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**Working Draft:
Amendment to ATSC Digital Television Standard,
Doc. A/53E Annex A**

Advanced Television Systems Committee

1750 K Street, N.W.

Suite 1200

Washington, D.C. 20006

www.atsc.org

This Amendment to A/53E Annex A brings the document in alignment with the AFD and bar data work being undertaken concurrently by the SMPTE and CEA. The only changes are to semantics, not syntax. One new constraint is added, and that is that only one pair of bar data may be sent.

Change instructions are given in *italics*. New text that is to be added is shown in [blue underline](#). Text that is to be deleted is shown in ~~red strikethrough~~.

In Annex A of A/53E, make the following changes:

1. *Revise the first sentence of footnote 2 to read:*

“² Note that there is a coordinated effort underway among ATSC, CEA, and SMPTE to revise and clarify standards related to delivering closed captions, ~~AFD, and bar data~~ so that each describes the aspects of the system for which they are primarily responsible without overlap.”

2. *Add the following references to the Informative Reference section:*

[\[A16\] CEA-CEB16 \[in development\]: Active Format Description \(AFD\) & Bar Data Recommended Practice.](#)

[\[A17\] Proposed SMPTE 2016-1 \[in development\]: Standard for Television—Format for Active Format Description and Bar Data.](#)

3. *Revise section 5.2.3 as shown below:*

5.2.3 ATSC Picture User Data Semantics

user_data_start_code – This is set to 0x0000 01B2.

ATSC_identifier – This is a 32 bit code that indicates that the video user data conforms to this specification. The value ATSC_identifier shall be 0x4741 3934.

user_data_type_code – An 8-bit value that identifies the type of ATSC user data to follow. Value 0x03 indicates cc_data(), value 0x06 indicates bar_data(), and other values are either in use in other standards or are reserved for future use.

cc_data() – A data structure defined in Table A8.

bar_data() – A data structure [defined in Table A9](#) indicating the sizes of letterbox or pillarbox areas within the coded video frame .

ATSC_reserved_user_data – Reserved for use by ATSC or used by other standards.

4. *Revise section 5.2.3.2 as shown below:*

5.2.3.2 Bar Data

Table A9 describes the syntax of bar data. Bar data 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 frame⁷ and AFD alone is insufficient to describe the extent of the image. See Section 5.2.4 of this Annex.

When present, bar data shall be carried in the data structure bar_data(), within the picture user data syntax as shown in Table A7. After any sequence_header() such bar data shall appear before the next picture_data() within extension_and_user_data(2). After introduction, such bar data shall remain in effect until:

1. the next sequence_header(), or
2. extension_and_user_data(2) containing a bar_data() structure which contains new bar data, or
3. extension_and_user_data(2) containing AFD per Sec. 5.2.4.

~~When present, bar data shall be carried in the picture user data of the video Elementary Stream. After each sequence start (and repeat sequence start), the bar data shall be signalled. After introduction, bar data shall remain in effect until the next sequence start. 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 video sequence, unless AFD data is present specifying otherwise, the absence of bar data shall indicate that the rectangular picture area containing useful information extends to the full height and width of the coded frame.

Bar data is constrained (below) to be signalled in pairs, either top and bottom bars or left and right bars, but not both pairs at once. Bars may be unequal in size. One bar of a pair may be zero width or height.

⁷ In other words, the video is letterboxed (bars above and/or below video) or pillarboxed (bars left and/or right of video).

Table A9 Bar Data Syntax

Syntax	No. of Bits	Format
<code>bar_data() {</code>		
top_bar_flag	1	bslbf
bottom_bar_flag	1	bslbf
left_bar_flag	1	bslbf
right_bar_flag	1	bslbf
reserved	4	'1111'
if (top_bar_flag == '1') {		
marker_bits	2	'11'
line_number_end_of_top_bar	14	uimsbf
}		
if (bottom_bar_flag == '1') {		
marker_bits	2	'11'
line_number_start_of_bottom_bar	14	uimsbf
}		
if (left_bar_flag == '1') {		
marker_bits	2	'11'
pixel_number_end_of_left_bar	14	uimsbf
}		
if (right_bar_flag == '1') {		
marker_bits	2	'11'
pixel_number_start_of_right_bar	14	uimsbf
}		
marker_bits	8	'1111 1111'
while (nextbits() != '0000 0000 0000 0000 0000 0001') {		
additional_bar_data		
}		
}		

Designation of line numbers for `line_number_end_of_top_bar` and `line_number_start_of_bottom_bar` is video format-dependent and shall conform to the applicable standard indicated in Table A10.

Note: The range of line numbers and pixels within the coded frame for each image format is specified in Table 2 of SMPTE 2016-1 [A17].

Table A10 Line Number Designation

Video Format	Applicable Standard
480 Interlaced (analog)	SMPTE 170M [A5]
480 Interlaced 4:3 (digital)	SMPTE 125M [A4]
480 Interlaced 16:9 (digital)	SMPTE 267M [A6]
480 Progressive	SMPTE 293M [A8]
720 Progressive	SMPTE 296M [A9]
1080 Interlaced	SMPTE 274M [A7]
1080 Progressive	SMPTE 274M [A7]

top_bar_flag – This flag shall indicate, when set, that the top bar data is present. If left bar flag is ‘1’, this flag shall be set to ‘0’.

bottom_bar_flag – This flag shall indicate, when set, that the bottom bar data is present. This flag shall have the same value as top_bar_flag.

left_bar_flag – This flag shall indicate, when set, that the left bar data is present. If top bar flag is ‘1’, this flag shall be set to ‘0’.

right_bar_flag – This flag shall indicate, when set, that the right bar data is present. This flag shall have the same value as left_bar_flag.

line_number_end_of_top_bar – A 14-bit unsigned integer value representing the last line of a horizontal letterbox bar area at the top of the reconstructed frame. Designation of line numbers shall be as defined in Table A10.

line_number_start_of_bottom_bar – A 14-bit unsigned integer value representing the first line of a horizontal letterbox bar area at the bottom of the reconstructed frame. Designation of line numbers shall be as defined in Table A10.

pixel_number_end_of_left_bar – A 14-bit unsigned integer value representing the last horizontal luminance sample of a vertical pillarbox bar area at the left side of the reconstructed frame. Pixels shall be numbered from zero, starting with the leftmost pixel.

pixel_number_start_of_right_bar – A 14-bit unsigned integer value representing the first horizontal luminance sample of a vertical pillarbox bar area at the right side of the reconstructed frame. Pixels shall be numbered from zero, starting with the leftmost pixel.

additional_bar_data – Reserved for future ATSC definition.

5. Add new section 5.2.3.2.1 as shown below:

5.2.3.2.1 Recommended Receiver Response to Bar Data

Receiving device designers are strongly encouraged to study Consumer Electronics Association (CEA) bulletin CEB16 [A16] which contains the most recent recommendations regarding the processing of bar data.

6. Revise section 5.2.4 as shown below:

5.2.4 Active Format Description Data

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.

When present, the AFD shall be carried using the syntax defined in [A10], in extension and user_data(2) in the MPEG-2 video Elementary Stream. After any sequence_header() the default aspect ratio of the area of interest shall be that signaled by the parameters in the sequence_header() and sequence_display_extension() structures. After any sequence_header() the AFD, when present, shall appear before the next picture_data(). After introduction, such an AFD shall remain in effect until the next sequence_header() or until a new AFD is introduced. ~~When present, the AFD shall be carried, using the syntax and semantics defined in [A10], in the user data of the video Elementary Stream. After each sequence start (and repeat sequence start) the default aspect ratio of the area of interest shall be that signalled by the sequence_header and sequence_display_extension parameters. After introduction, an AFD shall remain in effect until the next sequence start or until another AFD 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 A12).~~

Note: The AFD syntax as shown ~~below~~ here is identical to that specified in ETSI TS 101 154 V1.7.1 [A10], and is reprinted here with permission. Semantic differences are documented below.

7. Revise section 5.2.4.2 as shown below:

5.2.4.2 AFD Semantics

afd_identifier – A 32-bit field that identifies that the syntax of the user data is Active Format Description. Its value is 0x44544731.

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 13818-2 [A3].

The active_format is used by the decoder in conjunction with the “source aspect ratio.” The source aspect ratio is derived from the “display aspect ratio” (DAR) signaled in the aspect_ratio_information, the horizontal_size, vertical_size, and display_horizontal_size and display_vertical_size if present (see ISO/IEC 13818-2 [A3]):

- If sequence_display_extension() is not present, source aspect ratio = DAR
- If sequence_display_extension() is present, source aspect ratio =
$$\text{DAR} \times \frac{\text{display_horizontal_size}}{\text{display_vertical_size}} \times \frac{\text{vertical_size}}{\text{horizontal_size}}$$

The combination of source aspect ratio and active_format allows the decoder 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 A12 defines the coding of the active_format field that shall be used.

Table A12 Active Format

active_format	Description	
	4:3 coded frames	16:9 coded frames
'0000'	undefined (see below)	undefined (see below)
'0000' – '0001'	Reserved	Reserved
'0010' – '0011' '0100'	Not recommended	Not recommended
'0100'	Aspect ratio greater than 16:9 (see below)	Aspect ratio greater than 16:9 (see below)
'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

[AFD '0000' indicates that information is not available and is undefined. Unless bar data is available, DTV receivers and video equipment should interpret the active image area as being the same as that of the coded frame.](#)

[AFD '0000', when accompanied by bar data, signals that the image's aspect ratio is narrower than 16:9, but is not either 4:3 or 14:9. The bar data should be used to determine the extent of the image.](#)

[AFD '0100', which should be accompanied by bar data, signals that the image's aspect ratio is wider than 16:9, as is typically the case with widescreen features. The bar data should be used to determine the height of the image.](#)

Use of [either '0010', or '0011', or '0100'](#) is not recommended [in the ATSC television system. Values '0001', '0101' through '0111' and '1100' are reserved. ~~Illustrations of the various values of active_format may be found in ETSI TS 101 154 V1.7.1 Table B.3 \[A10\]. Users are strongly encouraged to consult this reference.~~](#)

8. *Revise section 5.2.4.3 as shown below:*

5.2.4.3 Recommended Receiver Response to AFD

Receiving device designers are strongly encouraged to study the ~~suite of~~ Consumer Electronics Association (CEA) bulletins [CEB16 \[A16\]](#), which contains the most recent recommendations regarding the processing of AFD.

12. *Revise section 5.2.5 as shown below:*

5.2.5 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. When AFD and bar data are present together, AFD should be used in preference to bar data, except in the cases of AFD '0000' and '0100', where bar data should be used in concert with AFD as described above.