Amendment No. 1 to ATSC Standard A/336:2018, "Timed VP1 Messages"

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Revision History

Version	Date
Amendment approved	26 August 2019

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1. OVERVIEW

1.1 Definition

An Amendment is generated to document an enhancement, an addition or a deletion of functionality to previously agreed technical provisions in an existing ATSC document. Amendments shall be published as attachments to the original ATSC document. Distribution by ATSC of existing documents shall include any approved Amendments.

1.2 Scope

This document describes a new type of VP1 message that enables reduced-latency acquisition of media presentation time from VP1 messages. The proposed amendment:

- Defines a new type of VP1 Message, called an extended_vp1_message(), which includes an 8-bit time_offset field that identifies the location of this VP1 Message relative to the first VP1 Message in the VP1 Message Group. This information enables presentation time to be determined with frame accuracy from every VP1 Message in the VP1 Message Group.
- Modifies the definition of the VP1 Message Group to permit use of a new VP1 Message, extended_vp1_message(), either with or instead of the existing VP1 message, vp1_message(), resulting in the following options for broadcasters:
  - Embed only the current vp1_message(), in accordance with the existing unamended specification but without the performance benefits of the present amendment;
  - Embed the vp1_message() and extended_vp1_message() together, for both improved performance with receivers built to this amended specification and backward compatibility with receivers unaware of the present amendment; or
  - Embed only the extended_vp1_message(), for improved performance with receivers built to this amended specification but without backward compatibility with receivers unaware of the present amendment.

The changes described in this document are relative to A/336:2018, dated 11 December 2018, and do not reflect changes proposed in other Amendments.

1.3 Rationale for Changes

The changes described in this document are being proposed because the current A/336 specification, which allows receivers to determine media presentation time with frame accuracy using VP1 Messages transmitted in the video watermark, requires the receiver to identify the first VP1 Message in a VP1 Message Group after tune-in or random access in the presentation (e.g., trick-play functions such as skip-ahead, skip-back, or speed change).

Because VP1 Message Groups start 1.5 seconds apart, there is a latency of up to 1.5 seconds after tune-in or random access before media presentation time is precisely known. This latency limits the precision with which the receiver can track media presentation time in important use cases such as hybrid presentation or Dynamic Ad Insertion (DAI) when VP1 messages are used.

For example, if a Broadcaster Application is performing DAI in the video watermark recovery use case and the viewer presses "skip back 15 seconds" on the set-top box, it is desirable that the video watermark detector be able to quickly determine from the watermark that the presentation

time is now 15 seconds prior and notify the Broadcaster Application so the DAI presentation can be adjusted accordingly.

1.4 Compatibility Considerations

The changes described in this document are backward-compatible relative to the currently published version of the standard to which this Amendment pertains and any previously approved Amendments for that standard as this proposal adds a new type of VP1 Message and does not substantively alter the definition of the existing vp1_message() or its usage.

2. LIST OF CHANGES

Change instructions are given below in *italics*. Unless otherwise noted, inserted text, tables, and drawings are shown in blue; deletions of existing text are shown in ~~red strikeout~~. The text "[ref]" indicates that a cross reference to a cited referenced document should be inserted.

2.1 Normative References

No changes.

2.2 Informative References

No changes.

2.3 Acronyms and Abbreviations

No changes.

2.4 Terms

VP1 Message – A vp1_message() or an extended_vp1_message().

VP1 Message Group – A set~~sequence~~ of video frames, each carrying a VP1 Message~~vp1_message()~~, each carrying a packet() with an identical ~~data repeated for all successive video frames across at least a 1/6 second duration of content~~VP1 Payload.

VP1 Video Watermark Segment – A continuous interval of time that contains watermarked video during which signaling information recovered via ~~vp1_message()~~ VP1 Message is applicable.

2.5 Change Instructions

In Section 5.1.1, Table 5.3, *add an entry for* extended_vp1_message().

Table 5.3 wm_message_id Encoding

wm_message_id Value	Max Fragments	Message	Reference
0x00	4	reserved	
0x01		content_id_message()	Sec. 5.1.4
0x02		presentation_time_message()	Sec. 5.1.5
0x03		uri_message()	Sec. 5.1.6
0x04		vp1_ message()	Sec. 5.1.7
0x05		dynamic_event_message()	Sec. 5.1.8
0x06		display_override_message()	Sec. 5.1.9
0x07		extended_vp1_message()	Sec. 5.1.7
0x0~~7~~8-0x7E		reserved	
0x7F		user_private_message()	Sec. 5.1.11
0x80	256	AEA_message()	Sec. 5.1.10
0x81-0xFE		reserved	
0xFF		user_private_message()	Sec. 5.1.11

In Section 5.1.7, *restructure and move text to consolidate information that is common to both types of VP1 Message. The text of the second, third, and fourth paragraphs has been moved here in their entirety from the original VP1 Message section, with the only changes modifying "vp1_message()" to "VP1 Message" and correcting editorial errors.*

The VP1 Message enables the recovery process (specified in Section 5.3) to be employed in conjunction with the Video Watermark.

A VP1 Video Watermark Segment shall consist of video content carrying a series of successive VP1 Message Groups whose initial video frames are nominally at 1.5 second intervals such that if the initial video frame of the first VP1 Message Group in a VP1 Video Watermark Segment occurs at time ~~T~~*T* seconds, the initial video frame of the ~~n~~*n*th successive VP1 Message Group in the VP1 Video Watermark Segment occurs within ~~+/-~~ ±0.5 video frames of time ~~T~~*T*+1.5*n*~~n~~ seconds. All VP1 Message Groups in a VP1 Video Watermark Segment shall have the same Server Code and successive VP1 Message Groups in a VP1 Video Watermark Segment shall have sequentially incrementing Interval Codes. The query_flag value in the VP1 payload may change between successive VP1 Message Groups in a VP1 Video Watermark Segment.

When the VP1 Message ~~vp1_message()~~ is carried in a video component of audiovisual content for which an audio component employs an audio watermark carrying the same VP1 Payload, the VP1 Message Groups of the video watermark shall be time-aligned such that the initial video frame in every VP1 Message Group occurs within ~~+/-~~ ±0.5 video frames of the corresponding starting Cell boundary in the VP1 audio watermark on the presentation timeline.

Because the VP1 Message contains header and ~~P~~parity bits in addition to payload bits and because it is always repeated in multiple video frames, it may be recoverable from content for which the run-in sequence is not recoverable or where there are bit errors that cause the CRC-32 check to fail. Receivers may attempt to recover the VP1 Message in instances where run-in sequence recovery or CRC-32 check ~~are~~is unsuccessful.

Following the above text, add a new section heading for the vp1_message-specific information, change the title of Table 5.11 to reflect its specificity to the existing vp1_message(), remove the

text that was moved to the main section in the previous change (above), and strike the final paragraph before Figure 5.2.

5.1.7.1 vp1_message()

The bit stream syntax of the VP1 Message shall be as shown in Table 5.11.

Table 5.11 Bit Stream Syntax for the vp1_message()~~VP1 Message~~

Syntax	No. of Bits	Format
vp1_message() {		
header	32	bslbf
packet()	127	bslbf
zero_pad	1	'0'
}		

header – This 32-bit field shall consist of a header element as specified in ATSC A/334 Audio Watermark Emission [4].

packet() – This 127-bit field shall be as given by Table 5.20 and the parameter descriptions that follow.

zero_pad – This one-bit field shall be set to value '0'.

When present, the vp1_message() shall be the first (i.e. left-most) wm_message() present in a video frame. When present, vp1_message()s carrying identical data shall be repeated for all successive video frames across at least a 1/6 second duration of content~~ (a VP1 Message Group)~~. The value of wm_message_version does not increment between vp1_message()s within a VP1 Message Group.

~~A VP1 Video Watermark Segment shall consist of video content carrying a series of successive VP1 Message Groups whose initial video frames are nominally at 1.5 second intervals such that if the initial video frame of the first VP1 Message Group in a VP1 Video Watermark Segment occurs at time T seconds, the initial video frame of the nth successive VP1 Message Group in the VP1 Video Watermark Segment occurs within +/-0.5 video frames of time T+1.5n seconds. All VP1 Message Groups in a VP1 Video Watermark Segment shall have the same Server Code and successive VP1 Message Groups in a VP1 Video Watermark Segment shall have sequentially incrementing Interval Codes. The query_flag value in the VP1 payload may change between successive VP1 Message Groups in a VP1 Video Watermark Segment.~~

~~When the vp1_message() is carried in a video component of audiovisual content for which an audio component employs an audio watermark carrying the same VP1 Payload, the VP1 Message Groups of the video watermark shall be time-aligned such that the initial video frame in every VP1 Message Group occurs within +/-0.5 video frames of the corresponding starting Cell boundary in the VP1 audio watermark on the presentation timeline.~~

~~Because the VP1 Message contains header and Parity bits in addition to payload bits and because it is always repeated in multiple video frames, it may be recoverable from content for which the run-in sequence is not recoverable or where there are bit errors that cause the CRC-32 check to fail. Receivers may attempt to recover the VP1 Message in instances where run-in sequence recovery or CRC-32 check are unsuccessful.~~

~~A VP1 Message Group is defined to be a series of successive video frames spanning at least a 1/6 second duration of content in which each video frame carries an identical vp1_message().~~

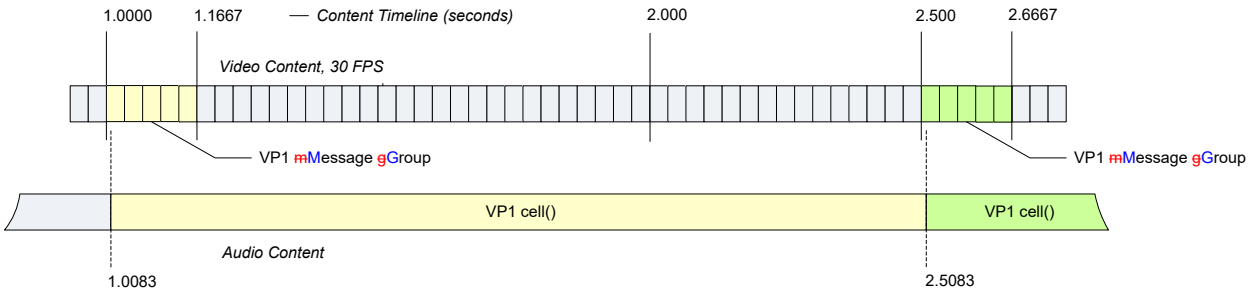

Figure 5.2 Temporal structure of VP1 Message Groups carrying vp1_message().

Figure 5.2 illustrates the temporal structure of VP1 Message Groups carrying a vp1_message()~~VP1 Message~~ in a VP1 Video Watermark Segment, with time alignment to a VP1 Audio Watermark Segment. The yellow-shaded VP1 Message Group carries the same ~~watermark information~~VP1 Payload as does the yellow-shaded VP1 cell() in the audio signal. Note that the VP1 Message Group spacing is exactly 1.5 seconds and the audio signal VP1 cell() is offset from the initial video frame of each VP1 Message Group by ¼ of a video frame period.

Immediately following this paragraph, add a new section for the new message, extended_vp1_message(), as follows.

5.1.7.2 extended_vp1_message()

The bit stream syntax of the extended_vp1_message() shall be as shown in Table 5.12.

Table 5.12 Bit Stream Syntax for the extended_vp1_message()

Syntax	No. of Bits	Format
extended_vp1_message() {		
time_offset	8	uimsbf
header	32	bslbf
alternate_packet()	127	bslbf
zero_pad	1	'0'
}		

time_offset – This 8-bit field shall convey the time offset of the video frame in which this extended_vp1_message() is carried relative to the first frame in its VP1 Message Group, in units of 1/30 of a second.

header – This 32-bit field shall consist of a header element as specified in ATSC A/334 Audio Watermark Emission [4].

alternate_packet() – This 127-bit field shall be as given by Table 5.22 and the parameter descriptions that follow; however, the alternate_parity_whitening_sequence and alternate_payload_whitening_sequence given in Table 5.13 shall be employed in place of the parity_whitening_sequence and payload_whitening_sequence given in Table 5.22.

zero_pad – This one-bit field shall be set to value '0'.

Table 5.13 Alternate Whitening Sequences

	alternate_parity_whitening_sequence	alternate_payload_whitening_sequence
Binary	0011100111001010011110001111000001110001010011001000110111101001000010011111000	1100100111010001110101110001001001100111 0101101100

When present, the extended_vp1_message() shall be the first (i.e. left-most) wm_message() present in a video frame.

Within a VP1 Message Group, an extended_vp1_message() shall be conveyed in at least those video frames whose sampling instant is within a right half-open time interval starting at a time that is an integer multiple of 0.3 seconds following the initial frame of the VP1 Message Group and ending 1/30 of a second later, for integers 0 through 4, unless a vp1_message() is also present in the VP1 Message Group, in which case for integers 1 through 4. When both vp1_message() and extended_vp1_message() are included in a VP1 Message Group, both message types shall be used in every VP1 Message Group of the VP1 Video Watermark Segment.

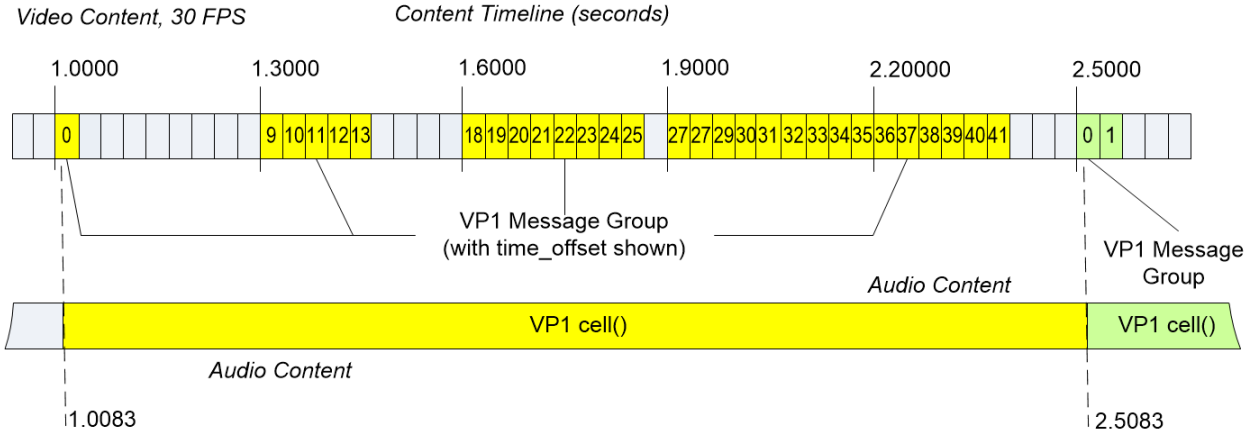

Figure 5.3 Temporal structure of VP1 Message Groups carrying extended_vp1_message().

Figure 5.3 illustrates the temporal structure of VP1 Message Groups carrying an extended_vp1_message() in a VP1 Video Watermark Segment, with time alignment to a VP1 Audio Watermark Segment. The yellow-shaded VP1 Message Group carries the same VP1 Payload as does the yellow-shaded VP1 cell() in the audio signal. Note that the VP1 Message Group spacing is exactly 1.5 seconds and the audio signal VP1 cell() is offset from the initial video frame of each VP1 Message Group by ¼ of a video frame period. Each video frame in the VP1 Message Group carries the same VP1 Payload as the aligned VP1 cell() and has a time_offset value equal to its offset from the first frame in the VP1 Message Group, since the frame rate is 30 fps.

Figure 5.4 illustrates the temporal structure of VP1 Message Groups carrying both vp1_message() and extended_vp1_message() in a VP1 Video Watermark Segment, with time alignment to a VP1 Audio Watermark Segment. The yellow-shaded VP1 Message Group carries the same VP1 Payload as does the yellow-shaded VP1 cell() in the audio signal. Note that the yellow-shaded video frames without time offset values convey vp1_message() and the yellow-shaded video frames with time offset values convey extended_vp1_message().

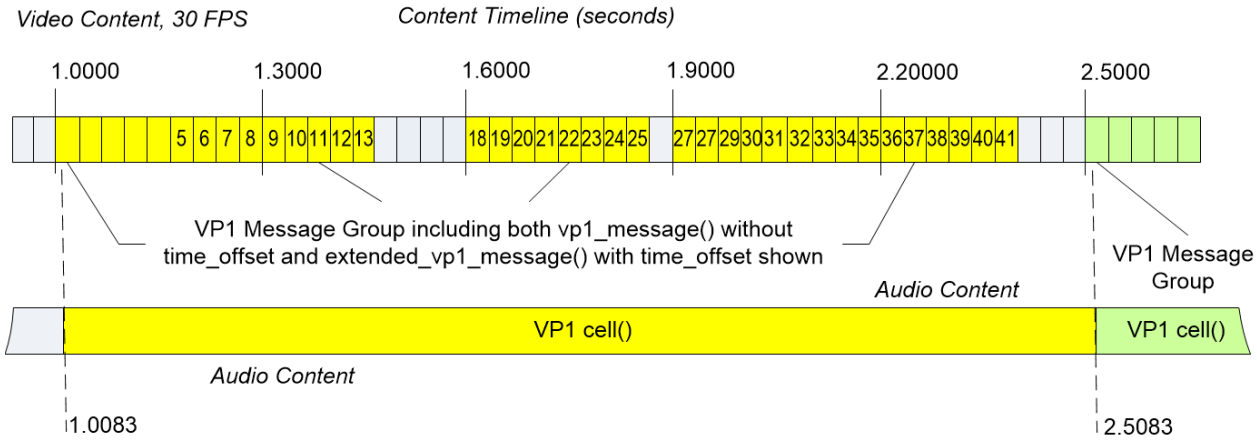

Figure 5.4 Temporal structure of VP1 Message Groups carrying both vp1_message() and extended_vp1_message().

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