RP 199-2004
Revision of RP 199-1999

SMPTE RECOMMENDED PRACTICE

Mapping of Pictures in Wide-Screen (16:9) Scanning Structure to Retain Original Aspect Ratio of the Work

1 Introduction and scope

1.1 Introduction

The 16:9 aspect ratio employed by digital television standards affords a possibility of avoiding the use of pan and scan techniques when adapting works produced in aspect ratios other than 16:9. The ability to use letterbox and sidebar techniques allows for portrayal of the work in the form originally intended by the artists who created the original work.

1.2 Scope

This practice describes a method of mapping images originating in aspect ratios different from 16:9 into a 16:9 scanning structure in a manner that retains the original aspect ratio of the work.

2 Definitions

For the purposes of this practice, the following definitions of terms apply:

2.1 letterbox: An image mapped into the total 16:9 display area such that the full width is utilized, but the full height is not (see figure 1).

2.2 sidebar: An image mapped into the total 16:9 display area such that the full height of the display area is utilized, but the full width is not (see figure 2).

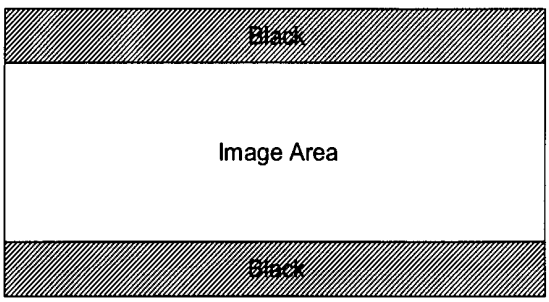

Figure 1 – Letterbox

Figure 2 – Sidebar image mapping

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3 Mapping images into the scanning structure

3.1 Works shall be mapped into the 16:9 aspect ratio scanning structure as shown in algorithm 1.

3.2 Works shall be mapped into the 16:9 aspect ratio so that the center of the original image corresponds with the center of the 16:9 image.

Algorithm 1

Calculation of the pixel mapping:

Let:

A = the aspect ratio of the film (ratio of width to height, expressed as a decimal)

P_h = number of horizontal pixels in scanned film image

P_v = number of vertical pixels in scanned film image

TV_h = number of horizontal pixels in television display system

TV_v = number of vertical pixels in television display system

If: $A < 16/9$ (1.78)
Then: $P_h = TV_v * A$
$P_v = TV_v$

If: $A > 16/9$ (1.78)
Then: $P_h = TV_h$
$P_v = TV_h / A$

Example:

Transfer a 1.85:1 image using SMPTE 274M (1920 × 1080)

Given:

A = 1.85 (greater than 1.78)

TV_h = 1920 (number of horizontal pixels in television display system)

TV_v = 1080 (number of vertical pixels in television display system)

Therefore:

1.85 > 1.78 (true)
so $P_h = TV_h$ = 1920 horizontal pixels in target image
and $P_v = TV_h / A$ = 1038 vertical pixels in target image

NOTES

1 This leaves the determination of the original aspect ratio to the user of the film. Fractional results should be rounded up to the next highest pixel value.

2 Examples of common film formats are given in table 1.

Table 1 – Common film formats

Film aspect ratio	SMPTE 274M (1920 × 1080)		SMPTE 296M (1280 × 720)	
	P_h	P_v	P_h	P_v
1.33	1440	1080	960	720
1.66	1793	1080	1195	720
1.78	1920	1080	1280	720
1.85	1920	1038	1280	692
2.39	1920	803	1280	536

Annex A (informative)
Bibliography

SMPTE 274M, Television — 1920 x 1080 Scanning and Interface

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

EG 25-2003, Telecine Scanning for Film Transfer to Television