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Candidate Standard: Amendment to ATSC Digital Television Standard, Doc. A/53D, to define Video System Characteristics of AVC as new Annex F

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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 Television Association (NCTA), and the Society of Motion Picture and Television Engineers (SMPTE). Currently, there are approximately 140 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.

About the Candidate Standard

This specification is being put forth as a Candidate Standard by the TSG/S6 Specialist Group on Audio and Video Coding. ATSC members and non-members are encouraged to review and implement this specification and return comments to cs_amend_editor@atsc.org. ATSC Members can also send comments directly to the TSG/S6 Specialist Group. The ATSC believes this specification is stable. It is expected to progress to Proposed Standard within a period of time ending 31 December 2007.

Insert new Annex F of A/53D as follows:

A/53D Annex F:
AVC Video System Characteristics (Normative)

1. SCOPE

This Annex describes the characteristics of the advanced video subsystem of the Digital Television Standard. The input formats and bit stream characteristics are described in separate sections.

2. REFERENCES

2.1 Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

[F1] ISO/IEC 13818-1:2000 (E), International Standard, Information technology – Generic coding of moving pictures and associated audio information: Systems.

[F2] ISO/IEC 13818-1/Amd. 3: 2003 Amendment 3: Transport of AVC video data over ITU-T Rec. H.222.0 |ISO/IEC 13818-1 streams.

[F3] ISO/IEC 14496-10 (ITU-T H.264), International Standard (2005), Advanced video coding for generic audiovisual services.

[F4] ITU-T T.35, International Standard (2000), Procedure for the allocation of ITU-T defined codes for non-standard facilities.

[F5] SMPTE 125M (1995): Standard for Television—Component Video Signal 4:2:2, Bit-Parallel Digital Interface, Society of Motion Picture and Television Engineers, White Plains, N.Y.

[F6] SMPTE 170M (1999): Standard for Television—Composite Analog Video Signal, NTSC for Studio Applications, Society of Motion Picture and Television Engineers, White Plains, N.Y.

[F7] SMPTE 274M (2003): Standard for Television—1920 x 1080 Scanning and Analog and Parallel Digital Interfaces for Multiple Picture Rates, Society of Motion Picture and Television Engineers, White Plains, N.Y.

[F8] SMPTE 293M (2003): Standard for Television—720 x 483 Active Line at 59.94-Hz Progressive Scan Production, Digital Representation, Society of Motion Picture and Television Engineers, White Plains, N.Y.

[F9] SMPTE 296M (2001): Standard for Television—1280 x 720 Progressive Image Sample Structure, Analog and Digital Representation and Analog Interface, Society of Motion Picture and Television Engineers, White Plains, N.Y.

[F10] CEA-708-B: "Digital Television (DTV) Closed Captioning," December 1999, Consumer Electronics Association.

[F11] ITU-R BT.601-5 (1995): Encoding Parameters of Digital Television for Studios.

[F12] ETSI TS 101 154 V1.7.1, Digital Video Broadcasting (DVB): Implementation Guidelines for the use of MPEG-2 Systems, Video and Audio in Satellite, Cable and Terrestrial Broadcasting Applications, Annex B, June 2005.

2.2 Informative References

[F13] Digital Receiver Implementation Guidelines and Recommended Receiver Reaction to Aspect Ratio Signaling in Digital Video Broadcasting, Issue 1.2, August 2000, Digital TV Group.

[F14] ANSI/SCTE 21 2001: Standard for Carriage of NTSC VBI Data in Cable Digital Transport Streams, Society of Cable Telecommunications Engineers.

[F15] ANSI/SCTE 43 2004: Digital Video Systems Characteristics Standard for Cable Television, Society of Cable Telecommunications Engineers.

[F16] CEA-CEB-10-A: "EIA-708-B Implementation Guidance," December 2002, Consumer Electronics Association.

[F17] ITU-R BT. 709-5 (2002): Parameter values for the HDTV Standards for Production and International Programme Exchange.

[F18] ITU-T H.261 (1993): Video Codec for Audiovisual Services at *p* x 64 kbits

[F19] ISO/IEC/JTC1/SC29/WG11/N7414: Liaison Statement to ATSC S6, July 2005.

[F20] CEA-805-A: "Data on the Component Video Interfaces," October 2003, Consumer Electronics Association.

3. COMPLIANCE NOTATION

As used in this document, "shall" or "will" denotes a mandatory provision of the standard. "Should" denotes a provision that is recommended but not mandatory. "May" denotes a feature whose presence does not preclude compliance, which may or may not be present at the option of the implementer.

In following tables conventional numbers denote decimal values, numbers preceded by 0x are to be interpreted as hexadecimal values and numbers within single quotes (e.g., '10010100') are to be interpreted as a string of binary digits.

4. POSSIBLE VIDEO INPUTS

While not required by this standard, there are certain television production standards, shown in Table f1, that define video formats that relate to compression formats specified by this standard.

Table F1 Standardized Video Input Formats

Video Standard	Active Lines	Active Samples/ Line
SMPTE 274M [F7]	1080	1920
SMPTE 296M [F9]	720	1280
SMPTE 293M [F8]	483	720
ITU-R BT.601-5 [F11]	483	720

The compression formats may be derived from one or more appropriate video input formats. It may be anticipated that additional video production standards will be developed in the future that extend the number of possible input formats.

5. SOURCE CODING SPECIFICATION

The AVC video compression algorithm shall conform to either the Main or the High Profile syntax of ISO/IEC 14496-10 [F3]. The allowable parameters shall be bounded by the upper limits specified for the High Profile at Level 4.[1] AVC bit streams shall conform to either the Main or High Profile syntax for SD resolutions (input formats SMPTE 293M [F8] and ITU-R BT.601-5 [F11]) and to the High Profile syntax for HD resolutions (input formats SMPTE 274M [F7] and SMPTE 296M [F9]).

Additionally, AVC bit streams shall meet the constraints and specifications described in Sections 5.1, 5.2, 5.4, and 5.5 of this document. AVC bit streams shall utilize the both the "Supplemental enhancement information (SEI)" and the "Video usability information (VUI)" syntactic elements defined in ISO/IEC 14496-10 Annexes D and E 0. Decoder design should be made under the assumption that any legal structure as permitted by ISO/IEC 14496-10 [F3] may occur in the broadcast stream even if presently reserved or unused.

For standard-definition SIF (352x240) (sometimes referred to as "525 CIF") or QSIF (176 x 120) resolution services, the AVC video compression algorithm shall conform to the "Main" profile syntax of ISO/IEC 14496-10. Such operation is intended only for mobile applications.

5.1 Carriage of AVC video in MPEG-2 Transport Streams (TS)

AVC video Elementary Streams shall be carried in the MPEG-2 TS in compliance with the requirements of Section 2.14 of ISO/IEC 13818-1 [F1] as amended by Amendment 3 [F2].

5.2 Constraints with Respect to ISO/IEC 14496-10 Main and High Profiles

The following tables list the allowed values for each of the ISO/IEC 14496-10 [F3] syntactic elements which are restricted beyond the limits imposed by HP@L4.

5.2.1 Profile and Level Constraints

The Level shall be constrained to 3 or 3.1 for SD resolutions (formats SMPTE 293M [F8] and ITU-R BT.601-5 [F11]) and 3.2, 4, or 4.2 for HD resolutions (formats SMPTE 274M [F7] and SMPTE 296M [F9]). Note: It is expected that all receivers will handle Level 4.0 and Profile 100.

5.2.2 AVC Access Point

An Access Point is defined as an access unit in an AVC bit stream at which a decoder can begin decoding video successfully. The access unit must contain one Sequence Parameter Set NAL unit and one Picture Parameter Set NAL unit that are active or being activated when decoding the primary coded picture in this access unit. The access unit must contain an IDR picture or an I picture.

[1] See ISO/IEC 14496-10, Annex A for more information regarding profiles and levels.

5.2.3 Sequence Parameter Set Constraints

For each Access Point, there shall be one Sequence Parameter Set present in the bit stream. Table F2 identifies parameters in the sequence parameter set of a bit stream that shall be constrained by the video subsystem and lists the allowed values for each.

Table F2 Sequence Parameter Set Constraints

Sequence Parameter Set Syntactic Element	Allowed Value
profile_idc	see Table F3
level_idc	see Table F3
constraint_set0_flag	0
constraint_set2_flag	0
constraint_set3_flag	0
PicWidth InMbs	see Table F3
PicHeight InMbs	see Table F3
aspect_ratio_idc	see Table F3
num_units_ in_tick	see Table F3
time_ scale	see Table F3

constraint_set1_flag shall be set to 1 when profile_idc has the value 77 and to 0 when profile_idc has the value 100. The time interval between two changes in pairs of pic_width_in_mbs_minus1 and pic_height_in_map_units_minus1 shall be greater than or equal to one second.

5.2.4 Picture Parameter Set Constraints

More than one Picture Parameter Set can be present in the bitstream between two Access Points. Between two Access Points, the content of a Picture Parameter Set with a particular pic_parameter_set_id shall not change. (If more than one Picture Parameter Set is present in the bitstream and these Picture Parameter Sets are different from each other, then each picture parameter set shall have a different pic_parameter_set_id.)

5.2.5 Compression Format Constraints

Table F3 lists the allowed compression formats.

Table F3 Compression Format Constraints

vertical size	horizontal size	PicWidth InMbs	PicHeight InMbs	aspect_ ratio_idc	profile_ idc [1]	level_ idc	display aspect ratio	allowed frame rates	Progressive interlaced
1080	1920	120	68	1	100	40	16:9	1,2,3,4	P
1080	1920	120	68	1	100	42 [2]	16:9	5,6	P
1080	1920	120	68	1	100	40	16:9	3,4	I
1080	1440	90	68	14 [3]	100	40	16:9	1,2,3,4	P
1080	1440	90	68	14	100	42	16:9	5,6	P
1080	1440	90	68	14	100	40	16:9	3,4	I
720	1280	80	45	1	100	32, 40	16:9	1,2,3,4,5,6	P
480	720	45	30	3	100	31, 40	4:3	1,2,3,4,5,6	P
480	720	45	30	5	100	31, 40	16:9	1,2,3,4,5,6	P
480	720	45	30	3	100	30	4:3	3,4	I
480	720	45	30	5	100	30	16:9	3,4	I
480	704	44	30	3	100	31, 40	4:3	1,2,3,4,5,6	P
480	704	44	30	5	100	31, 40	16:9	1,2,3,4,5,6	P
480	704	44	30	3	100	30	4:3	3,4	I
480	704	44	30	5	100	30	16:9	3,4	I
480	640	40	30	1	100	31, 40	4:3	1,2,3,4,5,6	P
480	640	40	30	1	100	31, 40	4:3	3,4	I
480	544	34	30	5	100	30	4:3	1	P
480	544	34	30	5	100	30	4:3	3	I
480	528	33	30	5	100	30	4:3	1	P
480	528	33	30	5	100	30	4:3	3	I
480	352	22	30	7	100	30	4:3	1	P
480	352	22	30	7	100	30	4:3	3	I
240	352	22	15	3	77	30	4:3	1	P
120	176	11	8	3	77	11	4:3	1	P

Legend:
frame rate: 1 = 23.976 Hz, 2 = 24 Hz, 3 = 29.97 Hz, 4 = 30 Hz, 5 = 59.94 Hz, 6 = 60 Hz
aspect_ratio_idc: 1 = 1:1 [square samples], 3 = 10:11, 5 = 40:33, 7 = 20:11, 11 = 15:11, 14 = 4:3

Note:
For vertical sizes of 1080 and 120, that 1088 and 128 lines (respectively) are actually coded in order to satisfy the AVC requirement that the coded vertical size be a multiple of 16 (progressive scan) or 32 (interlaced scan). The bottom 8 lines should be black and "frame cropping" shall be used. The value of frame_crop_top_offset shall be 0 and frame_crop_bottom_offset shall be 2*(1 + frame_mbs_only_flag).

Footnotes:
[1] A compliant bitstream may have a profile_idc value of either 77 or 100.
[2] Use of this format may be constrained by service_type (see A/65).
[3] Value will be clarified in a future amendment to [F3]. See [F22] for details.

5.2.6 Video Usability Information (VUI) Parameter Constraints

The following parameters in the Video Usability Information (VUI) part of a bit stream that shall be constrained. video_format shall only take the value of '000', low_delay_hrd_flag shall only take the value of '0'.

The decoder shall support the use of the VUI's following syntax elements: Aspect Ratio Information (aspect_ratio_idc), Color Parameter Information (colour_primaries, transfer_characteristics, and matrix_coefficients), Chrominance Information (chroma_sample_loc_type_top_field and chroma_sample_loc_type_bottom_field), and Timing information (time_scale, num_units_in_tick, low_delay_hrd_flag, timing_info_present_flag, and fixed_frame_rate_flag).

The values for time_scale, num_units_in_tick, and fixed_frame_rate_flag shall be explicitly indicated in the vui_parameters(). For each frame rate shown in Table F3, the values for num_units_in_tick and time_ scale shall be as shown in Table F4.

Table F4 Frame rate VUI Parameter Constraints

frame rate	num_units_in_tick	time_ scale
23.98 Hz	1,001	48,000
24 Hz	1	48
29.97 Hz	1,001	60,000
30 Hz	1	60
59.94 Hz	1,001	120,000
60 Hz	1	120

The values for color_primaries, transfer_characteristics, and matrix_coefficients shall be explicitly indicated in the vui_parameters(). While all values for color_primaries, transfer_characteristics, and matrix_coefficients defined in Tables E-3, E-4, and E-5 of ISO/IEC 14496-10, Annex E [F3] are allowed in the transmitted bit stream, those of ITU-R BT.709 [F17] and SMPTE 170M [F6] are the most likely to be in common use.

5.3 Low Delay and Still Picture Modes

For all applications, low_delay_hrd_flag shall be 0. Note: This standard does not permit "big pictures."

5.3.1 Low Delay Mode

In AVC, "Low delay mode" may be provided without special timing or buffering, so no special signaling is required.

5.3.2 Still Picture Mode

Still Picture Mode is supported and is governed by the conventional MPEG-2 Systems principles designed to support this mechanism. In particular, still picture mode is characterized by:

- Still picture mode shall be indicated when the fixed_frame_rate_flag is set to 0 in the vui_parameters( ). Otherwise, the fixed_frame_rate_flag shall be set to 1.
- Still pictures shall comply with the "AVC still picture" definition in ISO/IEC 13818-1, Amendment 3 [F2] Section 2.1.5. For Still pictures the frame rate specification for AVC decoders shall not apply.
- In the presence of Still pictures, a decoder shall maintain a fixed frame refresh rate according to the previous non-Still frame rate. When AVC Still picture mode is first sensed, the previously decoded picture shall be displayed until the presentation time of the next picture.

5.4 Constraints with Respect to ISO/IEC 14496-10 Baseline Profile

Picture coding shall use the subset of tools in 'Baseline profile' such that constraint_set1_flag shall be set to '1' allowing decoders that support only 'Main' profile to decode streams from both the Main and Baseline profiles.

5.4.1 Profile and Level Constraints

Levels shall be constrained as shown in Table F3 (indicated values for profile_idc and level_ idc).

5.5 Bit Stream Specifications Beyond ISO/IEC 14496-10

This section covers the specific data carried in the SEI RBSP and VUI sections of the video syntax. The syntax used for the insertion of closed captioning in the SEI payload is described. Much of the following material is duplicated or modified from material contained in Annex A, Section 5.2 and is provided here for ease of reading by the user.

5.5.1 Caption Data Syntax

Caption data shall be carried in the SEI RBSP syntax of the video Elementary Stream. Table F5 describes the caption data syntax (see 14496-10, Annex D.1.5 and D.2.5 [F3]).

Table F5 Caption Data Syntax[2]

Syntax	No. of Bits	Format
user_data_registered_itu_t_t35 ( ) {		
itu_t_t35_country_code	8	bslbf
itu_t_t35_provider_code	16	bslbf
user_identifier	32	bslbf
user_structure()		
}		

Note that SEI payloads carrying a SEI payloadType of 4 and containing a 32-bit field following the itu_t_t35_provider_code which has a value other than user_identifier may be present in an ATSC-compliant AVC video bit stream. Receiving devices are expected to process this field and use it to determine the syntax and semantics of the user data construct to follow.

Receiving devices are expected to silently discard any unrecognized SEI payloads encountered in the video bit stream. For example, if an unrecognized 32-bit identifier is seen following the itu_t_t35_provider_code, or an unrecognized 8-bit user_data_type_code is seen following the user_identifier, data should be discarded until another SEI payload is seen or the RBSP terminates.

5.5.2 Caption Data Semantics

itu_t_t35_country_code – A fixed 8-bit field registered by the ATSC. The value is 0xB5 and shall be a country code as specified by ITU-T Recommendation T.35 Annex A.

itu_t_35_provider_code – A fixed 16-bit field registered by the ATSC. The value is 0x0031.

[2] Shaded cells in this table indicate syntactic and semantic additions to the ISO/IEC 14496-10 Standard [F3].

user_identifier – This is a 32 bit code that indicates the contents of the user_structure() as indicated in Table F6.

user_structure() – This is a variable length data structure defined by the value of user_identifier and Table F6.

Table F6 user_identifier

user_identifier	user_structure()
0x47413934 (“GA94”)	ATSC1_data()
0x44544731 (“DTG1”)	afd_data()
all other values	ATSC Reserved

5.5.3 ATSC1_data() Syntax

Table F7 describes the ATSC1_data() syntax which shall be used.

Table F7 ATSC1_data() Syntax

Syntax	No. of Bits	Format
ATSC1_data( ) {		
user_data_type_code	8	uimsbf
user_data_type_structure()	var	
marker_bits	8	'11111111'
}		

5.5.4 ATSC1_data() Semantics

user_data_type_code – An 8-bit value that identifies the type of user data to follow in the user_data_type_structure(). The values are defined in Table F8.

Table F8 user_data_type_code

user_data_type_code	user_data_type_structure()
0x00 – 0x02	ATSC Reserved
0x03	cc_data() [1]
0x04	ATSC Reserved [2]
0x05	ATSC Reserved [2]
0x06	bar_data()
0x07 – 0xFF	ATSC Reserved
Footnotes: [1] To be replaced with a reference to cc_data() in CEA-708-C when published. [2] See ANSI/SCTE 21 [F14].	

user_data_type_structure – This is a variable length set of data defined by the value of user_data_type_code and Table F8.

5.5.4.1 Captioning Data[3]

Table F9 describes the syntax and the semantics of captioning data.

Table F9 Captioning Data Syntax

Syntax	No. of Bits	Format
cc_data() {		
reserved	1	'1'
process_cc_data_flag	1	bslbf
zero_bit	1	'0' [1]
cc_count	5	uimsbf
reserved	8	'1111 1111'
for (i=0 ; i < cc_count ; i++) {		
one_bit	1	'1'
reserved	4	'1111'
cc_valid	1	bslbf
cc_type	2	bslbf
cc_data_1	8	bslbf
cc_data_2	8	bslbf
}		
}		
Footnote: [1] For backwards compatibility, this bit must be zero, not one.		

process_cc_data_flag – This flag is set to indicate whether it is necessary to process the cc_data. If it is set to 1, the cc_data has to be parsed and its meaning has to be processed. When it is set to 0, the cc_data can be discarded.

zero_bit – This bit shall be '0' to maintain backwards compatibility with previous versions of this document.

cc_count – This 5-bit integer indicates the number of closed caption constructs following this field. It can have values 0 through 31. The value of cc_count shall be set according to the frame rate and coded picture structure (field or frame) such that a fixed bandwidth of 9600 bits per second is maintained for the closed caption payload data. Sixteen (16) bits of closed caption payload data are carried in each pair of the fields cc_data_1 and cc_data_2.

one_bit – This bit shall be '1' to maintain backwards compatibility with previous versions of this document.

cc_valid – This flag is set to '1' to indicate that the two closed caption data bytes that follow are valid. If set to '0' the two data bytes are invalid, as defined in [F10].

cc_type – Denotes the type of the two closed caption data bytes that follow, as defined in [F10].

cc_data_1 – The first byte of a closed caption data pair as defined in [F10].

[3] The syntax and semantics of cc_data() may be moved to a future revision of CEA-708. At that point this entire section should be deleted in deference to the CEA-708 definition. This syntax is bit-compatible with the existing syntax defined by previous versions of this document.

cc_data_2 – The second byte of a closed caption data pair as defined in [F10].

5.5.4.2 Bar Data

Bar data should be included in the Supplemental Enhancement Information whenever the rectangular picture area containing useful information does not extend to the full height or width of the coded frame[4].

Bar data shall be carried in the SEI RBSP syntax of the video Elementary Stream. After each access_unit_delimiter NAL Unit, the bar data shall be signalled by the SEI pan_scan_rect() parameters (14496-10, Annex D.1.3 and D.2.3 [F3]). After introduction, bar data shall remain in effect until the next sei_payload() or until new pan_scan_rect() is introduced. Within a sequence, bar data shall remain in effect until a picture contains new bar data or a picture contains AFD data without bar data. At the start of a sequence, the absence of bar data in a sei_payload(), unless accompanied by AFD data specifying otherwise, shall indicate that the rectangular picture area containing useful information extends to the full height and width of the coded frame.

Designation of line numbers for calculating pan_scan_rect_top_offset and pan_scan_rect_bottom_offset is video format-dependent and shall conform to the applicable standard indicated in Table F10.

Table F10 Line Number Designation

Video Format	Applicable Standard
480 Interlaced (analog)	SMPTE 170M [F6]
480 Interlaced 4:3 (digital)	SMPTE 125M [F5]
480 Progressive	SMPTE 293M [F8]
720 Progressive	SMPTE 296M [F9]
1080 Interlaced	SMPTE 274M [F7]
1080 Progressive	SMPTE 274M [F7]

5.5.5 Active Format Description Data

Active Format Description (AFD) is described in Annex A of this document. Some of the text from Annex A is reproduced in this section for the convenience of the reader. Active Format Description (AFD) should be included in video user data whenever the rectangular picture area containing useful information does not extend to the full height or width of the coded frame. AFD data may also be included in user data when the rectangular picture area containing useful information extends to the full height and width of the coded frame.

The AFD shall be carried within the SEI RBSP of the video Elementary Stream. For each Access Point the default aspect ratio of the area of interest shall be that signalled by the Supplemental Enhancement Information parameters. After introduction, an AFD shall remain in effect until the next Access Point or until another AFD value is introduced. Receivers should interpret the absence of AFD in a sequence start to mean the active format is the same as the coded frame, corresponding to AFD value '1000' (see Table F12).

[4] In other words, the video is letterboxed (bars above and/or below video) or pillarboxed (bars left and/or right of video).

Note: The AFD syntax as shown here, starting with the user_structure() of Table F5 is syntactically identical to that specified in ETSI TS 101 154 V1.7.1 [F12], and is reprinted here with permission.

5.5.5.1 AFD Syntax

The AFD is carried within the Supplemental Enhancement Information (SEI) as a "User data registered by ITU-T Recommendation T.35 SEI message" syntactic element (14496-10, Annex D.1.5 and D.2.5 [F3]). Table F11 describes the syntax of the Active Format Description.

Table F11 Active Format Description Syntax for AVC video

Syntax	No. of Bits	Format
afd_data() {		
zero_bit	1	'0'
active_format_flag	1	bslbf
alignment_bits	6	'00 0001'
if (active_format_flag == '1') {		
reserved	4	'1111'
active_format	4	bslbf
}		

5.5.5.2 AFD Semantics

active_format_flag – A 1 bit flag. A value of '1' indicates that an active format is described in this data structure.

active_format – A 4 bit field describing the "area of interest" in terms of its aspect ratio within the coded frame as defined in ISO/IEC 14496-10 [F3]. Table F12 defines the coding of the active_format field that shall be used.

The active_format is used by the receiver in conjunction with picture size and shape information as indicated in the "sequence parameter set RBSP" and the "VUI parameters". In particular, the picture width, picture height, frame cropping information, and sample aspect ratio are important for proper use of active_format. (see ISO/IEC 14496-10 [F3]):

The combination of source aspect ratio and active_format allows the receiver to identify whether the "area of interest" is the whole of the frame (e.g., source aspect ratio 16:9, active_format 16:9 center), a letterbox within the frame (e.g., source aspect ratio 4:3, active_format 16:9 center), or a "pillarbox" within the frame (e.g., source aspect ratio 16:9, active_format 4:3 center).

Table F12 Active Format

active_format	Description	
	4:3 coded frames	**16:9 coded frames**
'0000' – '0001'	Reserved	Reserved
'0010' – '0100"	Not recommended	Not recommended
'0101' – '0111'	Reserved	Reserved
'1000'	4:3 full frame image	16:9 full frame image
'1001'	4:3 full frame image	4:3 pillarbox image
'1010'	16:9 letterbox image	16:9 full frame image
'1011'	14:9 letterbox image	14:9 pillarbox image
'1100'	Reserved	Reserved
'1101'	4:3 full frame image, alternative 14:9 center	4:3 pillarbox image, alternative 14:9 center
'1110'	16:9 letterbox image, alternative 14:9 center	16:9 full frame image, alternative 14:9 center
'1111'	16:9 letterbox image, alternative 4:3 center	16:9 full frame image, alternative 4:3 center

Use of '0010', '0011' or '0100' is not recommended. Illustrations of the various values of active_format may be found in ETSI-TS 101 154 Table B.3 [F12]. Users are strongly encouraged to consult this reference.

5.5.5.3 Recommended Receiver Response to AFD

Receiving device designers are strongly encouraged to study the suite of Consumer Electronics Association (CEA) bulletins which contain the most recent recommendations regarding the processing of AFD. In several instances, a variety of design choices are possible when processing a given AFD value for display and the recommendation identifies one preferred method.

5.5.6 Relationship Between Bar Data and AFD (Informative)

Any combination of Active Format Description and bar data may be present in video user data (either, neither, or both). Note that AFD data may not always exactly match bar data because AFD only deals with 4:3, 14:9, and 16:9 aspect ratios while bar data can accurately represent nearly any aspect ratio. Whenever bar data is present, it should be assumed to be exact and a refinement of the AFD signaling.

-- End of document --