SMPTE RECOMMENDED PRACTICE

Specifications for Safe Action and Safe Title Areas for Television Systems

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Approved December 18, 2009

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 RP 218 was prepared by Technology Committee 10E.

Intellectual Property

At the time of publication no notice had been received by SMPTE claiming patent rights essential to the implementation of this Recommended Practice. 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

This section is entirely informative and does not form an integral part of this Engineering Document.

This Recommended Practice provides the tools for calculating Safe Action and Safe Title Areas of any size. It also defines a set of Safe Areas, which are given in Annex B. These are legacy safe areas and are not reflective of current practice; for current practice, users should consult SMPTE ST 2046-1 and SMPTE RP 2046-2.

Users are advised that at the time of issue of this revision, the closed captioning system defined in CEA 708 specified the Safe Title Area defined in this Recommended Practice as the area of the image within which captions must be displayed. As this area is significantly smaller than the SMPTE ST 2046-1 Safe Action and Safe Title Areas, users are cautioned that it may not be possible to directly overlay captions on elements around the outer margins of the SMPTE ST 2046-1 Safe Areas.

1 Scope

This practice describes a method for locating the safe action and safe title areas for television systems. This document is intended for application in program production where the image aspect ratio of the acquired essence is the same as that of the display.

The safe areas defined in Annex B of this Recommended Practice are a legacy of past practice. They are based on the limitations of CRT-based displays. Users are advised to consult SMPTE ST 2046-1 for the current safe areas, which are based on fixed pixel matrix displays and are significantly larger. Moreover, the safe areas defined herein do not offer guidance in situations where material generated in one aspect ratio may need to be displayed in a different aspect ratio. Users are advised to consult SMPTE RP 2046-2 for this information.

Safe action and safe title areas are located within the television system image production aperture lattice. *Safe action area* specifies an image area within which all significant action must take place. *Safe title area* specifies an image area within which important title information must be confined. These areas ensure visibility of action and title information on the majority of home television receivers.

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.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Definitions

3.1 Aspect Ratio

Aspect ratio is the ratio of the horizontal dimension to the vertical dimension of a rectangular active image area.

3.2 Image Lattice

An image lattice is a two-dimensional, rectangular array of pixels.

3.3 Production Aperture

Production aperture is the image lattice that represents the maximum possible active image extent in a given standard. In this practice, production aperture is defined in pixel units, the number active image pixels per horizontal row by the number of active image pixels per vertical column in a rectangular image area of any aspect ratio.

4 Safe Action and Safe Title Areas

4.1 Safe Action Area

The safe action area is the maximum image area within which all significant action shall be contained. The image area defined by the safe action area is smaller than, and concentric with the production aperture image area.

The horizontal safe action area shall be 90% of the production aperture picture width. The vertical safe action area shall be 90% of the production aperture picture height.

4.2 Safe Title Area

The safe title area is the maximum image area within which all significant titles shall be contained. The image area defined by the safe title area is contained within the production aperture image area and is smaller than, and cocentric with the image area defined by the safe action area.

The horizontal safe title area shall be 80% of the picture width. The vertical safe title area shall be 80% of the picture height.

4.3 Production Area

It shall be noted that it is not the intent of this practice that information outside the safe action and safe title areas be discarded. Production aperture image area shall be retained and, to the extent permitted by transmission standards, shall be transmitted.

5 Electronic Graticules

An electronic graticule that displays the border of the safe action area and/or safe title area can be generated and superimposed on a source production area image, thus indicating image areas within which action and/or title essence shall be contained. The graticule display shall take the form of thin but visible lines.

5.1 Width of Graticule

The graticule shall be of sufficient width to be displayed clearly. Each vertical line contained in the graticule shall be 0.5% of the number of active pixels per horizontal (scanning) line, rounded down to the nearest whole number of pixels. Each horizontal line contained in the graticule shall be 0.5% of the number of active (scanning) lines, rounded up to the nearest whole number of (scanning) lines.

5.2 Safe Action Area Graticule

The safe action area graticule shall be a solid, visible line superimposed on the source production area image.

5.3 Safe Title Area Graticule

The safe title area graticule shall be a dashed, visible line superimposed on the source production area image.

Annex A (Normative)
Example Calculation of Safe Area and Safe Title Positions

A.1 Safe Action Area and Safe Title Area Calculation

The following formulae may be used to calculate the safe action area and safe title area for a production area of any size and aspect ratio. Calculations for safe area width (horizontal) and safe area height (vertical) are independent. Zero based numbering is used to remain consistent with previous standards and practices such as ITU-R BT.601-5 and SMPTE RP 187.

A.1.1 Legend

H = Production area pixels per row (horizontal)

V = Production area pixels per column (vertical)

$\%_H$ = Picture width of safe area in percent

$\%_V$ = Picture height of safe area in percent

P_H = Pixels from production area edges to side safe action boundaries (horizontal)

P_V = Pixels from production area edges to top and bottom safe action boundaries (vertical)

H_{SW} = Safe area width pixels per row (horizontal)

V_{SH} = Safe area height pixels per column (vertical)

C_L = Left side safe area boundary pixel column number

C_R = Right side safe area boundary pixel column number

R_T = Top edge safe area boundary pixel row number

R_B = Bottom edge safe area boundary pixel row number

A.1.2 Number of pixels from left and right aperture edges to safe area boundaries:

$$P_H = (H - (\%_H \times H)) \div 2$$

A.1.3 Number of pixels from top and bottom aperture edges to safe area boundaries:

$$P_V = (V - (\%_V \times V)) \div 2$$

A.1.4 Rounding

Rounding is applied to locate boundaries in their most safe positions, toward the center of the image and away from the edges of the image.

The values P_H and P_V shall be rounded up to the nearest whole number.

A.1.5 Pixels contained in the safe area

Safe area pixels per row $H_{SW} = H - (2 \times P_H)$

Safe area pixels per column $V_{SH} = V - (2 \times P_V)$

A.1.6 Safe area boundary locations

A.1.6.1 Safe area boundary column numbers for picture sides:

Left side boundary pixel column number $C_L = P_H - 1$

Right side boundary pixel column number $C_R = H - P_H$

A.1.6.2 Safe area boundary row numbers for top and bottom edges of the picture:

Top edge boundary pixel row number $R_T = P_V - 1$

Bottom edge boundary pixel row number $R_B = V - P_V$

Annex B (Normative)
System Examples

The safe areas defined in Annex B of this Recommended Practice are a legacy of past practice. They are based on the limitations of CRT-based displays. Users are advised to consult SMPTE ST 2046-1 for the current safe areas, which are based on fixed pixel matrix displays and are significantly larger

Tables B.1 through B.6 illustrate examples of Safe Action Area and Safe Title area calculations for a number of television standards.

Table B.1a – Safe action area – 1920 x 1080

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	1920	1080	2,073,600
Safe action percent of width and height	90%	90%	
Safe action pixel matrix	1728	972	1,679,616
Number of pixels from production area edge to safe action boundary	96	54	
	Pixel column number		Pixel row number
Safe action boundary left side pixel column	95	Safe action boundary top edge pixel row	53
Safe action boundary right side pixel column	1824	Safe title boundary bottom edge pixel row	1026

Table B.1b – Safe title area – 1920 x 1080

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	1920	1080	2,073,600
Safe title percent of width and height	80%	80%	
Safe title pixel matrix	1536	864	1,327,104
Number of pixels from production area edge to safe title boundary	192	108	
	Pixel column number		Pixel row number
Safe title boundary left side pixel column	191	Safe title boundary top edge pixel row	107
Safe title boundary right side pixel column	1728	Safe title boundary bottom edge pixel row	972

Table B.2a – Safe action area – 1920 x 1035

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	1920	1035	1,987,200
Safe action percent of width and height	90%	90%	
Safe action pixel matrix	1728	931	1,608,768
Number of pixels from production area edge to safe action boundary	96	52	
Safe action boundary left side pixel column	95	51	Safe action boundary top edge pixel row
Safe action boundary right side pixel column	1824	983	Safe sction boundary bottom edge pixel row

Table B.2b – Safe title area – 1920 x 1035

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	1920	1035	1,987,200
Safe title percent of width and height	80%	80%	
Safe title pixel matrix	1536	827	1,270,272
Number of pixels from production area edge to safe title boundary	192	103	
Safe title boundary left side pixel column	191	103	Safe title boundary top edge pixel row
Safe title boundary right side pixel column	1728	931	Safe title boundary bottom edge pixel row

Table B.3a – Safe action area – 1280 x 720

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	1280	720	921,600
Safe action percent of width and height	90%	90%	
Safe action pixel matrix	1152	648	746,496
Number of pixels from production area edge to safe action boundary	64	36	
Safe action boundary left side pixel column	63	35	Safe action boundary top edge pixel row
Safe action boundary right side pixel column	1216	684	Safe action boundary bottom edge pixel row

Table B.3b – Safe title area – 1280 x 720

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	1280	720	921,600
Safe title percent of width and height	80%	80%	
Safe title pixel matrix	1024	576	589,824
Number of pixels from production area edge to safe title boundary	128	72	
Safe title boundary left side pixel column	127	71	Safe title boundary top edge pixel row
Safe title boundary right side pixel column	1152	648	Safe title boundary bottom edge pixel row

Table B.4a – Safe action area – 720 x 480

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	720	480	345,600
Safe action percent of width and height	90%	90%	
Safe action pixel matrix	648	432	279,936
Number of pixels from production area edge to safe action boundary	36	24	
Safe action boundary left side pixel column	35	23	Safe action boundary top edge pixel row
Safe action boundary right side pixel column	684	456	Safe action boundary bottom edge pixel row

Table B.4b – Safe title area – 720 x 480

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	720	480	345,600
Safe title percent of width and height	80%	80%	
Safe title pixel matrix	576	384	221,184
Number of pixels from production area edge to safe title boundary	72	48	
Safe title boundary left side pixel column	71	47	Safe title boundary top edge pixel row
Safe title boundary right side pixel column	648	432	Safe title boundary bottom edge pixel row

Table B.5a – Safe action area – 960 x 480

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	960	480	460,800
Safe action percent of width and height	90%	90%	
Safe action pixel matrix	864	432	373,248
Number of pixels from production area edge to safe action boundary	48	24	
Safe action boundary left side pixel column	47	23	Safe action boundary top edge pixel row
Safe action boundary right side pixel column	912	456	Safe action boundary bottom edge rixel row

Table B.5b – Safe title area – 960 x 480

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	960	480	460,800
Safe title percent of width and height	80%	80%	
Safe title pixel matrix	768	384	294,912
Number of pixels from production area edge to safe title boundary	96	48	
Safe title boundary left side pixel column	95	47	Safe title boundary top edge pixel row
Safe title boundary right side pixel column	864	432	Safe title boundary bottom edge pixel row

Table B.6a – Safe action area – 720 x 576

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	720	576	414,720
Safe action percent of width and height	90%	90%	
Safe action pixel matrix	648	518	335,664
Number of pixels from production area rdge to safe action boundary	36	29	
Safe action boundary left side pixel column	35	28	Safe action boundary top edge pixel row
Safe action boundary right side pixel column	684	547	Safe action boundary bottom edge pixel row

Table B.6b – Safe title area – 720 x 576

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	720	576	414,720
Safe title percent of width and height	80%	80%	
Safe title pixel matrix	576	460	264,960
Number of pixels from production area edge to safe title boundary	72	58	
Safe title boundary left side pixel column	71	57	Safe title boundary top edge pixel row
Safe title boundary right side pixel column	648	518	Safe title boundary bottom edge pixel row

Table B.7a – Safe action area – 704 x 480

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	704	480	414,720
Safe action percent of width and height	90%	90%	
Safe action pixel matrix	632	432	273,024
Number of pixels from production area edge to safe action boundary	36	24	
Safe action boundary left side pixel column	35	23	Safe action boundary top edge pixel row
Safe action boundary right side pixel column	668	456	Safe action boundary bottom edge pixel row

Table B.7b – Safe title area – 704 x 480

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	704	480	414,720
Safe title percent of width and height	80%	80%	
Safe title pixel matrix	562	384	215,808
Number of pixels from production area edge to safe title boundary	71	48	
Safe title boundary left side pixel column	70	47	Safe title boundary top edge pixel row
Safe title boundary right side pixel column	633	432	Safe title boundary bottom edge pixel row

Table B.8a – Safe action area – 704 x 576

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	704	576	414,720
Safe action percent of width and height	90%	90%	
Safe action pixel matrix	632	518	327,376
Number of pixels from production area edge to safe action boundary	36	29	
Safe action boundary left side pixel column	35	28	Safe action boundary top edge pixel row
Safe action boundary right side pixel column	668	547	Safe action boundary bottom edge pixel row

Table B.8b – Safe title area – 704 x 576

	Horizontal pixels	Vertical pixels	Total pixels
Production area pixel matrix	704	576	414,720
Safe title percent of width and height	80%	80%	
Safe title pixel matrix	562	460	258,520
Number of pixels from production area edge to safe title boundary	72	58	
Safe title boundary left side pixel column	70	57	Safe title boundary top edge pixel row
Safe title boundary right side pixel column	633	518	Safe title boundary bottom edge pixel row

Annex C (Informative)
Bibliography

C.1 SMPTE RP 187-1995, Center, Aspect Ratio, and Blanking of Video Images

C.2 Document 11A/TEMP/57-E, Preliminary Draft Revision of Recommendation ITU-R BT.1379, Safe Areas of Wide-Screen 16:9 and Standard 4:3 Aspect Ratio Productions to Achieve a Common Production Format during a Transition Period to Wide-Screen 16:9 Production and Broadcasting.

This draft document is applicable only to active pixel matrices of 704 horizontal by 576 vertical pixels. The reference information defines four safe action and safe graphics area options that can be used during acquisition and production of 16:9 or 4:3 aspect ratio program material and to result in an optimal display of program essence on both 16:9 and 4:3 aspect ratio television receivers. The four specific safe area applications as follows:

a) Acquire 16:9, protect central 14:9 area for action, protect central 4:3 area for graphics.
b) Acquire 16:9, protect central 4:3 area for action and graphics.
c) Acquire 16:9, protect action and graphics for 16:9 area.
d) Acquire 4:3, protect a central 14:9 area within the 4:3 area for action and graphics.

This practice (SMPTE RP 218) does not comply with the provisions of the above reference, ITU-R 11A/TEMP/57-E. Programs produced using this practice may, therefore, not meet the requirements of some broadcasters.

C.3 ARIB TR-B4, April 1997, Safety Zone for 16:9 Aspect Ratio Television System

The following safe areas are defined in the ARIB (Association of Radio Industries and Businesses) document TR-B4 for 16:9 aspect ratio television systems:

	Vertical	Horizontal
Safe title area:	80%	80%
Safe action area:	93.1%	93%
Important information area:	89%	88%

The above values are based on research of consumer receiver displays in the Japan market about 1996.

C.4 SMPTE ST 2046-1:2009, Specifications for Safe Action and Safe Title Areas for Television

C.5 SMPTE RP 2046-2:2009, Safe Areas for Protection of Alternate Aspect Ratios

Revision Notes

This revision incorporates Amendment #1 to SMPTE RP 218 approved December 18, 2009.

The changes are summarized below:

1. The following Sections have been added to be in conformance with other SMPTE documents: Table of Contents, Foreword, Intellectual Property, and Introduction.

2. "Section 1, Scope" has been modified.

3. "Section 2, Conformance Notation" has been added and all sections following have been renumbered (including all references to sections within the document).

4. An explanatory note has been added at the beginning of Annex B.

5. The following references have been added to Annex C, Bibliography:

C.4 SMPTE ST 2046-1:2009, Specifications for Safe Action and Safe Title Areas for Television

C.5 SMPTE RP 2046-2:2009, Safe Areas for Protection of Alternate Aspect Ratios