A new Super-16mm telecine alignment film

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This article describes a Super-16mm telecine alignment film which was developed at Channel Four Television, because suitable material could not be purchased commercially.

The prime purpose of the film is to provide an easy method of checking telecine scan size and position, so that a 16:9 image (1·78:1) which is suitable for widescreen 625-line television can be extracted from a Super-16mm original (1·66:1). Supplementary calibrations allow working with a 4:3 aspect ratio. A quick assessment of overall gate focus, resolution, scan/display linearity, and overall system performance can also be made.

1. Introduction

Channel Four Television has been transferring Super-16mm film to videotape for many years. During much of this time, it has been necessary to use ad-hoc arrangements for aligning the telecine scans, since it was not possible to purchase an alignment film suitable for the purpose.

In order to fill this gap in the market, the Author designed a test card in consultation with his colleagues. Comments were invited from other broadcasters and some changes were subsequently incorporated. The film was also discussed within EBU Project Group P/S16 (Use of Super-16mm film in television production).

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The remainder of this article describes the design features of the test card, which is shown in *Fig. 1*.

2. Image size and aspect ratio

There are two standards for the size of the image on Super-16mm film (see *Table 1*, [1] and [2]). Neither of these exactly matches the 16:9 format of widescreen television, which corresponds to an aspect ratio of 1·78:1.

In reality, the overwhelming majority of Super-16mm film is shot on cameras which accord with the DIN standard: additionally, the ISO is in the process of aligning with the DIN standard [3]. Therefore, the image on the test film described here (i.e. to the outside edge of the castellations – see *Fig. 1*) accords with the DIN 15602-1984 standard; this is the most important feature of the test film.

During manufacture of the film, the size and position of the images are checked by means of a travelling microscope equipped with a digital readout.

3. Telecine scan settings

For 16:9 television use, approximately 7% of the original image *height* has to be sacrificed. Overscan in the domestic receiver will cause a further loss. It is therefore suggested that the loss of image *width* in the telecine should be restricted to no more than 2%. This follows a proposal that was published in the SMPTE Journal in 1994 [4]. As modern telecines are equipped with X/Y zoom facilities, the geometry and centring can be set up with the test card and the actual image loss can be determined by the operator.

For a 16:9 image to have less than a 2% loss of image width, the telecine scans should be set to the point where the 16:9 arrows (see *Fig. 1*) meet the tips of the castellations. This is equivalent to a nominal 12·2 mm aperture width.

The basic dimensions of the alignment film are shown in *Fig. 2*.

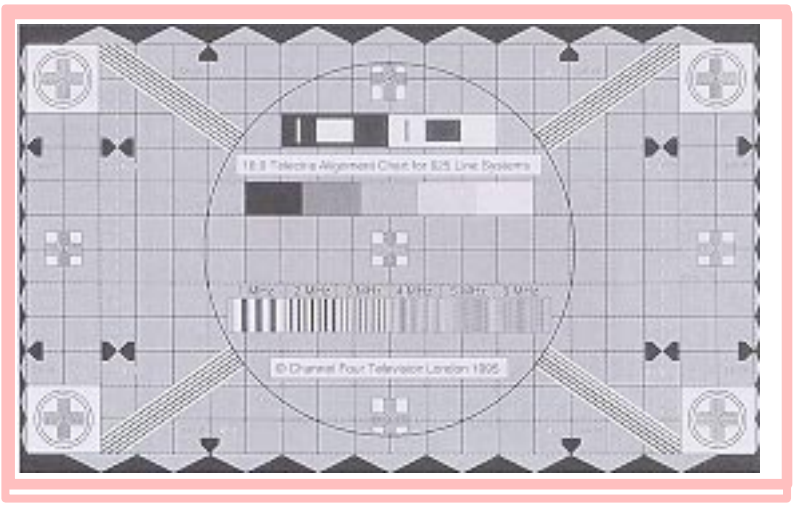

Figure 1
Super-16mm telecine test card.

For users who may wish to derive a 4:3 image from their film material, subsidiary markings are provided on the test card for this purpose. Note that a scanned height similar to that of the 16:9 image has been assumed. As mentioned above, the geometry and centring can be set up with the test card, and the actual image size can be determined by the operator using the X/Y zoom.

Six resolution patches are provided on the test card, allowing system checks up to 6 MHz. These patches are shown in MHz for a 625-line system, assuming that the telecine scanning is set as detailed above. This is because the resolution of a telecine chain, unlike that of a projector, is measured in MHz. No attempt has been made to reproduce sine waves.

4. Resolution / astigmatism

Nine astigmatism patches have also been provided. Their horizontal centre frequency corresponds to 5 MHz, which allows a quick assessment of overall gate focus to be made.

The concentric circles that surround the astigmatism patches in each corner are intended to show the effect of poor interlace.

Standard	Image width		Image height		Aspect ratio of image	Image centre line from reference (sprocket) edge	
	mm	Tolerance	mm	Tolerance		mm	Tolerance
DIN 15602–1984	12.35	–0, +0.1	7.42	–0, +0.15	1.66 : 1	9.00	±0.05
ISO 5768–1981	12.52	Nominal	7.42	–0, +0.15	1.69 : 1	9.16	±0.05

Table 1
The two standards for image size on Super-16mm film.

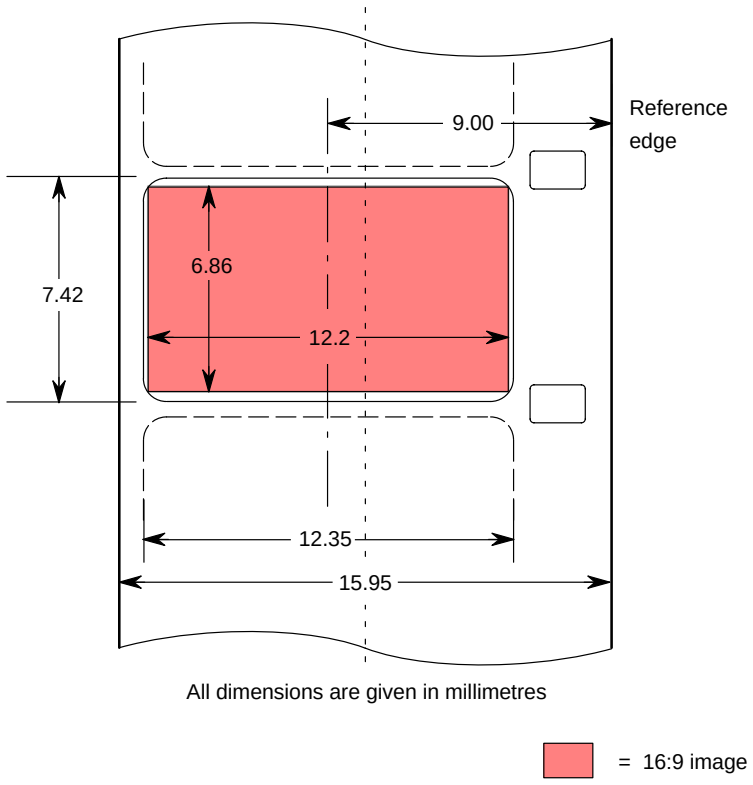

Figure 2
Basic dimensions of 16:9 television images taken from Super-16mm films (DIN 15602).

5. Linearity

A grid of 20 x 12 boxes, together with the main circle, allow a visual assessment to be made of the linearity of both the monitor and the telecine. The diagonal lines are intended to show up any interlace faults.

6. Overall density / greyscale / streaking

It is intended that the background density of the film should be approximately 1. This is also the nominal centre point for the 5-step greyscale. The maximum and minimum densities are around 2·8 and 0·3 respectively. Sample measurements of the greyscale levels taken during production are included with each film (see *Table 2*).

Patches are provided below the top of the circle to allow streaking to be assessed: long- and short-term, white after black, and black after white.

It should be noted that although the test card is manufactured from monochrome film and hence is nominally neutral, measurements are not made to verify this.

7. Performance / calibration accuracy

It is thought that this 16-mm film is unique in having a nominal response of 100% at 1 MHz and 6 MHz, although early production samples exhibited a slight (5%) rise at 3 MHz. In addition, all the astigmatism patches achieved 100% and thus the film can be used to give a very good indication of overall gate focus. These results were measured on two microdensitometers; one set of these measurements was produced by an independent third party.

The performance outlined above was not easy to achieve and considerable attention was given to the artwork. Circles and diagonal lines must have high resolution in order to avoid "stepping effects" on the final print. Hence, a relatively large image of the artwork – with a resolution of 1000 dpi – was used as the negative master from which the Super-16mm alignment film was produced.

Films are not calibrated individually for density and resolution, and are not sold as such; however, measurements are made during production, as follows. A full magazine is exposed in a pin-registered camera as one continuous run. After processing, several measurements are made on the un-cut roll, as follows:

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Mr. Hurley joined Channel Four Television in July 1982 as a Maintenance Supervisor (before the then new station had started transmissions). He currently holds the position of Electronic Maintenance Manager at Channel Four Television.

Parameter		Nominal (tolerance)	Measured	Comments
Image width (mm)		12·35 (–0, +0·1)		Measured along horizontal centre line
Image height (mm)		7·42 (–0, +0·15)		Measured along vertical centre line
Image Centre (mm)		9·0 (±0·05)		Measured to sprocket edge
Resolution:	**1MHz**	100%	100%	Reference
”	**2MHz**	100%		
”	**3MHz**	100%		
”	**4MHz**	100%		
”	**5MHz**	100%		
”	**6MHz**	100%		
Astigmatism patches		100%		
Greyscale:	**black**	2·8		
	level 2	2·0		
	level 3	1·0		
	level 4	0·5		
	white	0·3		Nominally clear film

Table 2
Basic performance chart supplied with each alignment film.

– image size and position;

– resolution;

– greyscale densities.

The average values of these measurements are supplied with each film (see *Table 2*). Users can expect an individual film to match the measured image size and position almost exactly, and to match the resolution and greyscale density figures extremely closely. As mentioned above, the image dimensions are checked on a travelling microscope and, given that all material sold is camera-original, every frame should be identical.

8. Conclusions

The film was designed to be used as a low-cost telecine alignment test card and this has been achieved: the two most important parameters, image size and position, are guaranteed and inherently correct by virtue of the production process. Resolution and density will be very close to the average values presented in the performance chart supplied with each film[1].

Bibliography

[1] DIN 15602–1984: **Film 16mm; bildgrössen, bildegrösse der Aufnahme, Bildseiten–Verhältnis 1,66:1 (Format Super 16)** [Film 16mm; image sizes, image produced by camera aperture, aspect ratio 1.66:1 (Super-16mm format)].

[2] ISO 5768–1981: **Cinematography – Image produced by camera aperture Type W on 16 mm motion-picture film – Position and dimensions.**

[3] ISO DIS 5768: **Cinematography – Image produced by camera aperture Type W on 16 mm motion-picture film – Position and dimensions** (revision of ISO 5768–1981).

[4] Richards, D. and DiGiulio, E: **Film-to-Video Transfers: Time for a Change.** SMPTE Journal, February 1994, pps 85-93.

1. The test film described here is available from the British Kinematograph, Sound and Television Society (BKSTS), London, United Kingdom.