ATSC Standard:
3D-TV Terrestrial Broadcasting, Part 1

Doc. A/104 Part 1
4 August 2014

The Advanced Television Systems Committee, Inc., is an international, non-profit organization developing voluntary standards for digital television. The ATSC member organizations represent the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

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.

ATSC was formed in 1982 by the member organizations of the Joint Committee on InterSociety Coordination (JCIC): the Electronic Industries Association (EIA), the Institute of Electrical and Electronic Engineers (IEEE), the National Association of Broadcasters (NAB), the National Cable and Telecommunications Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). Currently, there are approximately 120 members representing the broadcast, broadcast equipment, motion picture, consumer electronics, computer, cable, satellite, and semiconductor industries.

ATSC Digital TV Standards include digital high definition television (HDTV), standard definition television (SDTV), data broadcasting, multichannel surround-sound audio, and satellite direct-to-home broadcasting.

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

Version	Date
Initial version of this standard approved	4 August 2014

Table of Contents

ATSC Standard:
3DTV Terrestrial Broadcasting, Part 1

1. SCOPE

This document and its normative Parts provide detailed specification of the parameters of the 3D-TV system including the video encoder input scanning formats and characteristics of the service multiplex and transport layers.

1.1 Documentation Structure

The documentation of the ATSC 3D Standard consists of this Part and several related Parts that provide a general system overview, a list of reference documents, and sections relating to the system as a whole. The system is modular in concept and the specifications for each of the modules are provided in other parts:

- Part 2 – Service Compatible 3DTV using Real-Time Delivery
- Part 3 – Frame Compatible Coding Using Real-Time Delivery
- Part 4 – Service Compatible Hybrid Delivery 3D using Broadband or ATSC NRT
- Part 5 – Service Compatible 3D-TV using Main and Mobile Hybrid Delivery
- Part 6 – Independent Coded 3D Using Real-Time Delivery

1.2 Organization

This document is organized as follows:

- Section 1 – Outlines the scope of this document and provides a general introduction.
- Section 2 – Lists references and applicable documents.
- Section 3 – Provides a definition of terms, acronyms, and abbreviations for this document.
- Section 4 – System overview
- Section 5 – System specifications

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]   IEEE/ASTM: "Use of the International Systems of Units (SI): The Modern Metric System," Doc. SI 10-2002, Institute of Electrical and Electronics Engineers, New York, N.Y.

[2]   ATSC: "ATSC Digital Television Standard, Part 4 – MPEG-2 Video System Characteristics," Doc. A/53, Part 4:2009, Advanced Television Systems Committee, Washington, D.C., August 2009.

[3]   CEA: "Digital Television (DTV) Closed Captioning: 3D Extensions," CEA-708.1, Consumer Electronics Association, Arlington, VA, Oct. 2012.

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

[5]   ATSC: "ATSC Standard: 3D-TV Terrestrial Broadcasting, Part 2 – Service Compatible Hybrid Coding using Real-Time Delivery," Doc. A/104 Part 2:2012, Advanced Television Systems Committee, Washington, D.C., 26 December 2012.

[6]   ATSC: "ATSC Standard: 3D-TV Terrestrial Broadcasting, Part 3 – Frame Compatible Coding Using Real-Time Delivery," Doc. A/104 Part 3:2014, Advanced Television Systems Committee, Washington, D.C., 27 June 2014.

[7]   ATSC: "ATSC Working Draft: 3D-TV Terrestrial Broadcasting, Part 4 – Service Compatible Hybrid Delivery 3D using Broadband or ATSC NRT," Doc. S12-118r15, Advanced Television Systems Committee, Washington, D.C., 10 July 2014.

[8]   ATSC: "ATSC Candidate Standard: 3D-TV Terrestrial Broadcasting, Part 5 – Service Compatible 3D-TV using Main and Mobile Hybrid Delivery," Doc. S12-117r16, Advanced Television Systems Committee, Washington, D.C.,26 February 2014.

[9]   ATSC: "ATSC Candidate Standard: 3D-TV Terrestrial Broadcasting, Part 6 – Independent Coded 3D Using Real-Time Delivery," Doc. S12-115r10, Advanced Television Systems Committee, Washington, D.C., 25 June 2014.

3. DEFINITION OF TERMS

With respect to definition of terms, abbreviations, and units, the practice of the Institute of Electrical and Electronics Engineers (IEEE) as outlined in the Institute's published standards [1] shall be used. Where an abbreviation is not covered by IEEE practice or industry practice differs from IEEE practice, the abbreviation in question will be described in Section 3.3 of this document.

3.1   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.

3.2   Treatment of Syntactic Elements

This document contains symbolic references to syntactic elements used in the audio, video, and transport coding subsystems. These references are typographically distinguished by the use of a different font (e.g., restricted), may contain the underscore character (e.g., sequence_end_code) and may consist of character strings that are not English words (e.g., dynrng).

3.2.1   Reserved Elements

One or more reserved bits, symbols, fields, or ranges of values (i.e., elements) may be present in this document. These are used primarily to enable adding new values to a syntactical structure without altering its syntax or causing a problem with backwards compatibility, but they also can be used for other reasons.

The ATSC default value for reserved bits is '1.' There is no default value for other reserved elements. Use of reserved elements except as defined in ATSC Standards or by an industry standards setting body is not permitted. See individual element semantics for mandatory settings

and any additional use constraints. As currently-reserved elements may be assigned values and meanings in future versions of this Standard, receiving devices built to this version are expected to ignore all values appearing in currently-reserved elements to avoid possible future failure to function as intended.

3.3   Acronyms and Abbreviation

The following acronyms and abbreviations are used within this document.

ATSC – Advanced Television Systems Committee
AVC – Advanced Video Coding
CVCT – Cable Virtual Channel Table
FC – Frame Compatible
MDTV – Mobile Digital TV
MVC – Multiview Video Coding
NRT – Non-Real-Time
RT – Real-Time
SC – Service Compatible
SCH – Service Compatible Hybrid
TVCT – Terrestrial Virtual Channel Table

3.4   Terms

The following terms are used within this document.

reserved – An element that is set aside for use by a future Standard.

Additional view video – Stereoscopic video component added to the reference video to compose stereoscopic video.

Hybrid-delivery 3D – 3D-TV broadcasting service composed of two coded video images, where one image is transmitted via ATSC A/53 terrestrial broadcast, and the second image is transmitted via another means.

Real-time Hybrid-delivery 3D – Hybrid-delivery 3D, in which the second image is transmitted simultaneously via another means (e.g., broadband, or ATSC A/53 MDTV).

Non-real-time Hybrid-delivery 3D – Hybrid-delivery 3D, in which the second image is transmitted in advance of presentation via the same means or another means. (e.g., ATSC NRT, broadband).

Broadband – Two-way communication network providing media delivery via Internet Protocols.

Left view – Video provided for the left eye.

Reference view video (or Base view video) – Stereoscopic video component which is used for legacy 2DTV service.

Right view – Video provided for the right eye.

Service compatible – 3D TV broadcasting service composed of two or more compressed video images, where at least one of them is the legacy 2D-TV image having the same resolution as the production resolution.

Hybrid-coded 3D – 3D-TV broadcasting service using two different video codecs, where the base view is encoded using one codec and the additional view is encoded using a different video codec.

Stereoscopic 3D video – Video composed of a left view and a right view.

4. SYSTEM OVERVIEW

This document describes several different methods an implementer may choose to deploy a 3D ATSC service. A broadcaster may choose one or more method to implement depending on their particular needs. The following describes the methods and the relevant parts of this standard. The parts referenced below establish the characteristics of the subsystems necessary to accommodate the various 3D services envisioned:

Part 1 – Any implementer should reference Part 1 which contains the overview, definitions, the general structure of the standard and the technologies commonly used by other parts.

Part 2 – A broadcaster choosing to deliver 3D content in real time by means of an MPEG-2 view plus an additional view coded using AVC should use Part 2 of this standard. This method of coding is called Service Compatible Hybrid Coding using Real Time Delivery. It should be noted that both views are contained in a single channel and single transport multiplex.

Part 3 – A broadcaster choosing to deliver 3D content in real time using frame compatible packing should use Part 3 of this standard. Frame compatible is when the stereo images are spatially subsampled in order to fit two images into the space of a single image.

Part 5 – A broadcaster choosing to deliver 3D content in real time by utilizing the ATSC main 2D-TV service and the ATSC Mobile DTV service as the two views of the 3D-TV service should use Part 5 of this standard. This method of delivery is called Service Compatible 3DTV using Main and Mobile Hybrid Delivery. It should be noted that both views are contained in a single channel and single transport multiplex.

Part 6 – A broadcaster choosing to deliver 3D as a real time simulcast service using MVC would use Part 6 of this standard. This service is called Independent Coded 3D.

The parts listed above are self-contained. Each part contains the required elements and some optional elements. Additional ATSC standards may define other required and/or optional elements.

5. COMMON TECHNOLOGIES

This section specifies technologies commonly used in other parts of this specification.

5.1 Closed Captioning for 3D-TV

Closed captioning data is transported in the video of ATSC main service in compliance with ATSC A/53 Part 4 [2]. Closed captioning commands to support z-axis placement of caption windows (e.g., disparity data) shall be formatted in accordance with CEA-708.1 [3] and carried in the cc_data() specified in Section 6.2.3.1 of A/53 Part 4. Delivery of cc_data() depends on the video codec used by each 3D-TV services.

5.2 Channel Type Signaling for 3D-TV

A virtual channel that carries a 3D-TV service shall be identified by service_type equal to 0x09 (Extended Parameterized Service) in the TVCT or CVCT. In addition, the parameterized_service_descriptor() as defined in A/71 [4] shall be used for the delivery of parameters specific to a particular application. For channels containing 3D content, the value of application_tag shall be 0x01. The application_data() for application_tag value 0x01 shall be as shown in Table 1.1. As shown, additional bytes following the last defined field may be present.

Table 1.1 Bit Stream Syntax of Application Data for Application Tag 0x01

Syntax	No. of Bits	Format
application_data(0x01) {		
Reserved	3	Uimsbf
3D_channel_type	5	Uimsbf
for (i=0; i<N; i++) {		
Reserved	8	Bslbf
}		
}		

3D_channel_type – This 5-bit unsigned integer field shall indicate the type of 3D service carried in the Virtual Channel associated with this Parameterized Services Descriptor. The coding for 3D_channel_type shall be as given in Table 1.2.

Table 1.2 3D Channel Type Encoding

3D_channel_type	Description
0x00	Frame compatible stereoscopic 3D service – side-by-side (A/104 Part 3 [6])
0x01	Frame compatible stereoscopic 3D service – top and bottom (A/104 Part 3 [6])
0x02	Reserved
0x03	Full-frame stereoscopic 3D service – base and additional view streams; additional view in-band (A/104 Part 2 [5] and A/104 Part 6 [9])
0x04	Full-frame stereoscopic 3D service – Broadcast and broadband Hybrid (A/104 Part 4 [7])
0x05	Full-frame stereoscopic 3D service – Broadcast and NRT (A/104 Part 4 [7])
0x06	Full-frame stereoscopic 3D service – Main and Mobile Hybrid (A/104 Part 5 [8])
0x07-0x1F	Reserved for Future Use

End of document