is agnostic to the band/tuner/source of the radio service. In other words, the user can select any radio station or channel and set it as a "favorite" (up to the total capacity of presets offered by a given receiver/system), from any Terrestrial, Satellite or Internet Radio source that the receiver/system can access, whereupon all such selected stations/services will be collected by the receiver/system and displayed for later selection on a single "Presets" or "Favorites" screen.*

5. References

[ASF] Advanced Systems Format http://www.microsoft.com/en-us/download/details.aspx?id=14995

[DASH] ISO/IEC 23009-1:2012, "Information technology — Dynamic adaptive streaming over HTTP (DASH) — Part 1: Media presentation description and segment formats", http://standards.iso.org/ittf/PubliclyAvailableStandards/c057623_ISO_IEC_23009-1_2012.zip

[HE-AAC] Standards in a Nutshell "MPEG-4 high-efficiency AAC coding", Jürgen Herre, Martin Dietz

[HLS] http://tools.ietf.org/html/draft-pantos-http-live-streaming-08

[HTTP] HTTP: Hyper Text Transfer Protocol: IETF RFC2616. http://www.ietf.org/rfc/rfc2616.txt

[ICECAST] http://www.icecast.org/

[IMDA] Internet Media Device Alliance: http://www.imdalliance.org/

[IMDA ASX] http://www.imdalliance.org/file-formats/playlist-definitions/

[IMDA Cert] IMDA Certification Stream Test Directory. Document is available to members via: http://www.imdalliance.org/contact/

[IMDA SI] IMDA Service Identification for Broadcasters and Aggregators, http://www.imdalliance.org/metadata/spec/serviceid/v2.2/

[IMDA M3U] M3U: http://www.imdalliance.org/file-formats/playlist-definitions/

[IMDA PLS] http://www.imdalliance.org/file-formats/playlist-definitions/

[IP] Internet Protocol version 4: IETF RFC791. http://www.ietf.org/rfc/rfc791.txt

[MMS] http://msdn.microsoft.com/en-gb/library/cc234711(PROT.10).aspx

[MP3] MPEG-1/2 Layer III: ISO/IEC 11172-3 (MPEG-1); ISO/IEC 13818-3 (MPEG-2)

[MPEG2 Part7] International Standard Information technology "Generic coding of moving pictures

[MPEG4 Audio] International Standard Information technology "Coding of audio-visual objects" Part 3: Audio ISO/IEC 14496-3

[MPEG4 Part12] International Standard Information technology "Coding of audio-visual objects" Part 12: ISO base media file format; ISO/IEC 14496-12

[MPEG Surround] http://www.mpegsurround.com/

[MPEGD USAC] International Standard ISO/IEC 23003-3:2012 "Information Technology – MPEG audio technologies – Part 3: Unified speech and audio coding"

[RadioDNS]	RadioDNS documentation, http://radiodns.org/documentation/
[RadioEPG]	REPG01 V1.0.0, http://radiodns.org/wp-content/uploads/2012/04/REPG01-1.0.0.pdf
[RTSP]	Realtime Streaming Protocol: IETF RFC2326. http://www.ietf.org/rfc/rfc2326.txt
[WMA]	http://msdn.microsoft.com/en-us/library/dd443195(VS.85).aspx
[WMPR]	About protocol rollover, Microsoft Technet: http://technet.microsoft.com/en-us/library/cc771761.aspx
[WMSP]	http://msdn.microsoft.com/en-us/library/cc251060.aspx
[XML]	Extensible Markup Language http://www.w3.org/XML/

Annex A – Supplemental Information

A.1 HE-AAC

The ISO HE-AAC standard has been widely adopted by digital radio and TV broadcasting systems around the world including DVB, DAB+, DMB (France), ATSC-MH and ISDB-Tmm/Tsb as well as ISDB-T in South America. It was selected by 3GPP for mobile multimedia streaming services and is part of the DLNA specification. HE-AAC is supported by a large number of software players including Flash and WMP 12, QuickTime and Winamp. HE-AAC encoders are widely available from many different hard- and software providers. Device supports includes digital radio and TV receivers, Internet radios, gaming consoles, mobile phones, DTVs and STBs.

A.1.1 Terms of Licensing

The AAC family of patents is licensed by the patent pool administrator VIA Licensing, Inc. and the terms and pricing are publicly available on their website: http://www.vialicensing.com/index.aspx . All AAC variants listed in this specification are available under one license for the same price. Since AAC is an ISO standard, optimized encoder and decoder software implementations are available from various vendors or alternatively, a reference decoder is available from ISO.

A.1.2 Definitions

Definitions relating to the above used terminology of the ISO/IEC standards [MPEG4 Audio] and [MPEG2 Part7]: In the ISO/IEC Standards, Audio Object Types (AOTs) are typically used to distinguish between the different audio codecs within MPEG-4. In addition, [MPEG4 Audio] defines different Profiles and Levels, which describe the used codec subset and its complexity. The HE-AAC streams, as mentioned above, refer to the High Efficiency AAC v2 Profile Level 6 as defined in [MPEG4 Audio], which contains the Audio Object Types 2, 5 and 29, i.e., AAC-LC, HE-AAC and HE-AAC v2.

For a good summary of the HE-AAC standard please refer to [HE-AAC].

A.2 MPEG Surround

MPS has been adopted by various broadcasting standards including DAB, DAB+, DRM+, Korean T-DMB, French DMB, DVB and the new Japanese ISDB-Tmm/Tsb system. Application standard bodies such as the Open IPTV Forum, ATIS and DLNA have also selected it.

A.2.1 Terms of Licensing

The MPEG Surround family of patents is licensed by the patent pool administrator VIA Licensing, Inc. and the terms and pricing are publicly available on their website: http://www.vialicensing.com/licensing/mpegsurround-overview.aspx. Since MPEG Surround is an ISO standard, optimized encoder and decoder software implementations are available from various vendors or alternatively, a reference decoder is available from ISO.

A.2.2 Definitions

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A.3 Extended HE-AAC

Extended HE-AAC is a new member of 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 standardized Extended HE-AAC decoder has to be able to decode regular HE-AACv2 bit streams as well as new Extended HE-AAC bit streams. In a moving vehicle that's typically connected to the Internet under extremely constraint network conditions, this state-of-the-art audio codec is recommended to ensure a high quality of service for radio talk and music programs.

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. Decoder complexity is comparable to HE-AACv2; meaning current chip generations are capable of decoding without increased CPU load. Extended HE-AAC makes Internet radio receivers future-proof and compatible with the majority of current mobile streams at the same time.

A.3.1 Definitions

The Extended HE-AAC streams, as mentioned above, refer to the Extended High Efficiency AAC Profile Level 2 as defined in [MPEGD USAC], which contains the Audio Object Types 2, 5, 29, and 42, i.e., AAC-LC, HE-AAC, HE-AAC v2, and Baseline USAC.

A.4 Shoutcast/Icecast Protocol Requirements

An Automotive Profile 1 Internet Media Device shall support the Shoutcast/Icecast protocol. Because of the lack of formal references describing both protocols, this Annex has been added to define the requirements for Automotive Profile 1 compliant Devices.

A.4.1 Client Requirements

Streaming from Shoutcast or Icecast Servers is negotiated over HTTP (version 1.0 or later) [HTTP]. A Client shall support HTTP GET requests to access a Shoutcast/Icecast stream.

A.4.1.1 Shoutcast or Shoutcast-compatibility mode of Icecast

This subpart describes the protocol used by Shoutcast or by Icecast, if operated in Shoutcast-compatibility mode. After an initial GET request by the client the Shoutcast or Icecast Server responds with a custom http message followed by the audio data in case of a successful connection attempt. The GET request has to supply a 'User-Agent' that does not begin with 'Mozilla'.

For a successful connection attempt the response of the Shoutcast/Icecast server will contain

ICY 200 OK\r\n

as the first line, rather than

HTTP/1.x 200 OK\r\n

as common for HTTP. After the first line the header contains a set of ICY parameters as key-value pairs. An important parameter is the content-type, which specifies the used audio codec. This content-type shall be used by the device to select the appropriate decoder for the stream.

Content-Type:audio/mpeg\r\n , for example, signals the use of MP3 or MP3 Surround. The other ICY parameters provide additional information about the radio station, for example it's name, the url, the streamed bitrate or the interval for the title information, if requested by the client (see A.5.1.4). The parsing of those parameters is optional whereas the content-Type has to be parsed to determine, which decoder to use. All parameters fill their own line in the header, which ends on *\r\n*. The header is finalized by an additional newline

\r\n

The encoded audio data is sent right after the header. A device should enter a receiving loop after parsing the header and setting up the decoder chain.

Note: The ICY parameters together with the content type value are not set by the Shoutcast/Icecast server itself. The source sets those values and passes them to the server during its own connection setup and the server just passes on those values as it passes on the encoded data stream.

A.4.1.2 Icecast

Many Internet Radios are streamed using the Icecast Protocol which is not fully compatible with Shoutcast. The Icecast2 Server [ICECAST] uses this protocol, if not configured in Shoutcast-compatibility mode. During the initial GET request by the client a specific Icecast mount point can be accessed.

The Icecast server will answer this request with

HTTP/1.0 200 OK\r\n

if successful. Thus an Automotive Profile 1 compliant Device has to parse the first line of the response for both *ICY 200 OK\r\n* and *HTTP/1.0 200 OK\r\n* to support both Shoutcast and Icecast.

Other than that the requirements of part A.5.1.1 also apply for Icecast streams.

A.4.1.3 Buffering

After a successful connection a Shoutcast/Icecast server will send an initial amount of data in a burst, so the client is able to fill its internal buffers. This makes it possible to cope with varying network conditions.

Especially in the moving car environment it is important to design this buffer big enough. With Shoutcast/Icecast around 10 seconds of audio can be buffered in the beginning, which helps with a smooth playback.

A.4.1.4 Metadata

The server itself normally does no manipulations on the data stream and just passes it on to the connected clients. Only if a client requests it, will metadata periodically be inserted.

A client would typically request metadata to get the current artist and title. The request consists of the line

Icy-MetaData: 1\r\n

in contrast to

Icy-MetaData: 0\r\n

in the initial Get request. If the client requests metadata, he has to parse an additional field in the ICY parameters of the response header, which is *icy-metaint* followed by the number of bytes till the next inserted Metadata. The client is then responsible to parse and remove the metadata before passing the received data stream to the decoder. Details on the format of the metadata can be found at [SHOUTCAST].

A.5 MPEG-DASH

MPEG DASH is a very flexible, codec agnostic solution, which can be applied to many application scenarios for live and on-demand streaming. In the context of Internet radio streaming to cars, the IMDA recommends MPEG DASH in combination with the HE-AACv2 codec for best possible audio quality under varying network conditions.

The server for an MPEG DASH service may be a plain HTTP server [HTTP]. This avoids NAT and firewall traversal issues and allows the reuse of existing infrastructure (server, proxies, CDN). The control of the streaming session lies entirely on the client side, thus giving it full control over the used bandwidth and allowing scalability on the server side.

A.5.1 Media Presentation Description

A Media Presentation Description (MPD) is used to provide all required information for a streaming service to the client. It uses XML [XML] to provide a manifest of the available content and its various alternatives. Contained are the URL addresses of the actual media segments and other characteristics of the media stream.

In [DASH] chapter 8 different profiles, which define restrictions on the MPD and the Segment formats, are described. An Automotive Profile 1 compliant device shall be able to parse an MPD, which conforms to *the ISO Base media file format live profile* as defined in 8.4 of [DASH]. It shall also be able to receive and play segments as defined within the same profile.

A.5.2 Container

The media stream consists of one segment or a sequence of segments. As defined in *ISO Base media file format live profile* the format of those segments is based on the ISO Base Media File Format as described in [MPEG4 Part12]. An Automotive Profile 1 compliant device must implement [MPEG4 Part 12].

A.5.3 Transport

An Automotive Profile 1 compliant device also has to implement an HTTP client as specified in [HTTP] both to access the MPD and to download the media segments.

A.6 Revision History

This section describes the revision history for this Profile. MP3 Surround was in IMDA-Automotive Profile 1, Revision 1. In Revision 2, we have removed this codec from the Profile.

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