FAST FACTS

HE-AAC - THE CODEC OF CHOICE FOR BROADCAST AND STREAMING

MPEG HE-AAC (High Efficiency Advanced Audio Coding) has become one of the most important enabling technologies for state-of-the-art multimedia systems. Thanks to its unique combination of high-quality audio at low bit rates and audio-specific metadata support, it is the perfect audio solution especially over channels with limited capacity, such as those in broadcasting or for new adaptive streaming standards such as MPEG-DASH.

Ten facts about HE-AAC:

1. HE-AAC is the world's **most efficient** high-quality multi-channel and stereo audio codec.
2. HE-AAC is deployed in more than **6 billion devices.**
3. HE-AAC is the **globally established broadcast audio codec.**
4. HE-AAC is the de-facto **standard for streaming** services.
5. HE-AAC is fully **supported by an end-to-end ecosystem** for content delivery.
6. HE-AAC is a **multi-channel** codec.
7. HE-AAC supports the full set of DVB/MPEG **metadata.**
8. HE-AAC is future-proof through **continuous innovation.**
9. HE-AAC can be licensed through a stable and transparent **licensing program.** administered by Via Licensing.
10. Fraunhofer IIS - main driver of the AAC ecosystem and a **premiere source for product-ready implementations**

Fraunhofer Institute for
Integrated Circuits IIS

Director
Prof. Dr.-Ing. Albert Heuberger
Am Wolfsmantel 33
91058 Erlangen
www.iis.fraunhofer.de

Contact
Matthias Rose
Phone +49 9131 776-6175
matthias.rose@iis.fraunhofer.de

Fraunhofer USA, Inc.
Digital Media Technologies*
100 Century Court
Suite 504
San Jose, California 95112
www.dmt.fraunhofer.org
Contact
Phone +1 408 573 9900
codecs@dmt.fraunhofer.org

* Fraunhofer USA Digital Media Techno-
logies, a division of Fraunhofer USA, Inc.,
promotes and supports the products of
Fraunhofer IIS in the U. S.

1. HE-AAC is the world's most efficient high-quality multi-channel and stereo audio codec

HE-AAC's combination of high audio quality and very low bit rates makes it one of the key enabling technologies for state-of-the-art multimedia systems. HE-AAC's efficiency enables it to deliver the same audio quality at one-half or one-third the bit rate of other codecs. For example, it can provide high-quality stereo audio at bit rates as low as 32 kbit/s but also scale up to full transparency when required. The excellent multi-channel audio performance of HE-AAC was confirmed by an extensive, independent listening test conducted by the European Broadcast Union (EBU) that resulted in the "broadcast quality" label at only 160 kbit/s.

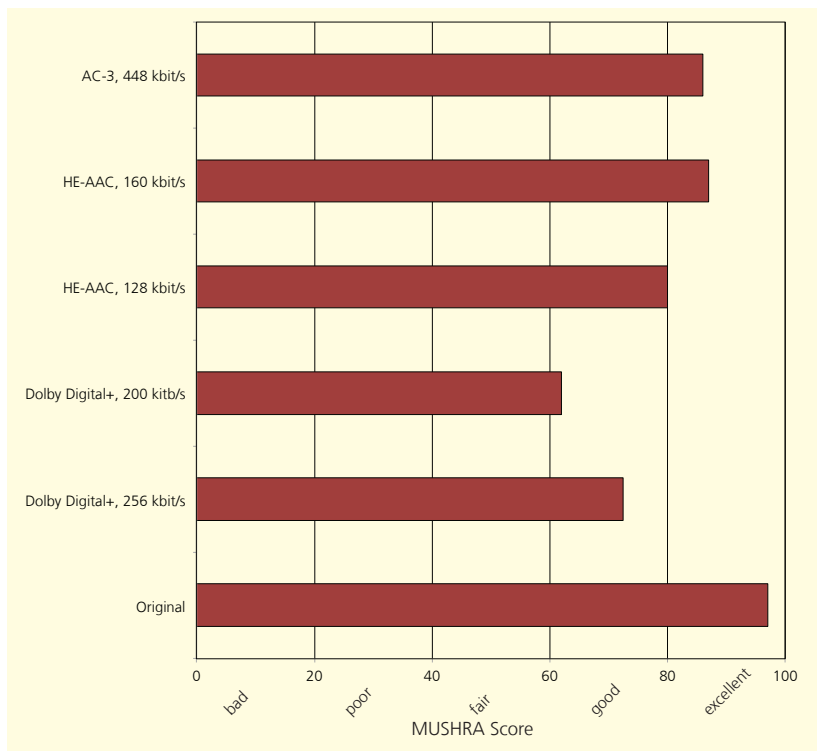*HE-AAC sets the industry benchmark for high-quality audio at low bit-rates.*

Figure 1: "For bitrates equal and higher than 160 kbit/s, the average of all ten test items was found to be in the region of 'Excellent'. This means that the mean value of HE-AAC is similar to the mean value of the above mentioned codecs operating at almost 3 times higher bitrate!" (EBU evaluation of multi-channel audio codecs; EBU tech 3324; EBU, Geneva, Sept 2007, p.25. http://tech.ebu.ch/docs/tech/tech3324.pdf)

HE-AAC and HE-AACv2 are members of the AAC family of codecs. The basic MPEG-4 AAC codec is commonly referred to as AAC-LC (AAC Low Complexity). The combination of AAC-LC with the Spectral Band Replication (SBR) tool is defined in the "High Efficiency AAC profile" (HE-AAC profile). The SBR tool improves the coding efficiency significantly and extends the usable bit rate range to unprecedented low bit rates. For a further increase of coding efficiency, HE-AAC can be combined with the Parametric Stereo (PS) tool as defined in the "High Efficiency AAC v2 Profile" (HE-AAC v2 profile), which is now the most commonly used profile. The AAC profiles are backwards compatible: for example, an HE-AAC v2 decoder can decode AAC-LC, HE-AAC and HE-AAC v2 bit streams. The same holds true for the encoder.

2. HE-AAC is deployed in more than 6 billion devices

HE-AAC is an established and proven technology. It is the predominant codec in most broadcast and streaming systems, which is why more than 6 billion devices support HE-AAC – from consumer electronics to professional broadcast equipment.

Services, platforms and devices with support for HE-AAC include iOS, Android, Windows Phone, Symbian, Blackberry, Windows 7/8, Mac OS, IE9, IE10, Safari, Chrome, Flash, Windows Media Player, Winamp, iTunes, smart phones, tablets, TVs, BluRay players, set-top boxes, game consoles, digital radios, etc.

Fraunhofer HE-AAC software is natively supported on devices running Android 4.1 or later: "Fraunhofer's FDK AAC code provides a complete, high-quality audio solution to Android users. Fraunhofer not only contributes codec code, but also the audio systems knowledge and decades of experience as the primary AAC and MP3 inventor." (Source: Google, Inc.)

HE-AAC is in almost all devices, from professional equipment to consumer electronics.

3. HE-AAC is the globally established broadcast audio codec

HE-AAC is widely established in state-of-the-art TV and radio broadcast systems around the globe. Additionally, HE-AAC is an established part of the Smart TV environment.

HE-AACv2 is used worldwide in mobile or fixed digital TV:
It is part of the DVB toolbox (for example, used in Great Britain, France, Irleand, Norway, Denmark, Portugal, Vietnam, New Zealand, Australia, Ghana …), ATSC-Mobile DTV Standard, ARIB ISDB-Tmm (Japan), SBTVD (South America), T-DMB (for example Korea), and HbbTV for connected TVs.

HE-AACv2 is used worldwide in digital radio:
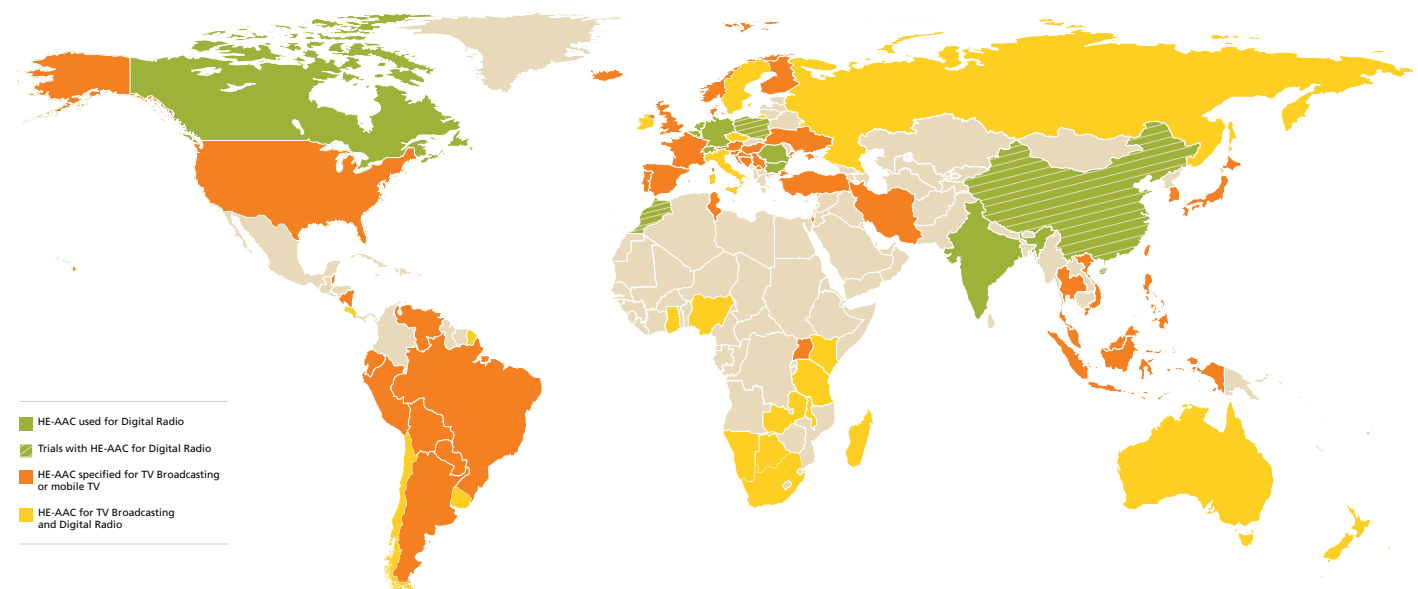DAB+, DRM Digital Radio Mondiale, ARIB ISDB-Tsb (Japan), and satellite radio

HE-AAC is used in radio, TV and hybrid broadcasting services.

Legend:
- HE-AAC used for Digital Radio
- Trials with HE-AAC for Digital Radio
- HE-AAC specified for TV Broadcasting or mobile TV
- HE-AAC for TV Broadcasting and Digital Radio

Figure 2. HE-AAC – The audio codec of choice for digital broadcasting.

4. HE-AAC is the de-facto standard for streaming services

HE-AAC is used worldwide in the most successful streaming services and supported by all major streaming and media platforms. For multi-screen delivery with adaptive streaming systems, HE-AAC is the perfect choice as its encoding efficiency allows for seamless bit rate switching as well as the streaming of surround sound without the need to switch to stereo when bandwidth becomes constrained. Consequently, HE-AACv2 is the mandatory stereo and optional multi-channel codec in the DASH-AVC/264 implementation guidelines.

HE-AAC is supported by all major streaming and media platforms.

HE-AAC-powered streaming services include Netflix, YouTube, BBC iPlayer, Hulu, Amazon video on demand, Pandora, Google Play, China Mobile, KDDI and many more.

HE-AAC is mandatory for stereo and multichannel in the specifications of the Open IPTV Forum and HbbTV. The Alliance for Telecommunication Industry Solutions ATIS-0800013 specifies HE-AACv2 for IPTV services. In UltraViolet AAC is mandatory for stereo and one of the optional multi-channel codecs. AAC is also the mandatory audio codec in DLNA.

Established HTTP streaming systems such as MPEG-DASH, Apple HLS, Microsoft Smooth Streaming and Adobe Dynamic Streaming fully support HE-AAC. AAC-LC is a mandatory requirement for content streamed to iOS devices using HLS.

5. HE-AAC is fully supported by an end-to-end ecosystem for content delivery

HE-AAC is supported by virtually every leading streaming/broadcast equipment vendor. Examples include Harmonic, Ericsson, Elemental, Digital Rapids, NEC, Envivio, Rovi, Orban, and Thomson. More than six billion playback devices already deployed in the market ensure that HE-AAC encoded content plays almost everywhere. Due to its widespread use, it is possible for HE-AAC to be easily integrated into existing production and distribution chains without great effort.

All major device manufacturers have already integrated HE-AAC.

6. HE-AAC is a multi-channel codec

HE-AAC supports any channel configuration from mono to up to 48 channels, including stereo, 5.1 and 7.1 surround. Playback of surround sound is natively supported by all leading operating systems (Win 7/8, Mac OS, Android, iOS), HTML 5 browsers (IE9, IE10, Safari, Chrome), and many consumer electronics devices, such as set-top boxes or digital TV sets.
With Fraunhofer Cingo, surround sound can also be played back over headphones or stereo speakers of mobile devices. For more information about Cingo, please visit www.fraunhofer-cingo.com.

HE-AAC is one of the worldwide leading surround audio codecs.

7. HE-AAC supports the full set of DVB/MPEG metadata

HE-AAC supports all commonly used metadata parameters, including loudness norma-lization, dynamic range control and downmixing. Fraunhofer IIS offers HE-AAC encoder and decoder implementations which support the standardized metadata. In addition, Fraunhofer IIS provides dedicated solutions for metadata creation and transcoding.

8. HE-AAC is future-proof through continuous innovation

HE-AAC is highly flexible. For example, it offers an ancillary data field enabling the transmission of additional data together with the audio signal. In the future, this might enable the creation of enhanced services, such as the improvement of speech intelligibility in broadcast transmissions.

Enhanced new services can easily be implemented through the ancillary data field of HE-AAC.

Figure 3: Dialog Enhancement allows for an individual adjustment of the balance between dialog and ambient volume.

9. HE-AAC can be licensed through a stable and transparent licensing program administered by Via Licensing

HE-AAC is an open MPEG standard, and many different companies and organizations participated in the technical development and standardization process. A patent licensing program is administered by Via Licensing Corporation.

Andrew Fischer, Director, Licensing Programs, Via Licensing Corporation:
„Under the AAC Patent Licensing Program administered by Via Licensing, licenses from multiple patent holders to the essential patents needed to practice a variety of ‚flavors‘ of AAC are granted under a single agreement. This includes AAC-LC, HE-AAC, HE-AACv2 and AAC-ELD – a low-latency version of AAC. Once licensed under the AAC Patent Licen-se Agreement, no additional agreements or extra fees are necessary from Via for licensees to implement any of the above AAC technologies in any combination."

For further information about the AAC patent licensing program, please contact Via Licensing at www.vialicensing.com.

10. Fraunhofer IIS - main driver of the AAC ecosystem and a premiere source for product-ready implementations

HE-AAC is an open standard with widely available encoder and decoder implementations and chip-sets. Fraunhofer IIS is an active member of MPEG with involvement in all AAC-related standardization activities, including 3GPP, AES, ARIB, ATSC, SCTE, DLNA, DVB, DASH-IF, EBU, GSMA, HbbTV, HDMI, IEC, IMDA, WiFi Alliance, and WorldDMB. Fraunhofer offers fast access to high-quality, product-ready HE-AAC implementations. Optimized encoder and decoder real-time implementations on embedded processors and DSPs are available, as well as software implementations for PC platforms. These implementations also include broadcast metadata support and DASH mp4 fragmentation for seamless switching.

HE-AAC is an open standard with widely available implementations.

ABOUT FRAUNHOFER IIS

Fraunhofer IIS, based in Erlangen, Germany, is the home of the Audio and Multimedia division, which has been working in audio coding technology for more than 25 years and remains a leading innovator of technologies for cutting-edge multimedia systems. Fraunhofer IIS is universally credited with the development of mp3 and co-development of the AAC family of audio codecs.

Through the course of more than two decades, Fraunhofer IIS has licensed its audio codec software and application-specific customizations to at least 1,000 companies. Fraunhofer estimates that it has enabled more than 6 billion commercial products worldwide using its mp3, AAC and other media technologies.

The Fraunhofer IIS organization is part of Fraunhofer-Gesellschaft, based in Munich, Germany. Fraunhofer-Gesellschaft is Europe's largest applied research organization and is partly funded by the German government. With more than 22,000 employees worldwide, Fraunhofer-Gesellschaft is composed of 66 Institutes conducting research in a broad range of research areas. For more information, contact Matthias Rose, matthias.rose@iis.fraunhofer.de, or visit www.iis.fraunhofer.de/amm.