Formats

Professional Audio Ethernet AVB
Functional and Interoperability Specification

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Avnu Alliance

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Table of Contents

1. Introduction

Professional Audio use cases require the Ethernet-AVB network to transport a common media format.

2. References

Name	*Reference*
AVTP	IEEE 1722-2016, “IEEE Standard for a Transport Protocol for Time-Sensitive Applications in Bridged Local Area Networks”.
AVDECC	IEEE 1722.1-2013, “IEEE Standard for Device Discovery, Connection Management, and Control Protocol for IEEE 1722 Based Devices”.

3. Glossary

Term	*Meaning*
PAAD	A professional audio device with Ethernet AVB functionality compliant to this specification.
Standard-Stream-Format	A format type specified in this document.
HC32-Stream-Format	A format type specified in this document.
HC24-Stream-Format	A format type specified in this document.
AAF	AVTP Audio Format, as defined in AVTP, clause 7.
PAAD Talker	A PAAD capable of sending an AAF Media Stream.
PAAD Listener	A PAAD capable of receiving an AAF Media Stream.
Format	The combination of samples per frame, channels per frame, sample rate, bit depth.
Format Type	A set of formats with common bit depth and a common maximum number of channels per frame.

4. Scope

The intent of this document is to define a minimum set of formats for PAAD interoperability.

5. Format Types

5.1. Standard Formats

The Standard-Stream-Format Type is designed to achieve interoperability between all PAADs.

The Standard-Stream-Format is AAF, as defined in AVTP [AVTP, clause 7.3.2], with the following parameters:

- data encapsulation = PCM
- bit depth = 32-bit
- sample rate = SR, where SR is an element from {48 kHz, 96 kHz, 192 kHz}
- number of channels = N, where N is an element from {1, 2, 4, 6, 8}
- Each PDU shall contain NS audio samples per channel and 1 timestamp (normal timestamp mode, not sparse), where
  NS = 6 for SR = 48 kHz,
  NS = 12 for SR = 96 kHz,
  NS = 24 for SR = 192 kHz.

Table 1 below summarizes the possible parameter combinations for the Standard-Stream-Format Type.

Data encapsulation	PCM		
Format	AAF		
Bit depth	32		
Number of channels	1, 2, 4, 6, 8		
Sample rate	48 kHz	96 kHz	192 kHz
Samples per PDU	6	12	24

Table 1: Standard Formats

5.2. High Capacity 32bit Formats (HC32)

The HC32-Stream-Format is designed to enable the transport of high channel count streams with efficient CPU utilization.

The HC32-Stream-Format is AAF, as defined in AVTP [AVTP, clause 7.3.2], with the following parameters:

- data encapsulation = PCM
- bit depth = 32-bit
- sample rate = SR, where SR is an element from {48 kHz, 96 kHz}
- number of channels = N, where N is an element from
  {16, 24, 32, 40, 48, 56} for SR = 48 kHz,
  {16, 24} for SR = 96 kHz.
- Each PDU shall contain NS audio samples per channel and 1 timestamp (normal timestamp mode, not sparse), where
  NS = 6 for SR = 48 kHz,
  NS = 12 for SR = 96 kHz.

Table 2 below summarizes the possible parameter combinations for the HC32-Stream-Format Type.

Data encapsulation	PCM	
Format	AAF	
Bit depth	32	
Number of channels	16, 24, 32, 40, 48, 56	16, 24
Sample rate	48 kHz	96 kHz
Samples per PDU	6	12

Table 2: High Capacity 32bit Formats

Note: This specification does not define a HC32-Stream-Format with a sample rate of 192 kHz.

5.3. High Capacity 24bit Formats (HC24)

The HC24-Stream-Format is designed to enable the transport of high channel count streams with low bandwidth utilization.

The HC24-Stream-Format is AAF, as defined in AVTP [AVTP, clause 7.3.2], with the following parameters:

- data encapsulation = PCM

- bit depth = 24-bit
- sample rate = SR, where SR is an element from {48 kHz, 96 kHz, 192 kHz}
- number of channels = N, where N is an element from
  {1, 2, 4, 6, 8, 16, 24, 32, 40, 48, 56, 64} for SR = 48 kHz,
  {1, 2, 4, 6, 8, 16, 24, 32, 40} for SR = 96 kHz,
  {1, 2, 4, 6, 8, 16} for SR = 192 kHz.
- Each PDU shall contain NS audio samples per channel and 1 timestamp (normal timestamp mode, not sparse), where
  NS = 6 for SR = 48 kHz,
  NS = 12 for SR = 96 kHz,
  NS = 24 for SR = 192 kHz.

Table 2 below summarizes the possible parameter combinations for the HC24-Stream-Format Type.

Data encapsulation	PCM		
Format	AAF		
Bit depth	24		
Number of channels	1, 2, 4, 6, 8, 16, 24, 32, 40, 48, 56, 64	1, 2 , 4, 6, 8, 16, 24, 32, 40	1, 2, 4, 6, 8, 16
Sample rate	48 kHz	96 kHz	192 kHz
Samples per PDU	6	12	24

Table 3: High Capacity 24bit Formats

6. Requirements

6.1. Stream Reservation Class

A PAAD shall transport audio streams according to Stream Reservation Class A.

6.2. Sample rates

A PAAD shall support a 48 kHz audio sample rate, as defined in AVTP. [AVTP, clause 7.3.2]

A PAAD may support a 96 kHz audio sample rate, as defined in AVTP. [AVTP, clause 7.3.2]

A PAAD may support a 192 kHz audio sample rate, as defined in AVTP. [AVTP, clause 7.3.2]

If a PAAD supports a 192 kHz audio sample rate, it shall also support a 96 kHz audio sample rate.

If a PAAD supports a given sample rate (48kHz, 96kHz, 192kHz), then it shall implement this sample rate for all format types (Standard, HC32, HC24) supported by the PAAD.

NOTE: This requirement refers to the sample rate of the streams. Devices may use any sample rate for internal processing, as long as they are able to send/receive streams at the rates specified above.

6.3. Channel counts

If a PAAD-Listener supports a given format type (Standard, HC32, HC24), then it shall implement all the channel counts associated with the format type.

If a PAAD-Talker supports a given format type (Standard, HC32, HC24), then it shall implement at least one of the channel counts associated with the format type.

6.4. Format types

A PAAD shall support the Standard format on all streams.

A PAAD may support the HC32 format on some or all streams.

A PAAD may support the HC24 format on some or all streams.

Streams supporting the HC24 format shall also support the HC32 format.

7. Annex

Table 4 below lists all formats and the corresponding AVDECC format strings that are specified in this document.

If a PAAD supports any count from 1 up to N channels per frame, then it should use the ut bit, as specified in AVTP, annex I.2.4, to describe all the related formats using a single AVDECC format string.

Format Type	Version	Subtype	Nominal sample rate	Format	Bit depth	Channels per frame	Samples per frame	AVDECC format string
Standard/ HC32	0	AVTP_AUDIO_SUBTYPE (0x02)	48 kHz (5)	32-bit integer (2)	32	1	6	0x0205022000406000
						2		0x0205022000806000
						4		0x0205022001006000
						6		0x0205022001806000
						8		0x0205022002006000
			96 kHz (7)			1	12	0x0207022000406000
						2		0x0207022000806000
						4		0x0207022001006000
						6		0x0207022001806000
						8		0x0207022002006000
			192 kHz (9)			1	24	0x0209022000406000
						2		0x0209022000806000
						4		0x0209022001006000
						6		0x0209022001806000
						8		0x0209022002006000
HC32			48 kHz (5)			16	6	0x0205022004006000
						24		0x0205022006006000
						32		0x0205022008006000
						40		0x020502200A006000

						48		0x020502200C006000
						56		0x020502200E006000
			96 kHz (7)			16	12	0x0207031808006000
						24		0x020703180A006000
HC24			48 kHz (5)	24-bit integer (3)	24	1	6	0x0205031800406000
						2		0x0205031800806000
						4		0x0205031801006000
						6		0x0205031801806000
						8		0x0205031802006000
						16		0x0205031804006000
						24		0x0205031806006000
						32		0x0205031808006000
						40		0x020503180A006000
						48		0x020503180C006000
						56		0x020503180E006000
						64		0x0205031810006000
			96 kHz (7)			1	12	0x0207031800406000
						2		0x0207031800806000
						4		0x0207031801006000
						6		0x0207031801806000
						8		0x0207031802006000
						16		0x0207031804006000
						32		0x0207031808006000
						40		0x020703180A006000

			192 kHz (9)			1	24	0x0209031800406000
						2		0x0209031800806000
						4		0x0209031801006000
						6		0x0209031801806000
						8		0x0209031802006000
						16		0x0209031804006000

Table 4: Summary of audio stream formats