ATSC Standard A/72 Part 2

AVC Video Transport Subsystem Characteristics

A/72 Part 2:2014
18 February 2014

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Specifically, ATSC is working to coordinate television standards among different communications media focusing on digital television, interactive systems, and broadband multimedia communications. ATSC is also developing digital television implementation strategies and presenting educational seminars on the ATSC standards.

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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.

Revision History

A/72 Part 2:2008, initial version of standard approved	29 July 2008.
A/72 Part 2:2014, first revision of standard approved	18 February 2014

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1. SCOPE

This Part describes the transport of ITU-T Rec. H.264 | ISO/IEC 14496-10 [2] ("AVC") as constrained by ATSC A/72 Part 1 for the ATSC Digital Television System. The syntax and semantics of this specification conform to ATSC A/53 Part 3 [1], with additional constraints specified in this Standard.

2. REFERENCES

All referenced documents are subject to revision. Users of this Standard are cautioned that newer editions might or might not be compatible.

2.1 Normative References

The following documents, in whole or in part, as referenced in this document, contain specific provisions that are to be followed strictly in order to implement a provision of this Standard.

[1] ATSC: "ATSC Digital Television Standard, Part 3 – Service Multiplex and Transport Subsystem Characteristics," Doc. A/53 Part 3:2013, Advanced Television Systems Committee, Washington, D.C., 7 August 2013.

[2] ISO/IEC: "Information technology — Coding of audio-visual objects – Part 10: Advanced Video Coding," ISO/IEC 14496-10:2012 (E), International Organization for Standardization and International Electrotechnical Commission, 1 May 2012[1].

[3] ATSC: "ATSC Digital Television Standard, Part 1 – Digital Television System," Doc. A/53 Part 1:2013, Advanced Television Systems Committee, Washington, D.C., 7 August 2013.

[4] ISO/IEC: "Information technology – Generic coding of moving pictures and associated audio information: Systems – Part 1," ISO/IEC 13818-1:2013 (E), International Organization for Standardization and International Electrotechnical Commission, 15 June 2013.

[5] ATSC: "Video System Characteristics of AVC in the ATSC Digital Television System," Doc. A/72 Part 1:2014, Advanced Television Systems Committee, Washington, D.C., 18 February 2014.

[6] SCTE: "AVC Video Constraints for Cable Television, Part 2 – Transport," Doc. SCTE 128-2 2013, Society of Cable Telecommunications Engineers, Exton, PA.

[7] ATSC: "Program and System Information Protocol for Terrestrial Broadcast and Cable," Doc. A/65:2013, Advanced Television Systems Committee, Washington, D.C., 7 August 2013.

[8] ATSC: "ATSC Parameterized Services Standard," Doc. A/71:2012, Advanced Television Systems Committee, 3 December 2012.

2.2 Informative References

The following documents contain information that may be helpful in applying this Standard.

[9] SCTE: "AVC Video Constraints for Cable Television, Part 1 – Coding," Doc. SCTE 128-1 2013, Society of Cable Telecommunications Engineers, Exton, PA.

[10] CEA: "Digital Television (DTV) Closed Captioning," Doc. CEA-708, Consumer Electronics Association, Arlington, VA.

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[1] Also published by ITU as ITU-T Rec. H.264.

3. COMPLIANCE NOTATION

This section defines compliance terms for use by this document:

shall – This word indicates specific provisions that are to be followed strictly (no deviation is permitted).

shall not – This phrase indicates specific provisions that are absolutely prohibited.

should – This word indicates that a certain course of action is preferred but not necessarily required.

should not – This phrase means a certain possibility or course of action is undesirable but not prohibited.

4. DEFINITIONS

All the provisions of A/53, Part 1 [3] Section 3 shall apply when any such provisions or definitions are used in this Part.

5. SYSTEM OVERVIEW (INFORMATIVE)

The transport format and protocol for the ATSC Digital Television Standard is a compatible subset of the MPEG-2 Systems specification defined in ISO/IEC 13818-1 [4]. It is based on a fixed-length packet Transport Stream approach which has been defined and optimized for digital television delivery applications.

The reader is referred to Section 5 of A/53 Part 3 [1] for additional information on the system overview.

Not shown explicitly in A/53 Part 3 Figure 5.1 [1], but essential to the practical implementation of this Standard, is a control system that manages the transfer and processing of the elementary streams from the application encoders. The rules followed by this control system are not a part of this Standard. The output of the control system implementation shall conform to the MPEG-2 Transport Stream coding as specified in ISO/IEC 13818-1 [4] with the additional constraints specified in this Standard.

6. SPECIFICATION

This section of the standard describes the coding constraints that apply to the use of the MPEG-2 systems specification ISO/IEC 13818-1 [4] in the digital television system.

6.1   MPEG-2 Systems Standard Usage

The transport subsystem shall comply with the Transport Stream definition of the MPEG-2 Systems standard as specified in ISO/IEC 13818-1 [4] and shall be further constrained as specified in ATSC A/53 Part 3 [1] and herein. Program shall mean the collection of all elements within the emission that have the same value of MPEG-2 program_number, independent of the methods used to propagate the program elements.

The stream_type value for AVC video program elements shall be as defined ISO/IEC 13818-1 [4] which is 0x1B. The video T-STD for AVC shall be as defined in Section 2.14.3.1 of ISO/IEC 13818-1 [4] and shall follow the constraints for the profile and level encoded in the video elementary stream in Appendix A of ISO/IEC 14496-10 [2].

An AVC Access Point, as defined in Section 6.1.3 of ATSC A/72 Part 1 [5], shall occur at least once per second. See also SCTE 128-1 [9] Section 6.4.1 for additional background.

Video streams of stream_type 0x1B shall be identified and constrained as described hereinafter.

6.2   Constraints on PSI

All program elements in the Transport Stream are described in the PSI and shall conform to the requirements of ATSC A/53 Part 3 [1] and the following:

- When the video elementary stream_type is equal to 0x1B the descriptor loop immediately following ES_info_length in the TS_program_map_section() shall contain the AVC video_descriptor() described in Section 2.6.54 of ISO/IEC 13818-1 [4] with the AVC_24_hour_picture_flag set to '0'. For video sequences that contain AVC still pictures, the AVC_still_present field shall be set to '1' in this descriptor; otherwise this flag shall be set to '0'.

- When the video elementary stream_type is equal to 0x1B, the data_stream_alignment_descriptor is not required, except as specified in Section 6.4.

- When private data bytes of the adaptation field of the TS packets are in use, with tag, length, and data structures as defined in Section 6.4.3 of SCTE 128-2 [6], the descriptor loop immediately following ES_info_length in the TS_program_map_section() shall contain the SCTE_adaptation_field_data_descriptor as described in Section 6.3.2.3 of SCTE 128-2 [6]. In the absence of such adaptation field private data, the descriptor shall not be included in the corresponding ES_info_loop of the PMT.

6.3   Virtual Channels and Parameterized Services

Any virtual channel referencing an MPEG-2 program carrying a video component of stream_type 0x1B shall identify such channel within all transmitted VCTs (TVCT and/or CVCT per A/65 [7]). The service_type value for all such virtual channels shall be set to 0x07. Such virtual channels (including their signaling) shall comply with the ATSC A/71 Parameterized Services Standard [8].

For Virtual Channels signaled as being service_type 0x07, as required by A/71 [8] there is a component_list_descriptor() present in the descriptor loop following the descriptors_length field in the virtual channel descriptor loop of any terrestrial_virtual_channel_table_section() or cable_virtual_channel_table_section(). For each stream_type present in inner loop of the component_list_descriptor(), there shall be a stream_info_details() present.

The contents of the stream_info_details() for stream_type 0x1B shall be structured as shown in Table 6.1.

Table 6.1 Stream Information Details Syntax for AVC video

Syntax	No. of Bits	Format
stream_info_details() {		
AVC_profile	2	uimsbf
level_idc	6	uimsbf
caption_data_rate	3	uimsbf
reserved	5	uimsbf
future_fields()	var	
}		

AVC_profile – This is a two-bit unsigned integer field encoding a range of values for profile_idc from Table 6.3 of ATSC A/72 Part 1 [5]. Values shall indicate the AVC Profile in use: '01' = Baseline (for the value of profile_idc = 66); '10' = Main (for the value of profile_idc = 77); and '11' = High (for the value of profile_idc = 100). As specified in Section 6, all receiving devices that support a higher binary-numbered profile must support all lower numbered profiles. The highest profile

that will be used for the virtual channel associated with the component_list_descriptor() carrying this stream_info_details() shall be sent.

level_idc – This is a six-bit unsigned integer field. Values shall be as defined in Table 6.3 of ATSC A/72 Part 1 [5]. As specified in A/72 Part 1, all receiving devices that support a higher binary-numbered level must also support a lower numbered level. The highest level that will be used for the virtual channel associated with the component_list_descriptor() carrying this stream_info_details() shall be sent.

caption_data_rate – This is a three-bit unsigned integer field specifying the transport rate for CEA-708 [10] caption data. The values shall be per Table 6.2. Non-zero values shall indicate rates less than 9600 bps when defined.

Table 6.2 CEA-708 Caption Data Rate Values

CEA-708 Transport Bitrate	caption_data_rate values
9600 bps	'000'
reserved	'001'-'111'

future_fields() – This variable-length data structure is established to indicate the explicit ability to convey additional information in future versions of this standard. The value in the length_of_details which immediately precedes this instance of stream_info_details() in the component_list_descriptor() (see A/71 [8]) includes the count of the bytes in this field. In the present standard, the value of length_of_details is 1.

> Note: Per A/71 [8], if an unsupported value of length_of_details is encountered, receivers are expected to conclude that the stream is not supported for decoding.

> Note: Per A/71 [8], this structure will be placed in the Component List Descriptor within either a Terrestrial Virtual Channel Table or a Cable Virtual Channel Table.

6.4   PES Constraints

Packetized Elementary Stream syntax and semantics shall conform to the requirements of ATSC A/53 Part 3 [1]. For streams of stream_type 0x1B, each PES packet shall contain only one AVC access unit start, as defined in Sections 2.1.3 and 2.14.1 of ISO/IEC 13818-1 [4], unless multiple access units fit into the payload of a single transport packet. Section 6.4.1 specifies the constraints for the case when multiple access units are placed in a PES packet. The access unit start code is not required to be aligned with the PES packet header (to avoid overhead for low bit rate and SDTV resolutions) and alignment of the access unit to PES packet header shall be signaled using the data_alignment_descriptor in the PMT (see Section 6.2). Each PES header shall contain a PTS and DTS if DTS differs from the PTS. The PES packet shall be void of video picture data only when transmitted in conjunction with the discontinuity_indicator to signal that the continuity_counter may be discontinuous.

Within the PES packet header, the following restrictions apply:

- The PES_packet_length shall be coded as '0x0000'.
- If the data_stream_alignment_descriptor is present in the PMT, then the data_alignment_indicator shall be set to '1'

6.4.1   Multiple Access Units in a PES Packet

When a PES packet contains multiple access unit starts, for any access unit starts following the first access unit start in the same PES packet, the ISO/IEC 14496-10 [2] syntax elements num_units_in_tick, time_scale, pic_struct (if present), and the value of syntax variables TopFieldOrderCnt and BottomFieldOrderCnt of the access unit shall allow the derivation of PTS and DTS for that access unit.

6.4.2   Adaptation Field Private Data

As defined in Section 6.4.3 and Appendix A of SCTE 128-2 [6], the AU_information() structure may be placed into the Adaptation Field Private Data of the TS packet carrying PES data. When this structure is placed in the TS packet, the requirements of Section 6.3.2.3 ("SCTE Adaptation field data descriptor") of SCTE 128-2 [6] shall apply.

6.5   Transport of Still Pictures

AVC still pictures may be used and when used shall comply with the transport constraints of Section 9.0 of SCTE 128-2 [6].

6.6   Support for Low Delay Mode

Low Delay Mode may be used and when used shall comply with the transport constraints of Section 7.2.1.6 of SCTE 128-2 [6].

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