ATSC Standard:
A/335:2016 Amendment No. 1,
Additional Video Resolutions

Doc. A/335:2016 Amendment No. 1
9 December 2019

Advanced Television Systems Committee
1776 K Street, N.W.
Washington, D.C. 20006
202-872-9160
The Advanced Television Systems Committee, Inc., is an international, non-profit organization developing voluntary standards and recommended practices for digital television. ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries. ATSC also develops digital television implementation strategies and supports educational activities on ATSC standards. ATSC was formed in 1983 by the member organizations of the Joint Committee on Inter-society Coordination (JCIC): the Electronic Industries Association (EIA), the Institute of Electrical and Electronic Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable Telecommunications Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). For more information visit www.atsc.org.

Note: The user's attention is called to the possibility that compliance with this standard may require use of an invention covered by patent rights. By publication of this standard, no position is taken with respect to the validity of this claim or of any patent rights in connection therewith. One or more patent holders have, however, filed a statement regarding the terms on which such patent holder(s) may be willing to grant a license under these rights to individuals or entities desiring to obtain such a license. Details may be obtained from the ATSC Secretary and the patent holder.

Implementers with feedback, comments, or potential bug reports relating to this document may contact ATSC at https://www.atsc.org/feedback/.

Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amendment approved</td>
<td>9 December 2019</td>
</tr>
</tbody>
</table>
ATSC Standard:  
A/335:2016 Amendment No. 1, Additional Video Resolutions

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 how video watermarking can be supported for video encodings whose horizontal resolution is not evenly divisible by the number of encoded symbols per video frame (240). The specified approach employs “fractional pixels” in a manner that ensures that the video watermark signaling maintains a consistent position within the video frame independent of video resolution and facilitates recovery in the event of video resolution conversion.

1.3 Rationale for Changes
The A/335:2016 specification includes video watermark specifications only for those video encodings having horizontal resolutions that are evenly divisible by the number of encoded symbols per video frame. No specification of the video watermark is provided for other video resolutions. An example of an unsupported video resolution is of 1280x720, which, when divided in the horizontal dimension by the number of symbols (240), results in 5⅓ pixels per symbol. Thus, for an ATSC 3.0 transmission that uses 1280x720 video resolution, use of the video watermark is unsupported.

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 because the previous version of the specification did not support encoding of video watermarks in video resolutions addressed by the amendment. Implementations built to the A/335:2016 specification will not encode or recover watermarks in video with previously-unsupported resolutions.

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

No changes.

2.5 Change Instructions

In Section 5.2, change the wording of the first paragraph as follows:

For the 1X system, two-level encoding is used so that each symbol represents one bit of payload data, while for the 2X system, four-level encoding is used and each symbol represents two bits of data. For both the 1X and 2X systems, 240 symbols shall be encoded across within the full extent of the video line, regardless of the horizontal resolution of the video. Thus, for HD encodings of 1920 pixels horizontally, 8 pixels will convey the information of one symbol. For HD encodings of 1440 pixels, 6 pixels will encode one symbol. All symbols within a line shall be encoded across the same number of pixels. Table 5.1 summarizes the number of pixels per symbol for typical horizontal resolutions.

After Table 5.1, insert the following text and diagram:

When the number of pixels of a video line divided by 240 does not result in an integer value (e.g., for video resolutions of 1280x720 or 2560x1440), the luma value of the pixel shared by two adjacent symbols shall be set to the weighted sum of the luma encoding values of the adjacent symbols, in proportion to the fractional spatial contribution of the symbol.

For example, for encodings of 1280 pixels, 5⅓ pixels will encode one symbol. Figure [X.Y] illustrates the mapping of symbols to pixels and the resulting luma values for 32 pixels in the payload of a 1280-pixel-wide video frame, using 1X and modulation level 40 for symbol value ‘1’. In this example, the luma values for each pixel (abbreviated as "px" below) shared by two symbols are:

- px i+5: (⅓ * 40) + (⅔ * 40) = 40
- px i+10: (⅔ * 40) + (⅓ * 4) = 28
- px i+21: (⅓ * 40) + (⅔ * 4) = 16
- px i+26: (⅔ * 4) + (⅓ * 4) = 4

End of Document