

Format for Active Format
Description and Bar Data



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Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Administrative Practices.

SMPTE ST 2016-1 was prepared by Technology Committee 22TV.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Standard. However, attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights.

Introduction

Image formatting information describes certain spatial characteristics of a high definition or standard definition video image. It may be generated and carried through all or some of the video production, distribution, and emission chain. The image formatting metadata types are Active Format Description (AFD), Bar Data, and Pan-Scan information.

AFD and Bar Data are intended to be broadcast with the video signal that they describe. AFD information is intended to guide DTV receivers and/or intermediate professional video equipment regarding the display of video of one aspect ratio on a display of another aspect ratio. Bar Data information is used to signal the precise unused areas of active video when the active image does not completely fill the picture area, in particular widescreen cinema material carried letterboxed in a frame with bars top and bottom.

Pan-Scan information is a set of data that is intended to guide professional video equipment in extracting an image to be presented in an aspect ratio that is different from that in which the material was produced or distributed. Independent parameters are provided for pan (horizontal offset), tilt (vertical offset), vertical size, horizontal size, and output aspect ratio. Pan-Scan information is not intended for use beyond the production and distribution environments.

The following suite of SMPTE standards defines the origination and carriage of AFD, Bar Data, and Pan-Scan information:

SMPTE ST 2016-1	Format for Active Format Description and Bar Data
SMPTE 2016-2	Format for Pan-Scan Information
SMPTE ST 2016-3	Vertical Ancillary Data Mapping of Active Format Description and Bar Data
SMPTE 2016-4	Vertical Ancillary Data Mapping of Pan-Scan Information
SMPTE 2016-5	KLV Data Coding for Active Format Description, Bar Data, and Pan-Scan Information

Other SMPTE standards may be used for alternative transport methods for this data. The relationship among these and related standards is shown in the Road Map in Annex C.

1 Scope

This Standard defines Active Format Description (AFD) and Bar Data for origination and conveyance through the production and distribution processes for standard definition or high definition television signals. AFD and Bar Data are intended to be ultimately broadcast with the video signals that they describe, therefore references to emission and DTV receivers are included to ensure compatibility between the origination of the AFD and Bar Data and its ultimate use.

Associated standards define how this information is placed into ancillary data packets and is KLV coded as SMPTE metadata. Annex C shows the relationship among the standards.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

3 Normative References

The following standards 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 agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standards indicated below.

ANSI/SMPTE 125M-1995, Television — Component Video Signal 4:2:2 — Bit-Parallel Digital Interface

ITU-R BT.656-4, Interfaces for Digital Component Video Signals in 525-Line and 625-Line Television Systems Operating at the 4:2:2 Level of Recommendation ITU-R BT.601 (Part A)

ITU-R BT.1358, Studio Parameters of 625 and 525 Line Progressive Scan Television Systems

SMPTE 274M-2008, Television — 1920 x 1080 Image Sample Structure, Digital Representation and Digital Timing Reference Sequences for Multiple Picture Rates

SMPTE 293M-2003, Television — 720 x 483 Active Line at 59.94-Hz Progressive Scan Production — Digital Representation

SMPTE 296M-2001, Television — 1280 x 720 Progressive Image Sample Structure — Analog and Digital Representation and Analog Interface

4 Definitions

active image: The portion of the video picture area that is being utilized for program content. Also referred to in CEA-CEB16 as the useful image inside the video frame. Active image excludes letterbox bars and pillarbox bars.

active video: The portion of the video signal that is used to carry picture information. For baseband digital systems, it has the specific meaning of the picture area where the V bits and H bits are both set to 0.

alternative center: A contraction of “alternative center cut” indicating an alternate aspect ratio subset of the active image, containing all of the critical action and centered on the active image.

bslbf : Bit string, left bit first, where “left” is the order in which bit strings are written. In this standard, bit strings are written as a string of 1's and 0's within single quote marks; e.g. ‘1000 0001’. Blanks within a bit string are for ease of reading and have no significance.

coded frame: The video frame as coded in a compressed bitstream for emission.

For consistency with ATSC, CEA, ETSI, and other standards, the Active Format Description and Bar Data specifications in this document refer to the term coded frame. For the purpose of this SMPTE standard, use of the words “coded frame” shall be taken to apply also to the active video area defined by the applicable production format standard for the video signal being described by the AFD and Bar Data.

letterbox: “Letterbox” describes a frame that the active image does not fill vertically, requiring bars without active image information at the top and/or the bottom of the image.

pillarbox: “Pillarbox” describes a frame that the active image does not fill horizontally, requiring bars without active image information at the left and/or right sides of the image. Some publications, including SMPTE RP 199, refer to pillarbox in a 16:9 display area by the term “sidebar”.

reconstructed frame: The video frame at the output of a compressed bitstream decoder.

For consistency with ATSC, ETSI, and other standards, the Active Format Description and Bar Data specifications in this document refer to the term reconstructed frame. For the purpose of this SMPTE standard, use of the words “reconstructed frame” shall be taken to apply also to the image area defined by the applicable production format standard for the video signal being described by the AFD and Bar Data.

uimsbf: Unsigned integer, most significant bit first. The byte order of multi-byte words is most significant byte first.

5 Active Format Description

The Active Format Description (AFD) is a 4-bit code describing a video picture in terms of the aspect ratio and other characteristics of the active image within the coded frame. The complete set of Active Format Description codes is shown in Table 1, where in every case the term image refers to the active image.

NOTE – A DTV receiver or intermediate processing equipment interprets the AFD in conjunction with the aspect ratio of the coded frame.

Table 1 – Active Format Description codes

Active Format Description		AFD Code
In a 4:3 coded frame	In a 16:9 coded frame	a3, a2, a1, a0
Undefined (see below)	Undefined (see below)	'0000'
Reserved	Reserved	'0001'
Letterbox 16:9 image, at top of the coded frame (see note 1)	Full frame 16:9 image, the same as the coded frame (see notes 1 and 2)	'0010'
Letterbox 14:9 image, at top of the coded frame (see note 1)	Pillarbox 14:9 image, horizontally centered in the coded frame (see notes 1 and 3)	'0011'
Letterbox image with an aspect ratio greater than 16:9, vertically centered in the coded frame (see note 1)	Letterbox image with an aspect ratio greater than 16:9, vertically centered in the coded frame (see note 1)	'0100'
Reserved	Reserved	'0101'
Reserved	Reserved	'0110'
Reserved	Reserved	'0111'
Full frame 4:3 image, the same as the coded frame	Full frame 16:9 image, the same as the coded frame	'1000'
Full frame 4:3 image, the same as the coded frame (see note 4)	Pillarbox 4:3 image, horizontally centered in the coded frame	'1001'
Letterbox 16:9 image, vertically centered in the coded frame with all image areas protected (see note 5)	Full frame 16:9 image, with all image areas protected (see note 5)	'1010'
Letterbox 14:9 image, vertically centered in the coded frame	Pillarbox 14:9 image, horizontally centered in the coded frame	'1011'
Reserved	Reserved	'1100'
Full frame 4:3 image, with alternative 14:9 center (see note 6)	Pillarbox 4:3 image, with alternative 14:9 center (see note 6)	'1101'
Letterbox 16:9 image, with alternative 14:9 center (see note 6)	Full frame 16:9 image, with alternative 14:9 center (see note 6)	'1110'
Letterbox 16:9 image, with alternative 4:3 center (see note 6)	Full frame 16:9 image, with alternative 4:3 center (see note 6)	'1111'

If Bar Data is not present (see § 9.2.1), AFD '0000', indicates that exact information is not available and the active image should be assumed to be the same as the coded frame. AFD '0000', when accompanied by Bar Data, signals that the active image's aspect ratio is narrower than 16:9, but is not 4:3 or 14:9. As the exact aspect ratio cannot be conveyed by AFD alone, wherever possible, AFD '0000' should be accompanied by Bar Data to define the exact vertical or horizontal extent of the active image.

AFD code '0100' signals that the active image aspect ratio is wider than 16:9. As the exact aspect ratio cannot be conveyed by AFD alone, wherever possible, AFD '0100' should be accompanied by Bar Data to define the exact vertical extent of the active image.

AFD codes may be applicable to 4:3 coded frames, 16:9 coded frames, or both and may have different meanings for each. Example illustrations in Figures 2 and 3 show AFD representations for both 4:3 and 16:9 coded frames. The AFD codes may also be used with coded frames of other aspect ratios but such use is outside the scope of this standard.

NOTES

- 1 In determining AFD codes to originate, users are cautioned that emission systems in some areas of the world may not support some or all of AFD codes '0001' through '0111'.

- 2 In a 16:9 coded frame, AFD code '0010' represents the same image display as AFD code '1000'. AFD code '1000' is the preferred coding for a full frame 16:9 image. AFD code '0010' is not used in North America.
- 3 In a 16:9 coded frame, AFD code '0011' represents the same image display as AFD code '1011'. AFD code '1011' is the preferred coding for a horizontally centered 14:9 pillarbox image. AFD code '0011' is not used in North America.
- 4 In a 4:3 coded frame, AFD code '1001' represents the same image display as AFD code '1000'. AFD code '1000' is the preferred coding for a full frame 4:3 image.
- 5 AFD code '1010' is intended for use with images that may not fill the frame vertically but where all areas of the image should be displayed (e.g. an image where cropping is not permitted) and which therefore can only be adequately displayed in letterbox format.
- 6 The “alternative center” image refers to an area of essential picture information. The areas outside this area (shown gray in the illustrations in figures 1, 2, and 3) may optionally be cropped without significant loss to the viewer.
- 7 Aspect ratio information for the coded frame is not part of the AFD code and it is necessary to code this aspect ratio information separately – see § 5.2. The AFD and aspect ratio codes may be transported together as part of a larger data structure.

The AFD codes are illustrated using the diagrammatic representation shown in Figure 1, Figure 2, and Figure 3, where in every case the term image refers to the active image. The duplicate image displays for codes mentioned in Notes 3, 4 and 5 above are not illustrated.

For further guidance on how consumer devices handle AFD and Bar Data information, see the ETSI, Digital TV Group and CEA references in Annex A.

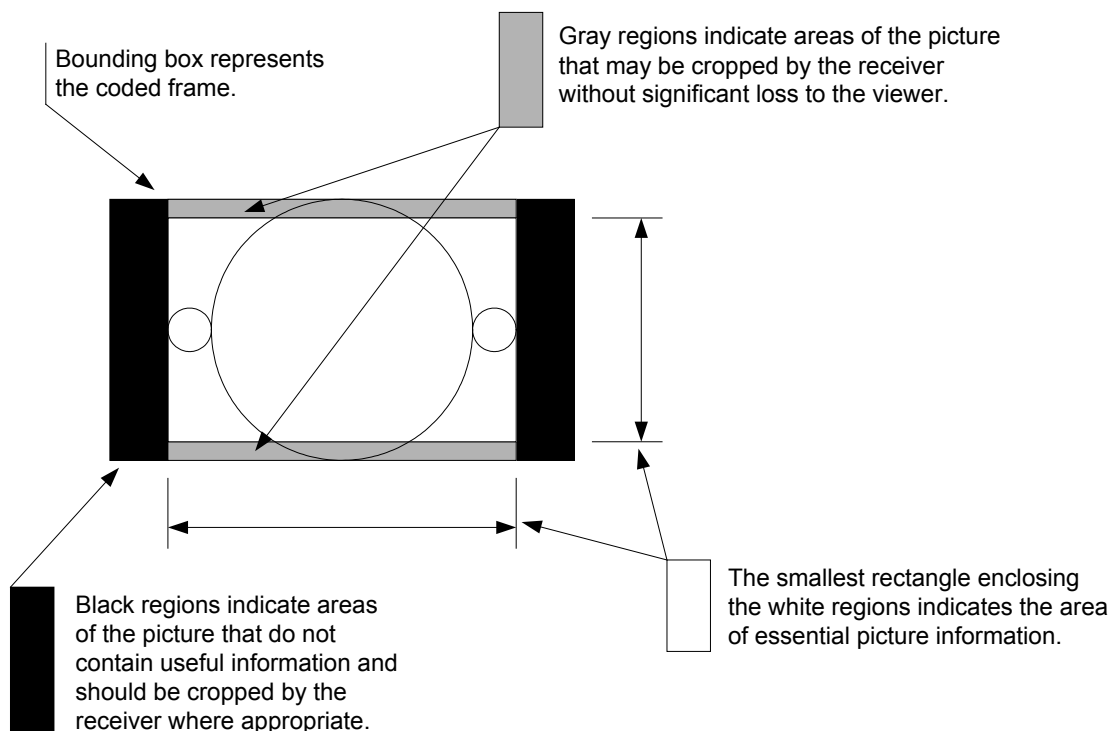


Figure 1 – Explanation of AFD diagrammatic representations (Informative)