

EBU Technical Recommendation R86-2000

Scanned image area dimensions from films for television

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PMC	1997	2000	

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1 Introduction

The EBU has reviewed its advice to EBU Members on the scanning of film for television. The use of film in television has evolved over many years from being a source of programmes for transmission to becoming an integral part of programme production. Thus there has been a need for a complete review of all existing standards and recommendations to ensure that they conform with how film is used today in television. The EBU has taken advantage of this review to harmonise all recommendations from other organisations working in this area, aiming at world-wide standards that will be referenced for equipment performance and production practice.

This recommendation specifies the dimensions of area to be scanned from 16mm and 35mm motion picture films. Its purpose is to be a reference document for harmonising the areas used in film cameras, film projectors, telecines and test films for television purposes.

The dimensions of the recommended areas are based on how film material and film technology are actually used for television production and reproduction. The technical properties of film and television techniques are taken into account, as well as the artistic criteria for format harmonisation from shooting to presentation. The listed dimensions are based on key values taken from film industry standards and practices for exposure, printing, projection as well as past and present technology of television reproduction.

The EBU Recommends

- that Members use the dimension listed in Tables 1-4 as maximum safe areas for scanning of images on motion picture film for television.
- that Members use a test film to align telecine equipment according to the recommended scanned areas.*

* Suitable test films are available from BKSTS in London: <http://www.bksts.com>

2 General

Motion picture film is used in many different ways in television. The film material might be prepared for television using conventional cinematographic techniques or the film might be part of an otherwise electronic process. A modern telecine allows film images to be captured from camera original or print material using a variable image area to suit different applications. To harmonise the image content throughout a production process, from exposure to presentation, it is therefore necessary to specify certain reference dimensions. This will give the equipment industry certain agreed performance standards to aim for and the users will benefit from improved image harmonisation and consistency in production.

3 The scanning principles

In working out the scanned area dimensions, the EBU has taken account of the different applications of film for production and reproduction. The EBU has laid down principles based on existing image area standards and recommendations, production practice and technical and artistic harmonisation of the image area.

3.1 The basic principles

The areas defined in Tables 1-4 have been calculated from the following basic principles:

- a) Images on film which have been shot and framed for optical projection shall be scanned based on existing international standards for "projected image area" dimensions.
- b) Images on film which have been specially shot and framed for television shall be scanned based on "camera aperture" dimensions (typically camera aperture dimensions less 2%)
- c) If there is more than one standard for any area in current use and actively supported by the industry, each standard will be listed.

3.2 Anchor values

Because there are a number of aspect ratios used in film and television, the EBU has adopted "anchor dimensions" for calculating the scanned areas for 4:3 and 16:9 television from the different aspect ratios used on film. These are as follows:

a) Release formats intended for projection:

Format	Reference		Anchor	Dimensions (mm)	Image centre (mm) from reference edge
Standard 16 mm	ISO 359	[1]	width	9.65 mm	7.98 mm
Standard 16 mm	ISO 1223	[2]	width	9.35 mm	7.98 mm
35 mm Academy aperture	ISO 2907	[3]	height	15.29 mm	18.75 mm

b) Formats not intended for projection but used in television production:

Format	Reference		Anchor	Dimensions (mm)	Image centre (mm) from reference edge
Super 16 mm	derived from ISO 5768	[4]	width	12.20 mm[*]	9.00 mm
Super 35mm 4-perf	derived from ANSI/SMPTE 59M	[5]	width	24.00 mm	17.48 mm
Super 35mm 4-perf	DIN 15502-6	[6]	width	23.50 mm	17.48 mm
Super 35mm 3-perf	derived from ANSI/SMPTE 59M	[5]	width	24.00 mm[*]	17.48 mm

[* In calculating these dimensions, the film is assumed not to be spliced.]

4 Television presentation

If the aspect ratio of the framed area on film is different from that of the television system, the EBU has calculated scanned areas for the two typical presentations on television: "full screen" and "letterbox". In "full screen" display the maximum safe area of the film image is scanned to fill the display. In the "letter box" display, the total film image area is reproduced and the remaining areas of the television screen are black. Other compromise presentations will be between these two extreme cases.

The "full screen" dimensions are based on:

- the film image height, if the film aspect ratio is wider than the television aspect ratio,
- the film image width, if the film aspect ratio is narrower than the television aspect ratio.

The "letterbox" dimensions are based on:

- the film width, if the film aspect ratio is wider than the television aspect ratio,
- the film height if the film aspect ratio is narrower than the television aspect ratio.

The different presentations on television of the different film aspect ratios results in one of the following effects on television display:

1. the film image will be cropped on each side.
2. there will be black areas at top and bottom of the film image.
3. the film image will be cropped at top and bottom
4. there will be black areas at the sides of the film image.

The percentage amount of these effects are given in Fig. 1-4 in reference to the notes to Tables 1-4.

5 Image area and television scanning

The scanned areas from film relate to the nominal active picture area of analogue 625-line television systems as determined by the blanking given in ITU-R Recommendation 470-3 [7], that is a width of 52 μ s.

For the digital representation of 625-line television systems, based on ITU-R Recommendation 601-5 [8], it is important to note that the horizontal scanned dimension on film should coincide with the central 702 samples of the "digital active line" (Samples 9 to 710).

6 Note on the dimensions

Historically, many film dimensions were calculated in imperial units. Therefore there may be slight differences between the values given here and those published elsewhere due to conversion and rounding. However, these are well within the range of normal working tolerances.

The values given in this document have all been calculated in metric units and are consistent.

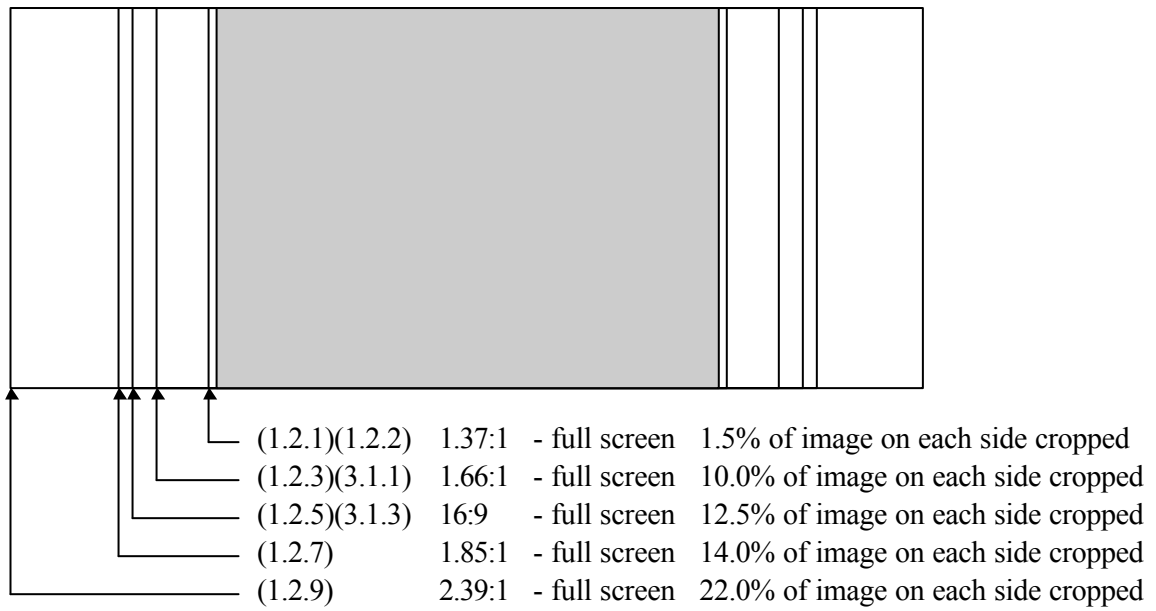


Figure 1: Full screen presentation on 4:3 television

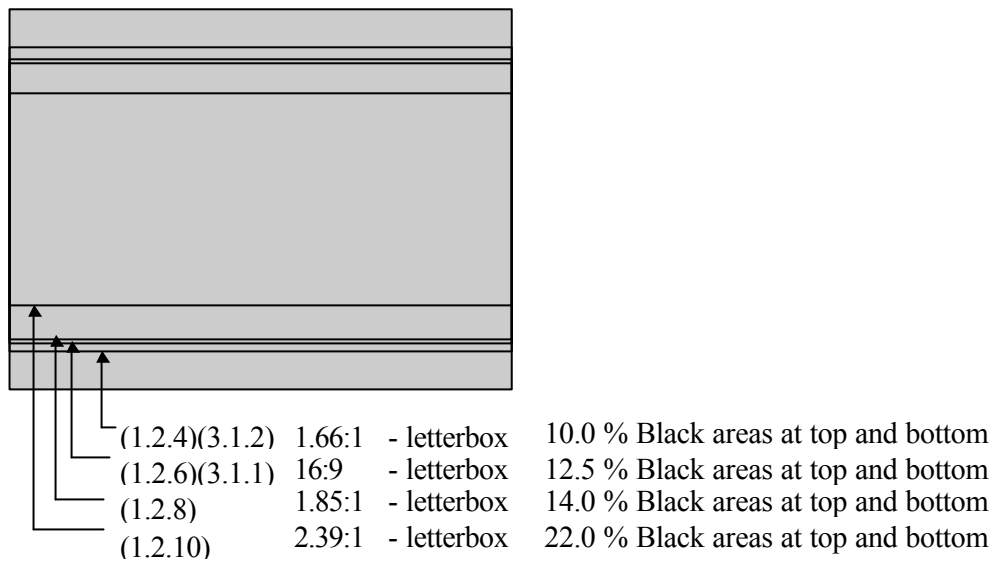


Figure 2: Letterbox presentation on 4:3 television

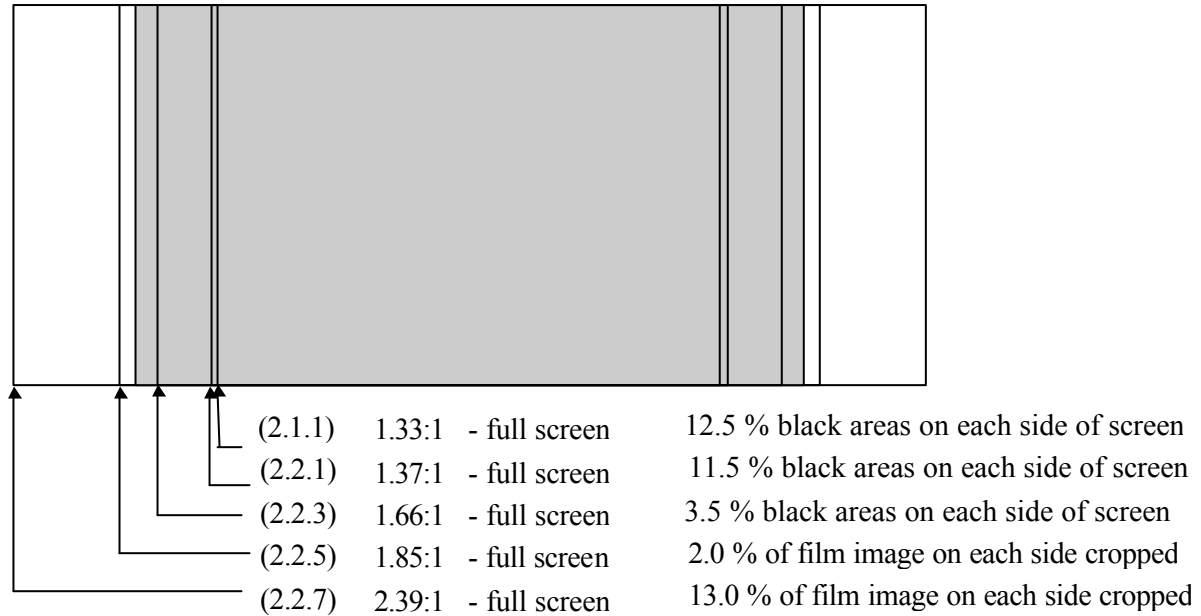


Figure 3 Letterbox/Full screen presentation on 16:9 television

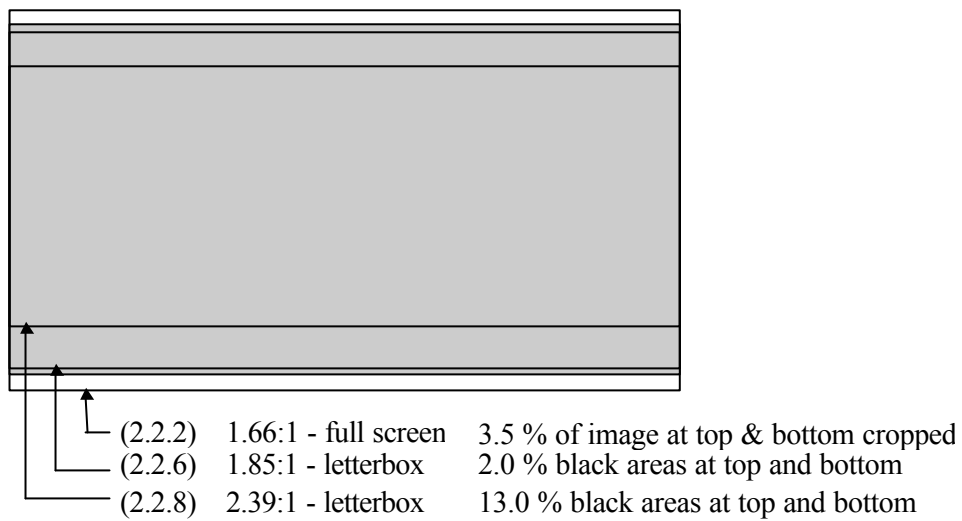


Figure 4: Full-screen/letterbox presentation on 16:9 television

TABLE 1 - Film shot and framed for projection - Scanned for 4:3 television

(Scanned area dimensions from images on film intended for contact printing and projection.
 The film material can be a print, an intermediate or camera original)

	Image aspect ratio		Scanned area dimensions (mm)			Appearance	Notes
	framed for	displayed on TV	width	height	centre		
1.1 16 mm: Standard aperture							
1.1.1	1.33:1	4:3 full screen	9.65	7.24	7.98		1
1.1.2	1.33:1	4:3 full screen	9.35	7.01	7.98		2
1.2 35 mm: Academy aperture							
1.2.1	1.37:1	4:3 full screen	20.39	15.29	18.75		3,4
1.2.2	1.37:1	4:3 full screen	20.12	15.09	18.75		2,4
1.2.3	1.66:1	4:3 full screen	16.83	12.62	18.75		4
1.2.4	1.66:1	1.66:1 letterbox	20.95	12.62	18.75		5
1.2.5	16:9	4:3 full screen	15.71	11.78	18.75		4
1.2.6	16:9	16:9 letterbox	20.95	11.78	18.75		5
1.2.7	1.85:1	4:3 full screen	15.09	11.32	18.75		4
1.2.8	1.85:1	1.85:1 letterbox	20.95	11.32	18.75		5
1.2.9	2.39:1	4:3 full screen	11.69	17.53	18.75		4
1.2.10	2.39:1	2.39:1 letterbox	20.95	17.53	18.75		5

Notes:

1. These dimensions are based on the “projected area” dimensions in Standard ISO 359 [1]
2. These dimensions are based on the “transmitted area” dimensions in Standard ISO 1223 [2]. These dimensions are related to historic concept of scanning film for television transmission.
3. These dimensions are based on the “projected area” dimensions in Standard ISO 2907 [3].
4. The television display will show the film image with areas on each side cropped (See Fig. 1).
5. The television display will show black areas at top and bottom of the film image (See Fig. 2).




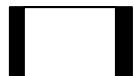

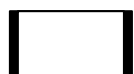
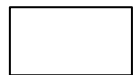
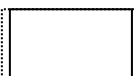

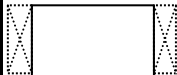

Cropped Area on the film image.



Black area on the television display


TABLE 2 - Film shot and framed for projection Scanned for 16:9 television

(Scanned area dimensions from images on film intended for contact printing and projection.
 The film material can be a print, an intermediate or camera original)

	Image aspect ratio		Scanned area dimensions (mm)			Appearance	Notes
	framed for	displayed on TV	width	height	centre		
2.1 16 mm: Standard aperture							
2.1.1	1.33:1	1.33:1 letterbox	9.65	7.26	7.98		1
2.2 35 mm: Academy aperture							
2.2.1	1.37:1	1.37:1 letterbox	20.95	15.29	18.75		1
2.2.2	1.66:1	16:9 full screen	20.95	11.78	18.75		2
2.2.3	1.66:1	1.66:1 letterbox	20.95	12.62	18.75		1
2.2.4	16:9	16:9 full screen	20.95	11.78	18.75		5
2.2.5	1.85:1	16:9 full screen	20.12	11.32	18.75		3
2.2.6	1.85:1	1.85:1 letterbox	20.95	11.32	18.75		4
2.2.7	2.39:1	16:9 full screen	15.58	17.53	18.75		3
2.2.8	2.39:1	2.39:1 letterbox	20.95	17.53	18.75		4

Notes:

1. The television display will show black areas on each side of the film area (See Fig. 3).
2. The television display will show the film image with areas top & bottom cropped (See Fig. 4).
3. The television display will show the film image with areas on each side cropped (See Fig. 3).
4. The television display will show black areas at top & bottom of the film area (See Fig. 4).

 Cropped Area on the film image.




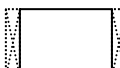




 Black area on the television display

TABLE 3 - Film specially shot and framed for television Scanned for 4:3 television

(Scanned area dimensions from images on film not intended for contact printing and projection.
 The film material will normally be a camera original)

	Image aspect ratio		Scanned area dimensions (mm)			Appearance	Notes
	framed for	displayed on TV	width	height	centre		
3.1. Super 16 mm aperture							
3.1.1	1.66:1	4:3 full screen	9.80	7.35	9.00		1
3.1.2	1.66:1	1.66:1 letterbox	12.20	7.35	9.00		2
3.1.3	16:9	4:3 full screen	9.15	6.86	9.00		1
3.1.4	16:9	16:9 letterbox	12.20	6.86	9.00		2
3.2 Super 35 mm: 4-perf. aperture							
3.2.1	4:3	4:3 full screen	24.00	18.00	17.48		3
3.2.2	4:3	4:3 full screen	23.50	17.63	17.48		4
3.3 Super 35 mm: 3-perf. aperture							
3.3.1	4:3	4:3 full screen	18.00	13.50	17.48		5

Notes:

1. The television display will show the film image with areas on each side cropped (See Fig. 1).
2. The television display will show black areas at the top & bottom of the film area (See Fig. 2).
3. These dimensions are derived from the camera aperture dimensions in standard ANSI/SMPTE 59 [6].
4. These dimensions are derived from the camera aperture dimensions in standard DIN 15502- part 6 [5].
5. These scanned area dimensions are based on current production practice since no standard yet exists.



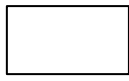

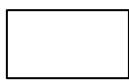

Cropped Area on the film image.



Black area on the television display

TABLE 4 - Film specially shot and framed for television Scanned for 16:9 television

(Scanned area dimensions from images on film not intended for contact printing and projection.
 The film material will normally be a camera original)

	Image aspect ratio		Scanned area dimensions (mm)			Appearance	Notes
	framed for	displayed on TV	width	height	centre		
4.1 Super 16 mm aperture							
4.1.1	16:9	16:9 full screen	12.20	6.86	9.00		
4.2 Super 35 mm: 4-perf. aperture							
4.2.1	16:9	16:9 full screen	24.00	13.50	17.48		1
4.2.2	16:9	16:9 full screen	23.50	13.22	17.48		2
4.3 Super 35 mm: 3-perf. aperture							
4.3.1	16:9	16:9 full screen	24.00	13.50	17.48		3

Notes:

1. These dimensions are derived from the camera aperture dimensions in standard ANSI/SMPTE 59 [6].
2. These dimensions are derived from the camera aperture dimensions in standard DIN 15502-part 6 [5].
3. These scanned area dimensions are based on current production practice since no standard yet exists.

Bibliography

- [1] ISO 359 - **Cinematography - Projectable image area on 16mm motion-picture prints**
 - [2] ISO 1223 - **Cinematography - Picture areas for motion picture films for television**
 - [3] ISO 2907 - **Cinematography - Maximum projectable Image area on 35mm motion picture film**
 - [4] ISO 5768 - **Cinematography - Image produced by camera aperture Type W on 16mm motion picture film**
 - [5] ANSI/SMPTE 59 - **35mm Camera Aperture Images and Usage**
 - [6] DIN 15502 - 6 - **Film 35mm; Image produced by camera aperture and projected image area 1,33:1**
 - [7] ITU-R Recommendation BT.470-3 - **Television systems**
 - [8] ITU-R Recommendation BT.601-5 - **Encoding parameters of digital television for studios**
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