



FORMATS INTEROPERABILITY SPECIFICATION

JUNE 5, 2018

REVISION 2.1

AUTHOR

Fabian Braun (d&b audiotechnik)

CONTRIBUTORS

Andrew Elder (AudioScience)

Ashley Butterworth (Apple)

Cole Peterson (Meyer Sound)

Frank An (Avid)

Genio Kronauer (L-Acoustics)

Henning Kaltheuner (d&b audiotechnik)

Johannes Zink (d&b audiotechnik)

Marc Illouz (L-Acoustics)

Ray Dippert (Biamp)

Richard Bugg (Meyer Sound)

Robert Hertel (Beyerdynamic)

Vicent Perales (d&b audiotechnik)

All members of the Avnu Pro Audio Technical Workgroup

Please visit <http://www.avnu.org/Milan> for additional resources or email Milan@avnu.org for further assistance. THIS DOCUMENT IS PROVIDED "AS IS" WITH NO WARRANTIES WHATSOEVER, EXPRESS, IMPLIED, OR STATUTORY.

AVNU ALLIANCE MAKES NO GUARANTEES, CONDITIONS OR REPRESENTATIONS AS TO THE ACCURACY OR COMPLETENESS CONTAINED HEREIN. Avnu Alliance disclaims all liability, including liability for infringement, of any proprietary or intellectual property rights, relating to use of information in this document. No license, express or implied, by estoppel or otherwise, to any proprietary or intellectual property rights is granted herein. THIS DOCUMENT AND THE INFORMATION CONTAINED HEREIN IS PROVIDED ON AN "AS IS" BASIS AND TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, Avnu ALLIANCE, INC., AS WELL AS THE AUTHORS AND DEVELOPERS OF THIS SPECIFICATION OR STANDARD HEREBY DISCLAIM ALL OTHER WARRANTIES AND CONDITIONS, EITHER EXPRESS, IMPLIED OR STATUTORY, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES, DUTIES OR CONDITIONS OF MERCHANTABILITY, OF FITNESS FOR A PARTICULAR PURPOSE, OF ACCURACY OR COMPLETENESS OF RESPONSES, OF RESULTS, OF WORKMANLIKE EFFORT, OF LACK OF VIRUSES, OF LACK OF NEGLIGENCE OR NONINFRINGEMENT. FURTHER, THIS DOCUMENT DOES NOT GRANT YOU ANY RIGHTS TO PRACTICE ANY PATENTABLE PROCESSES STATED OR DESCRIBED HEREIN, NOR DOES IT CONSTITUTE A LICENSE, EXPRESS OR IMPLIED, IN ANY CLAIMS OF PATENT WHICH MAY BE NECESSARY FOR IMPLEMENTATION OF THIS SPECIFICATION OR STANDARD.

TABLE OF CONTENTS

1. Introduction	2
2. References	2
3. Glossary	2
4. Scope	3
5. Format Types	3
5.1. Standard Formats	3
5.2. High Capacity 32bit Formats (HC32)	4
5.3. High Capacity 24bit Formats (HC24)	4
6. Requirements	5
6.1. Stream Reservation Class	5
6.2. Sample rates	5
6.3. Channel counts	6
6.4. Format types	6
7. Annex	6

1. INTRODUCTION

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

2. REFERENCES

<i>Name</i>	<i>Reference</i>
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

<i>Term</i>	<i>Meaning</i>
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/H C32	0	AVTP_AUDIO_SUBTYPE (0x02)	48 kHz (5)	32-bit integer (2)	32	1	6	0x0205022000406000
								0x0205022000806000
								0x0205022001006000
								0x0205022001806000
								0x0205022002006000
								0x0205022002006000
			96 kHz (7)			12	0x020702200040C000	
							0x020702200080C000	
							0x020702200100C000	
							0x020702200180C000	
							0x020702200200C000	
							0x020702200200C000	
			192 kHz (9)			24	0x0209022000418000	
							0x0209022000818000	
							0x0209022001018000	
							0x0209022001818000	
							0x0209022002018000	
							0x0209022002018000	
HC32			48 kHz (5)			16	6	0x0205022004006000
								0x0205022006006000
								0x0205022008006000

						40		0x020502200A006000									
						48		0x020502200C006000									
						56		0x020502200E006000									
						96 kHz (7)						16	12	0x020703180800C000			
												24		0x020703180A00C000			
						HC24					24		6	48 kHz (5)	24-bit integer (3)	1	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)															12	1	0x020703180040C000
																2	0x020703180080C000
																4	0x020703180100C000
																6	0x020703180180C000
						8	0x020703180200C000										
16	0x020703180400C000																

			192 kHz (9)			32		0x020703180800C000
						40		0x020703180A00C000
						1	24	0x0209031800418000
						2		0x0209031800818000
						4		0x0209031801018000
						6		0x0209031801818000
						8		0x0209031802018000
						16		0x0209031804018000

Table 4: Summary of audio stream formats