SMPTE STANDARD

Specifications for Safe Action and Safe Title Areas for Television

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Approved
November 23, 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 ST 2046-1 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 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

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

This Standard is a comprehensive revision of SMPTE RP 218-2002, Specifications for Safe Action and Safe Title Areas for Television Systems. It reflects the significant changes in production, transmission and display technologies that have occurred since that document was originally issued.

A safe area, in the context of television production, is the area of the image that is certain to be seen by the vast majority of viewers in the home. Historically, two types of safe areas are specified, the Safe Action Area and the Safe Title Area. They differ in that the extremes of the Safe Action Area are deemed usable even if there is some degree of geometric, chromatic or other distortion, whereas the Safe Title Area must be free of these distortions.

The Safe Action and Safe Title Areas specified in SMPTE RP 218 Annex B and its predecessor, SMPTE RP 27.3, were based on analog transmission and CRT displays; all evidence points to their having been derived from research conducted in the late 1950s. Virtually all the technologies of television production, transmission and display have changed radically since that time. In particular, the complete replacement of scanned analog imagers and displays by fixed-pixel-matrix imagers and displays has eliminated the need for large tolerances in image geometry, convergence and displayed area. Industry practice has changed as a result, and this Standard reflects those changes.

One aspect of the changes in industry practice, which is still in transition, is the nomenclature used to describe the image lattice. As defined, this is an array of pixels. However, in picture scanning, this is an array of pixels in the horizontal direction and a number of scan lines in the vertical. The image format definitions used in this document use both types of nomenclature and this usage is historical.

The following SMPTE documents specify the safe areas for television:

SMPTE ST 2046-1, Specifications for Safe Action and Safe Title Areas for Television

SMPTE RP 2046-2, Safe Areas for Protection of Alternate Aspect Ratios

SMPTE RP 218, Specifications for Safe Action and Safe Title Areas for Television Systems (Note: The Scope of this Recommended Practice has been narrowed significantly.)

1 Scope

This Standard defines and specifies Safe Action and Safe Title Areas for 1920 x 1080, 1280 x 720, 720 x 576 and 720 x 480 television formats. 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 this Standard differ from past practice; they take into account changes in image acquisition, transmission and display technology. They do not offer guidance in situations where material generated in one aspect ratio may need to be displayed in a different aspect ratio.

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.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

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 Normative Reference

The following document contains 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.

SMPTE RP 202-2008, Video Alignment for Compression Coding

4 Definitions

4.1 Aspect Ratio

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

4.2 Image Lattice

An Image Lattice is a two-dimensional, rectangular array of pixels.

Note: In § 5, Image Lattices are described in terms of an array of pixels and scan lines. See the Introduction for more background.

4.3 Production Aperture

The Production Aperture is the Image Lattice that represents the maximum possible active image area in a given image format. In this Standard, Production Aperture is defined in pixel units, and is denoted as the number of 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. For the 720 x 480 formats, the Production Aperture is not used. See Annex B.

4.4 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 concentric with the Production Aperture.

4.5 Safe Title Area

The Safe Title Area is the maximum image area within which all significant title information shall be contained. The image area defined by the Safe Title Area is concentric with the Production Aperture.

5 Specification of Safe Action Area and Safe Title Area

Safe Action and Safe Title Areas are specified in percentages of the full image area, which is typically but not always the same as the Production Aperture. Safe area calculations resulting in non-integer values for lines or pixel numbers shall be rounded to the nearest whole number. The numbers in parentheses are the horizontal and vertical dimensions of the defined safe area, inclusive, in (pixels x lines).

Note: Notwithstanding the specification of the Safe Action and Safe Title Areas given below, users are advised that many consumer fixed-pixel-matrix displays can be configured to show the entire image area. It is critically important to ensure that the entire image area is kept clear of extraneous elements such as lighting instruments, boom shadows, cables and graphics that are not intended to be seen by the viewer. This is especially important vertically in the case of 16:9 images, which might be rendered in letterbox form on legacy 4:3 displays and horizontally in the case of 4:3 images, which might be rendered in pillarbox form on 16:9 displays.

Note: All versions of CEA-708 reference the SMPTE RP 218 Safe Title Area, which is 80% of the width and 80% of the height of the Production Aperture. As of the date of publication of this standard, all consumer receivers in the United States were designed to place captions in the displayed image in accordance with CEA-708. Creators of closed caption information are advised to take this into account when authoring captions intended for display in specific areas of the image.

5.1 1080 Line Formats

The Safe Action Area for 1920 x 1080 formats shall be 93% of the width and 93% of the height of the Production Aperture (1786 x 1004). The Safe Title Area for 1920 x 1080 formats shall be 90% of the width and 90% of the height of the Production Aperture (1728 x 972). See Figure D.1.

5.2 720 Line Formats

The Safe Action Area for 1280 x 720 formats shall be 93% of the width and 93% of the height of the Production Aperture (1190 x 670.) The Safe Title Area for 1280 x 720 formats shall be 90% of the width and 90% of the height of the Production Aperture (1152 x 648.) See Figure D.1.

5.3 576 Line Formats

The Safe Action Area for 720 x 576 formats, regardless of Aspect Ratio, shall be 93% of the width and 93% of the height of the Production Aperture (670 x 536). The Safe Title Area for 720 x 576 formats, regardless of Aspect Ratio, shall be 90% of the width and 90% of the height of the Production Aperture (648 x 518.) See Figures D.1 and D.2.

Note: A different safe-area specification was developed by ITU-R for use during the transition period to wide-screen 16:9 broadcasting, and is still in use in some regions where 576-line formats are used. See Annex A Bibliography.

5.4 480 Line Formats

The Safe Action Area for 720 x 480 formats, regardless of Aspect Ratio, shall be 93% of the width and 93% of the height of the 720 x 480 Image Lattice (670 x 446). See Annex B. The Safe Title Area for 720 x 480 formats, regardless of Aspect Ratio, shall be 90% of the width and 90% of the height of the 720 x 480 Image Lattice (648 x 432). See Annex B and Figures D.1 and D.2. Both the Safe Action Area and the Safe Title Area are concentric with the 720 x 480 Image Lattice, not the Production Aperture.

For compatibility with legacy material, the RP-218 Safe Title Area and Safe Action Area may be used as follows: the Safe Action Area shall be 90% of the width and 90% of the height of the 720 x 480 Image Lattice (648 x 432). The Safe Title Area shall be 80% of the width and 80% of the height of the 720 x 480 Image Lattice (576 x 384). See Figure D.3.

Annex A Bibliography (Informative)

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

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

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

CEA-708-D (2008), Digital Television (DTV) Closed Captioning

EBU R95 (2008), Recommendation for Safe areas for 16:9 television production

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.1379-2 (09/07) – Safe Areas of Wide-Screen 16:9 and Standard 4:3 Aspect Ratio Productions to Achieve a Common Format During a Transition Period to Wide Screen 16:9 Broadcasting

Annex B 480-Line Format Image Lattice (Informative)

Users will note that the specification given here for the Image Lattice for 480-line (525 total lines) formats differs from that of SMPTE 125M and SMPTE RP 187.

The safe areas defined in this document for 480-line formats are given as percentages of the range of coded lines and pixels specified in SMPTE RP 202, rather than the Production Aperture as defined in ANSI/SMPTE 125M or SMPTE RP 187. This is consistent with SMPTE RP 218-2002, the predecessor of this Standard, and is necessary because of the widespread use of block-based video compression systems in television production, distribution and emission. While the analog and uncompressed digital 525-line television systems on which these are based are capable of conveying more than 480 lines, the vast preponderance of compression systems, including all those used for emission, limit the number of lines of picture information to 480. Moreover, in many of the major markets in which 525-line systems are used, up to 22 lines of each field have been used for sync, test signals and data, reducing the effective image height to no more than 481 lines, rather than the 486 lines cited in SMPTE RP 187.

Users are urged to adopt the 720 x 480 Image Lattice specified here as the maximum size of the transmitted image, as this will materially aid in conversion of images among formats and will minimize the possibility of unwanted legacy vertical interval information being transmitted to the home.

Annex C Safe Areas for Common Video Standards (Informative)

Line and pixel numbers to be used for Safe area calculations are video format dependent and are based on the applicable standard for the format, taking account of the spatial alignment of lines and pixels for MPEG encoding as recommended in SMPTE RP 202. Safe area calculations resulting in non-integer values for lines or pixel numbers have been rounded to the nearest whole number. Table 1 through Table 5 list the safe areas for a number of common television standards.

Table 1 – 1920 x 1080, 2:1 interlace (SMPTE 274M)

Production Aperture	Size (pixels x lines)	1920 x 1080
	Horizontal range (pixel # to pixel #, inclusive)	0 to 1919
	Vertical range (line # to line #, inclusive)	21 to 560 and 584 to 1123
Safe Action Area	Size (pixels x lines)	1786 x 1004
	Horizontal range (pixel # to pixel #, inclusive)	67 to 1852
	Vertical range (line # to line #, inclusive)	40 to 541 and 603 to 1104
Safe Title Area	Size (pixels x lines)	1728 x 972
	Horizontal range (pixel # to pixel #, inclusive)	96 to 1823
	Vertical range (line # to line #, inclusive)	48 to 533 and 611 to 1096

Table 2 – 1920 x 1080, Progressive (SMPTE 274M)

Production Aperture	Size (pixels x lines)	1920 x 1080
	Horizontal range (pixel # to pixel #, inclusive)	0 to 1919
	Vertical range (line # to line #, inclusive)	42 to 1121
Safe Action Area	Size (pixels x lines)	1786 x 1004
	Horizontal range (pixel # to pixel #, inclusive)	67 to 1852
	Vertical range (line # to line #, inclusive)	80 to 1083
Safe Title Area	Size (pixels x lines)	1728 x 972
	Horizontal range (pixel # to pixel #, inclusive)	96 to 1823
	Vertical range	96 to 1067

Table 3 – 1280 x 720, 16:9 aspect ratio, Progressive, (SMPTE 296M)

Production Aperture	Size (pixels x lines)	1280 x 720
	range	0 to 1279
	Vertical range (line # to line #, inclusive)	26 to 745
Safe Action Area	Size (pixels x lines)	1190 x 670
	Horizontal range (pixel # to pixel #, inclusive)	45 to 1234
	Vertical range (line # to line #, inclusive)	51 to 720
Safe Title Area	Size (pixels x lines)	1152 x 648
	Horizontal range (pixel # to pixel #, inclusive)	64 to 1215
	Vertical range (line # to line #, inclusive)	62 to 709

Table 4 - 525/59.94, 2:1 interlace (ANSI/SMPTE 125M, SMPTE RP 202)

720 x 480 Image Lattice	Size (pixels x lines)	720 x 480
	Horizontal range (pixel # to pixel #, inclusive)	0 to 719
	Vertical range (line # to line #, inclusive)	23 to 262 and 286 to 525
Safe Action Area	Size (pixels x lines)	670 x 446
	Horizontal range (pixel # to pixel #, inclusive)	25 to 694
	Vertical range (line # to line #, inclusive)	32 to 254 and 294 to 516
Safe Title Area	Size (pixels x lines)	648 x 432
	Horizontal range (pixel # to pixel #, inclusive)	36 to 683
	Vertical range (line # to line #, inclusive)	35 to 250 and 298 to 513

Table 5 - 625/50, 2:1 interlace (ITU-R BT.656)

Production Aperture	Size (pixels x lines)	720 × 576
	Horizontal range (pixel # to pixel #, inclusive)	0 to 719
	Vertical range (line # to line #, inclusive)	23 to 310 and 336 to 623
Safe Action Area	Size (pixels x lines)	670 × 536
	Horizontal range (pixel # to pixel #, inclusive)	25 to 694
	Vertical range (line # to line #, inclusive)	33 to 300 and 346 to 613
Safe Title Area	Size (pixels x lines)	648 × 518
	Horizontal range (pixel # to pixel #, inclusive)	36 to 683
	Vertical range (line # to line #, inclusive)	38 to 296 and 350 to 608

Annex D Graticules (Informative)

The figures below are graticules for Safe Title Area and Safe Action Area. In these figures, the solid outer line represents the Production Aperture, or 720 x 480 Image Lattice in the case of 480i (see Annex B.) The dot-dash middle line is the Safe Action Area. The dotted innermost line is the Safe Title Area.

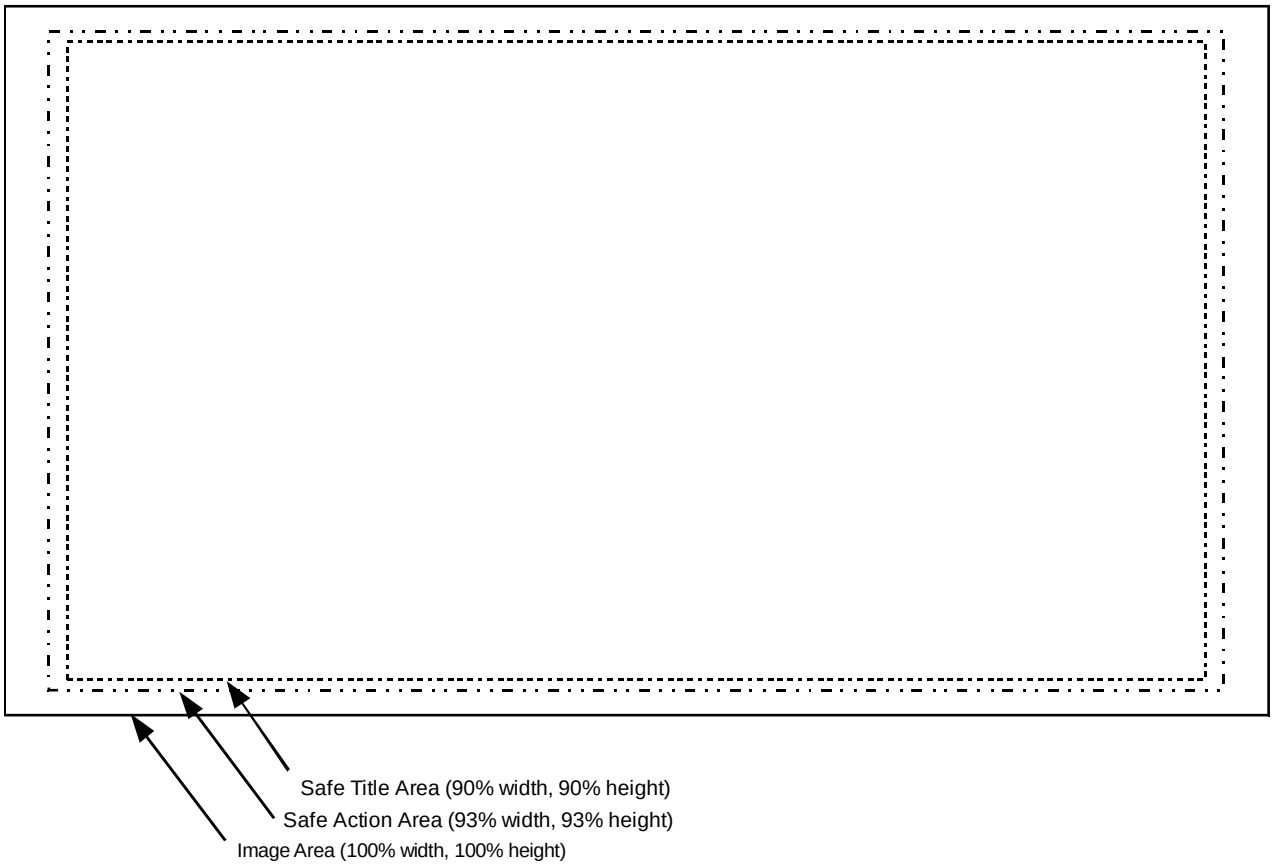

Figure D.1 – 16:9 Format Safe Action and Safe Title Areas

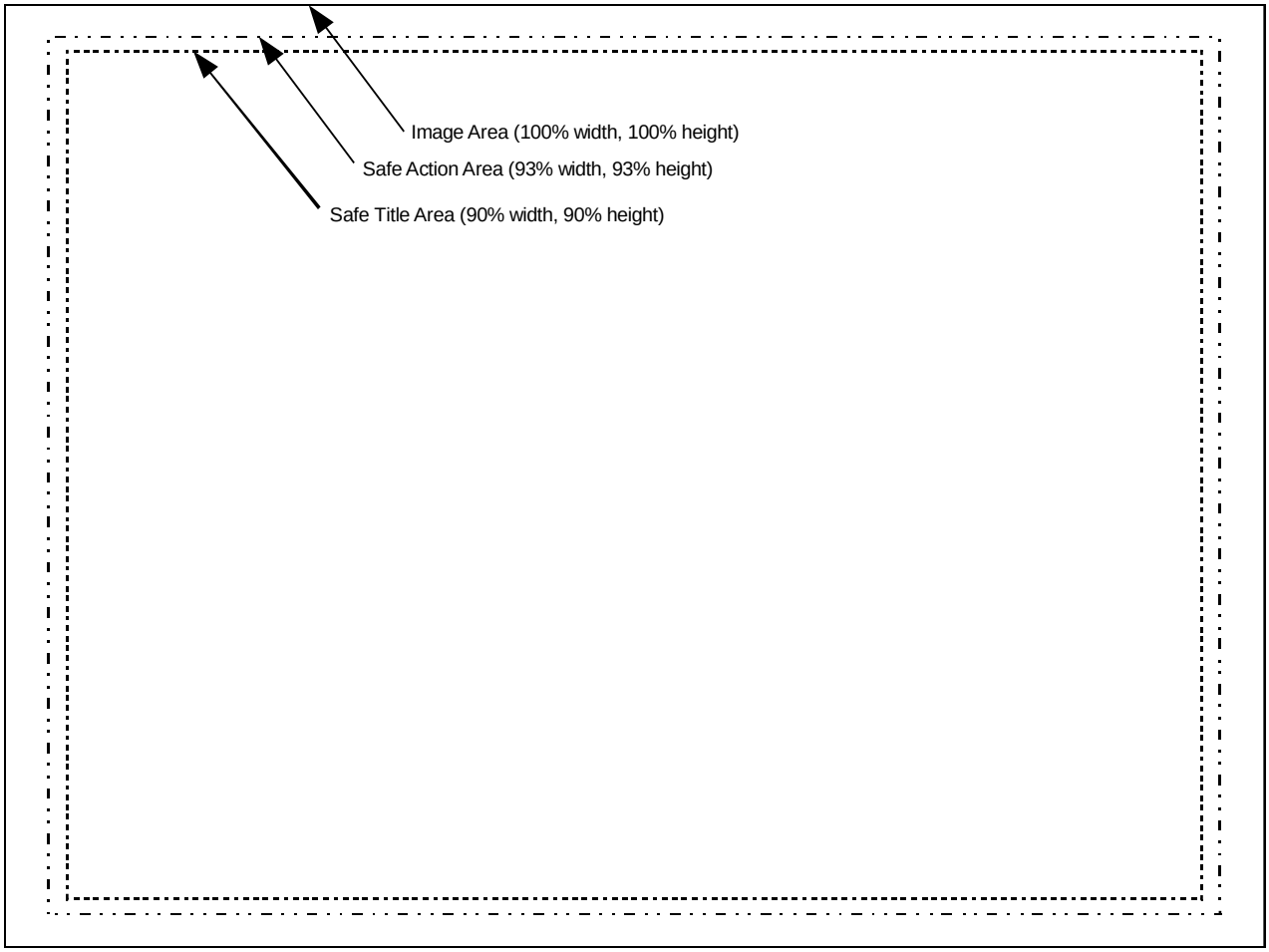

Figure D.2 – 4:3 Format Safe Action and Safe Title Areas

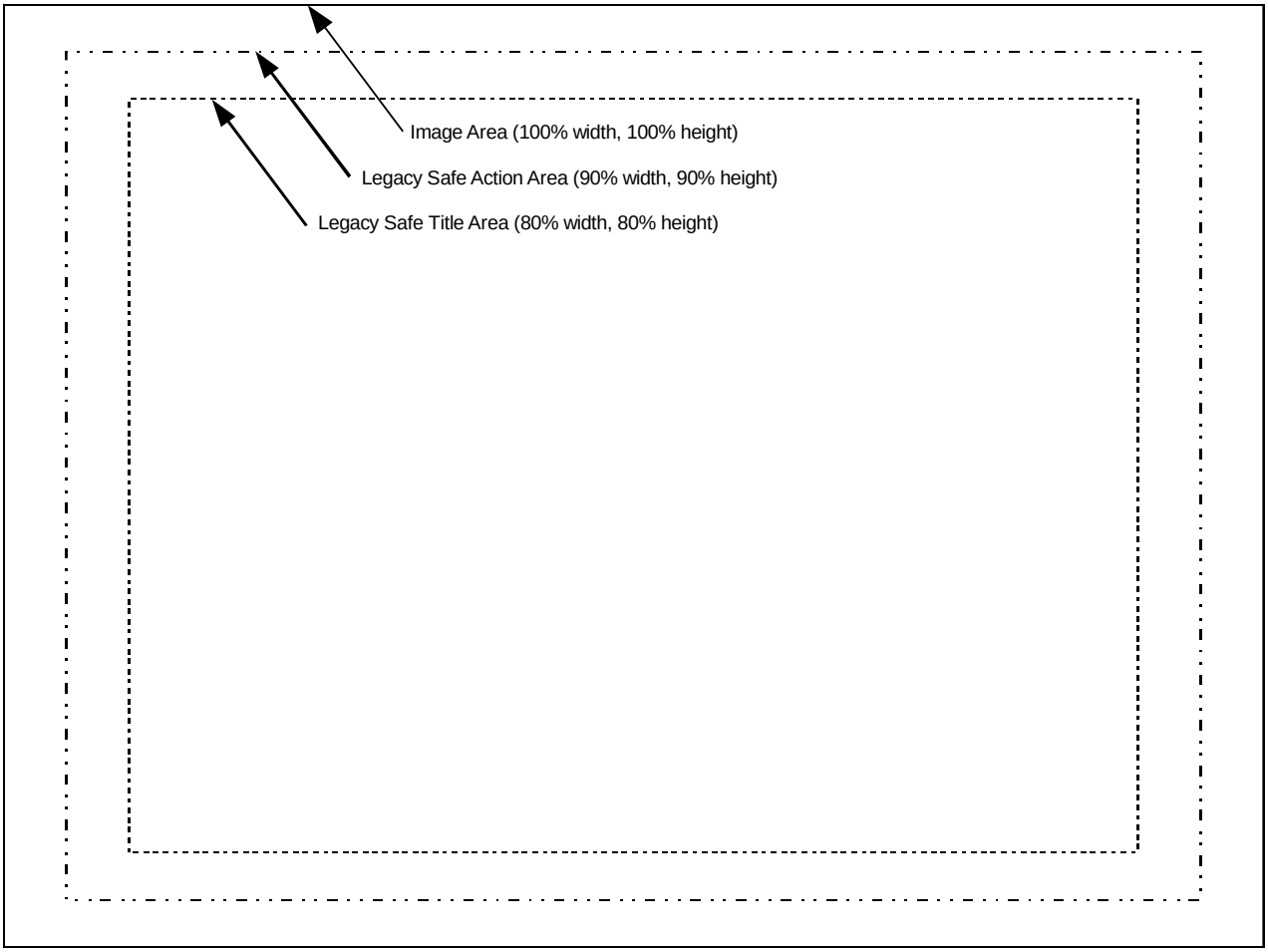

Figure D.3 – 4:3 Format Legacy Safe Action and Safe Title Areas