RECOMMENDATION ITU-R BR.1354*

TRANSFER OF FILM PROGRAMMES TO VIDEO TAPE FOR PROGRAMME EXCHANGE AND FOR PRESERVATION OF ENDANGERED FILMS

(Question ITU-R 238/11)

(1998)

The ITU Radiocommunication Assembly,

considering

a) that it is normal practice in broadcasting organizations to transfer television programmes originated on film to video tape for transmission;

b) that television programmes originated on film by broadcasting organizations are increasingly exchanged in the form of video tapes;

c) that, more and more often, films are transferred to video tape by external post-production or facilities houses rather than in-house by broadcasters;

d) that the aspect ratios of the television image and the film image do not always fully coincide, in particular when scanning wide-screen feature films made for the cinema;

e) that new television systems have been, and are being, developed with wide-screen aspect ratios. Two aspect ratios are currently recognised for images recorded on video tapes:

– the traditional 4:3 aspect ratio;

– a recent, 16:9 “anamorphic” aspect ratio, in which the 16:9 pictures occupy the full active lines of the television signal in association with a horizontal geometric compression relative to traditional images;

f) that the modern digital effect equipment (DVE) is available which means it is relatively cheap and easy to alter the geometry of television pictures;

g) the long term preservation of film programmes in television libraries is increasingly threatened by the appearance of colour casts, fading of colour information, or the imminent chemical/physical deterioration of the film support;

h) the transfer of endangered film to video tape may be seen as the only reasonable and convenient option to preserve valuable material;

j) the transfer to video tape should bridge a certain period of time before more durable and longer lasting media are available for long term preservation;

k) that D_{65} is recommended as the reference white point for the appraisal of programmes on colour film intended for television use;

l) that the programmes originally available on colour film also be exchanged in the form of telecine transfers to video tape;

m) that it may be necessary to readjust the colour balance of programmes on colour film since it tends to change with age, especially in non-optimal storage conditions;

n) that irrespective of such changes with ageing, it may be desirable to correct the colour balance of a programme on film, to match the colour balance of other programmes adjacent to it in the broadcast schedule;

o) that telecines are sometimes used as post-production tools, to adjust film colour for creative reasons, and full flexibility in colour adjustment is required for this application;

p) the content of Recommendations ITU-R BR.1288 “Scanned area of 16 and 35 mm release film used for 4:3 television”, ITU-R BR.1289 “Scanned area of 16 and 35 mm release film used for 16:9 television” and ITU-R BR.1219 “Handling and storage of cinematographic film recording”,

recommends

1 that when film programmes are exchanged in the form of transfers to video tape the procedures detailed in Annex 1 should be used;

2 that programmes produced on film that require long-term storage should be archived by broadcasting organizations as film under proper storage conditions for as long as possible (This has the advantage that the original picture quality can be recovered at a later date and the benefit of guaranteeing world-wide compatibility. If the film programme is endangered through deterioration of the base, first priority should be given, if possible, to copying the programme material onto a stable film support.);

3 that if the film programme is endangered by the deterioration of the colour information, the programme material should be preserved by transfer to video tape using the techniques in the Annex 2;

4 that the colour balance of telecines should be aligned to provide equi-level primary signals when scanning different levels of neutral area on film;

5 that, when scanning faded or poorly balanced films, the colour balance should be adjusted to provide equi-level primary signals on those areas of the film that are deemed to have been intended to be neutral; such colour adjustments may have to be performed on a scene-to-scene basis;

6 that telecine should optionally be capable of a wide range of colour adjustments, in order that they may also be used in a flexible way as creative post-production tools.

NOTE 1 – Information on transfer film programmes to video tape for programme exchange is given in EBU Recommendation R78-1993.

NOTE 2 – Information on scanning formats is given in Appendix 1.

NOTE 3 – Information on preservation of endangered film programmes on video tape is given in EBU Recommendation R77-1993.

NOTE 4 – The original film material should not be destroyed after such transfer but it should be kept under proper storage conditions because in the future it may be possible to achieve a better quality transfer.

ANNEX 1

Transfer of film programmes to video tape for programme exchange

1 Television signal standards

35 mm, Super 16 mm and 16 mm gauge films should be transferred to video tape in conventional resolution component television system, using the recording format requested by the customer.

NOTE – At present, many broadcasters, especially in the countries that adopt the NTSC system, use a conventional resolution composite television system. On these grounds, for the time of being, transfer in composite signal is also approved for programme exchange.

Transfer in HDTV is desirable for programme exchange in the case when high picture quality is required.

2 Film image area to be transferred

The usable image content on the film should ideally be transferred to tape. For reasons of operational convenience, however, it may be acceptable to allow some small amounts of image cropping.

The usable film image areas on motion picture prints are the maximum projectable image areas as specified by the ISO standards 2907-1984, 5768-1981 and 359-1983. The preferred practice for 35 mm film is described by the ITU-R, for 4:3 and 16:9 television is specified by the ISO Standard 1223-1985.

3 Image aspect ratio of recordings

The aspect ratio of the television image recorded on tape should be either 4:3 or 16:9 anamorphic.

4 Film scanning

4.1 Standard films (aspect ratio 1.37:1)

Older films or existing films made for television which were shot in 1.37:1 aspect ratio (e.g. on 35 mm film in Academy format, or on 16 mm film in standard format) and intended for display in that format should be transferred as 4:3 television signals.

Recent 35 mm film framed using the “shoot and protect” method should also be transferred as 4:3 television signals and the final aspect ratio chosen at the time of transmission. Some degree of reduced vertical resolution, compared with direct scanning of the central area of the images has to be accepted when these recordings are replayed for 16:9 television systems.

Dimensions for the scanning of standard film images on 35 mm film are given in Figure 1a); dimensions for standard film images on 16 mm film are given in Figure 2a).

4.2 Wide-screen films (aspect ratio 1.66:1 - 1.85:1)

Wide-screen films, where the aspect ratio of the image is close to 16:9 (for example 1.66:1 or 1.85:1), should be either transferred as 16:9 anamorphic television signals or, if required for immediate use only, as 4:3 letter-box format signals.

In the case of anamorphic recording, the maximum vertical resolution is preserved. A small amount of image cropping (horizontally for 1.85:1 or vertically for 1.66:1) has to be accepted, however. Direct replay for 6.9 television broadcasting systems (such as PALplus, D2-MAC, EDTV-2, etc.) would be possible without special post-processing. For replay of such recordings for conventional 4:3 television systems the use of a digital video effects (DVE) system would give the choice of using a letter-box presentation or a pan-scan presentation. For letter-box, the original film format (1.66:1 or 1.85:1) is converted to 16:9 (1.78:1). For pan-scan some of the image area and some horizontal resolution are lost.

In the case of recording in 4:3 letterbox format, direct replay for conventional 4:3 television systems is possible, with the added advantage that the original film format (1.66:1 or 1.85:1) is preserved exactly. For replay of such recording for 16:9 television systems a DVE is necessary to achieve the correct signals. Some degree of reduced vertical resolution has also to be accepted compared to a direct recording in 16:9 anamorphic form.

Scanning details for each of the above options are given in the Table 1.

TABLE 1

Scanning details

Film		Television	
Gauge	Shot aspect ratio	4:3 letter box	16:9 anamorphic
35 mm	1.66:1	Figure 1b)	Figure 1c)
35 mm	1.85:1	Figure 1d)	Figure 1e)
Super 16 mm	1:66:1	Figure 2b)	Figure 2c)

4.3 Extra-wide-screen films (e.g. Cinemascope, aspect ratio 2.35:1)

At the moment there is not standard practice for the presentation of extra-wide-screen films on television. In order to have the full usable picture content on the film recorder on tape in the 16:9 aspect ration a certain degree of letter-boxing has to be accepted with a small loss of vertical resolution.

The final presentation format chosen for transmission on 4:3 or 16:9 television systems is expected to depend on the picture content and should be selected in individual cases as a matter of creative judgement, using a DVE as necessary.

Dimensions for the scanning of this option are given in Figure 1f.

5 Reframing of images

Any further reframing of the recorded images which may be introduced along the production or emission chain (such as letter-boxing, pan-scan, leaving space for subtitles, conversion into 16:9 aspect ratio, etc.) will be dictated by an individual broadcaster's policy in the use of the emission system. It is assumed to be under the control of creative staff of the broadcaster.

6 Storage of recordings

The recorded video tapes should be kept under storage conditions as given in Recommendation ITU-R BR.1215.

7 Labelling of recordings

In all cases, the actual mode of tape-recording with details of the aspect ratio should be clearly indicated on the tape and box.

FIGURE 1

Image aspect ratio of video recordings taken from 35 mm films

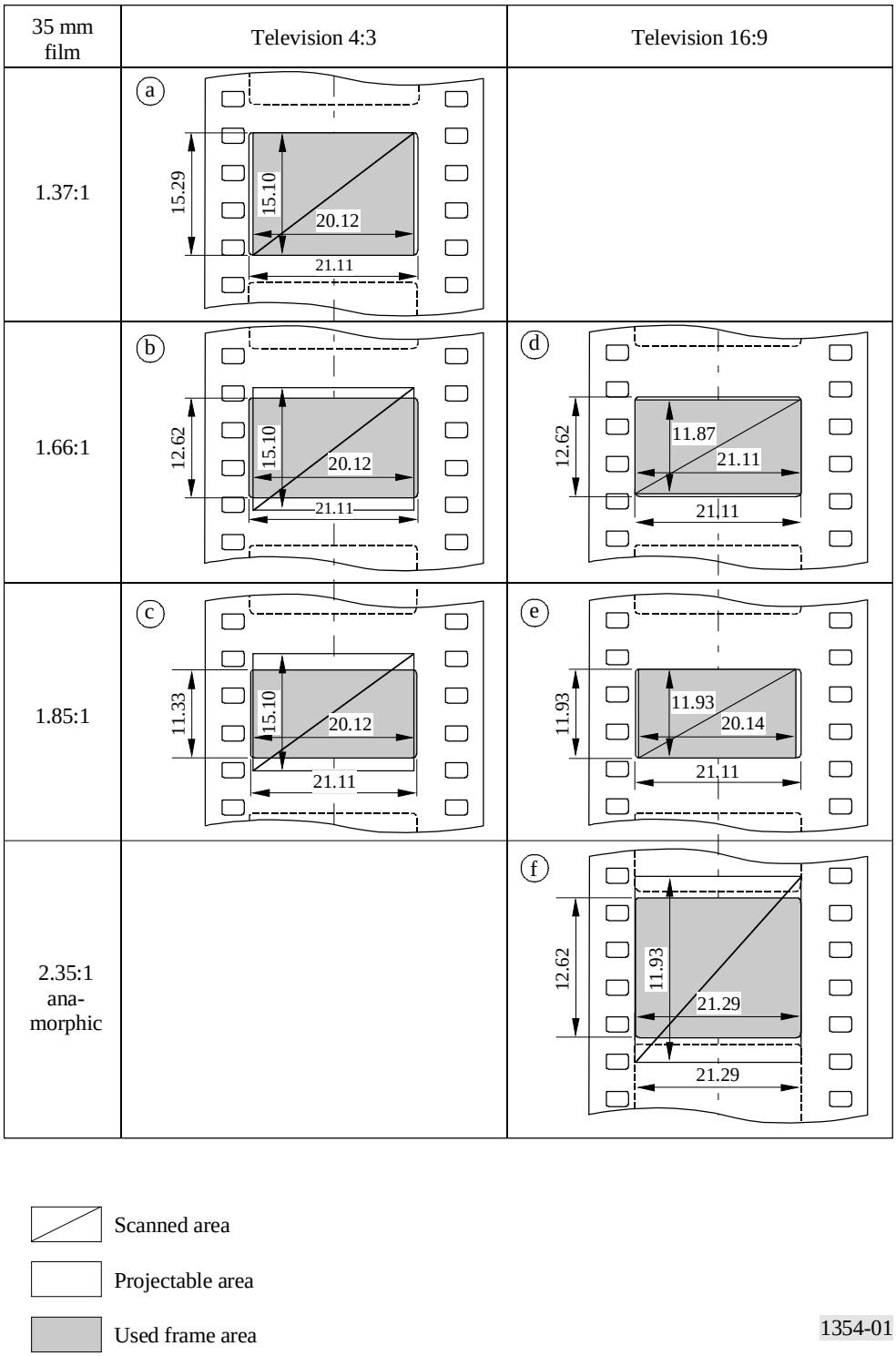
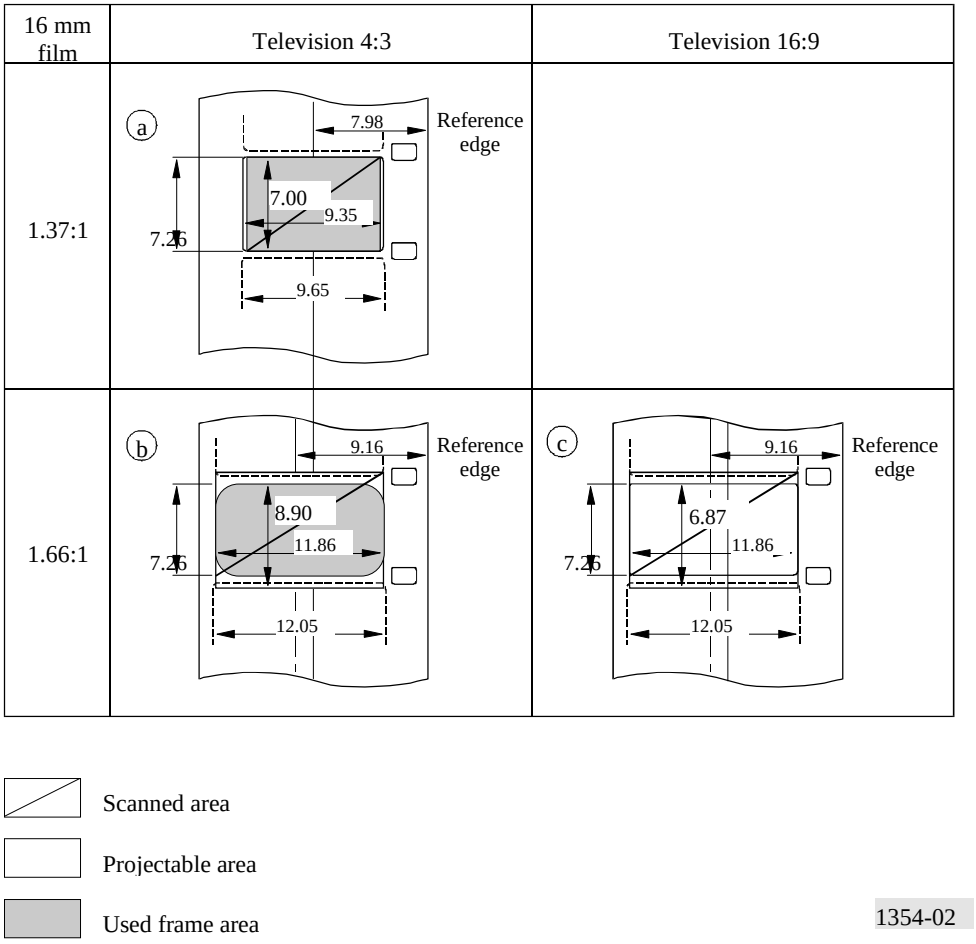


FIGURE 2

Image aspect ratio of video recordings taken from 16 mm



ANNEX 2

Transfer of endangered film programmes to video tape

1 Television signal standards

Film of all types should be transfer to tape as component signals, using the best recording format available.

NOTE – At present, many broadcasters, especially in the countries those adopt NTSC system, use conventional resolution composite television system. On these grounds, for the time of being, transfer in composite signal is also approved.

Transfer in HDTV is desirable in the case when high picture quality is required.

2 Colour correction

Electronic colour correction should be carried out, on a shot-by-shot basis necessary, at the time of transfer.

3 Film image area to be transferred

The full usable image content on the film as specified by the ISO Standard 2907-1984, 5768-1981 and 359-1983 for the maximum projectable image area of 35 mm, Super 16 mm and 16 mm motion picture prints should be transferred to tape. Those are defined by Recommendations ITU-R BR.1288 and ITU-R BR.1291.

4 Image aspect ratio of recordings

It is recommended that the aspect ratio of the television image recorded on tape should be either 4:3 or 16:9 anamorphic. When the film usable image area is transferred to tape for preservation, it should preferably cover the full television image, although a small amount of image cropping or letter-boxing may need to be accepted in order to fit the film image aspect ratio into the television image aspect ratio (see Figures 1 and 2 of Annex 1).

5 Storage of video tape recordings

The recorded video tapes should be kept under storage conditions as given in Recommendation ITU-R BR.1219.

APPENDIX 1

Telecine scanning format of feature films

1 Introduction

For many years, motion picture film has been an important source of programme material for television services and - at least in the initial phase of wide screen television system (e.g. HDTV, D- or D2-MAC, PAL plus) - it is expected that film will also play a leading role as a programme medium in the future. In particular, feature films, which are normally composed for a wide-screen showing in the cinema, are expected to be a valuable source of high-quality programme material which will be readily available for future television transmission in the 16:9 aspect ratio.

In recent years television programmes originated on film have increasingly been exchanged in the form of video tape. More and more often the film-to-tape transfer for this has no longer been carried out by the broadcasters themselves, but by post-production and facilities houses. This is especially true in the case of the transfer of feature films, for which the transmission rights are normally purchased for only a limited period of time and which, after the transfer, are returned to the production house or studio for archival storage.

There are a number of film formats and aspect ratios in common use throughout the world, not only for the image capture, but also for the release of feature films. It is important, therefore, to consider the ways in which telecine scanning formats are best applied for the transfer of films.

2 Release print formats

Various film formats are in general use worldwide for the release of feature films on 35 mm film gauge. In the United States of America, most of the feature films for both cinema or TV showing are shot and released either in full aperture (1.33:1) or, more frequently, in the Academy format (1.37:1). In some cases, the original size of the exposed camera aperture is reduced in the intermediate printing stage with a hard matte in the optical printer. This produces an aspect ratio of 1.85:1 on the release print for cinema showing.

In Europe, however, cameraman nowadays usually photograph their motion pictures with a hard matte in the camera which is close to an aspect ratio of 1.66:1. Consequently, the release print is also delivered in this format. If a feature film is intended for showing predominantly on conventional 4:3 television, the Academy format with an aspect ratio of 1.37:1 is generally chosen.

To achieve an extra wide screen format, feature films are sometimes shot worldwide in the Cinemascope format (2.35:1). An anamorphic camera lens squeezes the image horizontally (by a factor 2), but does not change the image height.

The Academy format can be found in vintage archive films, and also in recent films which are intended for both wide-screen cinema and conventional television presentation and are therefore photographed according to the “shoot and protect” concept. Vertical cropping of the film frame should be avoided in the former case, while it is legitimate in the latter.

3 Transfer of feature films to TV

Wide-screen feature films for the cinema are normally made without special attention being given as to how they might best be presented on the television screen. Thus, in general, there will be a need to set up the telecine scan characteristics to interpret the desires of the original producer, within the constraints of the TV format. To meet these requirements with regard to the picture content, one possibility is to scan the full or nearly the full width of the wide-screen image on the release print. For conventional television this would normally result in a “letter-box” presentation with black areas at the top and bottom of the screen. In cases, however, where it is desirable to utilise the full area of the display screen the full height of the image on the release print has to be televised. This aim can best be achieved by allowing the area reproduced within the film frame to be panned over the aperture available on the print (pan-scan method).

However, such a selective scanning can lead to difficulties in achieving an accurate and repeatable framing within practical telecine equipment. In the future, an increasing proportion of feature films can be expected to be produced using the “shoot and protect” method. Material of this type is amenable to reproduction using fixed telecine scan positions and sizes. Thus, in addition to the fully flexible scanning mode, it is also desirable to have a number of fixed scanning modes available in telecine equipment. Such fixed scanning modes can be accurately pre-set during normal maintenance procedures and give a reliable way of quickly achieving the chosen optimum conditions for the particular material being reproduced.

The use of a number of fixed scanning options is mainly attractive for reasons of operational convenience. However, at the start of a transfer operation, it may not be known which option best suits the local production preference and the artistic needs of a particular film. Even if these changes are synchronised with cuts in the action, the resulting changes to the black borders at top and bottom may be disturbing to the viewer. The option of continuous changes of pan, tilt and zoom during transfer (preferably to preprogrammed instructions) would therefore be an advantage.

The present conception of the European broadcasting organizations concerning the transfer and display for feature films on conventional 4:3 television systems is given below.

4 Conventional 4:3 television

Displaying a film with an Academy aperture image on a conventional 4:3 TV screen presents little difficulty as both have nearly the same aspect ratio. However, some films released on the Academy format have been shot on the assumption that a mask will be used in the projection, printing or television scanning process. This can lead to unwanted items, such as microphones, appearing in shot if this is not taken into account during transfer.

A survey within members of the European Broadcasting Union on the transmission of non-anamorphic wide-screen feature films has shown that it is normal practice at most of the broadcasters in continental Europe to transfer release prints which have an aspect ratio between 1.66:1 and 1.85:1 in the original aspect ratio. That means that black bars appear on the top and bottom of the picture on the display screen; the total percentage size depending on the actual film format on the release print. This letter-box method is normally preferred by production staff because it maintains the director's framing, even though the height of the picture on the screen and consequently, the vertical resolution of the picture details are lower. Cinemascope films with an aspect ratio of 2.35:1 are also often transmitted - if the scene content allows - with an aspect ratio of 1.85:1. This gives some cropping on both sides (2 x11%) and with black areas on top and bottom (in total nearly 30% of screen area). In exceptional cases, Cinemascope films are televised in nearly the original aspect ratio (e.g. 2.2:1), leaving about 40% of the total screen area unused, but this gives severe losses in vertical resolution.

Where subtitles are used, a letter-box or semi-letter-box presentation can be an advantage. The film image can be moved to the top of the television frame and the subtitles put in the bottom black area which keeps them from obscuring the action in the film.

Most broadcasting organizations in the United Kingdom have traditionally shown both anamorphic and non-anamorphic wide-screen feature films at full image height. The main action is followed if possible by panning the area scanned by the telecine. This process normally requires a rather time-consuming post-production exercise and is not always successful as far as the artistic presentation is concerned. However, this procedure is not usually followed during the running of trails, titles and credit sequences of anamorphic films, when a letter-box presentation is used. A compromise letter-box setting is often applied to particularly critical material, where there is a large amount of action at the edges which makes panning difficult.

5 Wide-screen 16:9 television

At present, European broadcasters do not yet have much operational experience with the transfer films to wide-screen television. Consequently, the scanned and transmitted area dimensions are still under discussion. In what follows, some obvious possibilities are given, taking into account both operational convenience and the artistic presentation of a film.

For feature films released in the Academy format (1.37:1), there are two obvious alternative ways of reproduction on wide-screen television:

– the full image height on the print is scanned. By this procedure, the full information on the film frame is shown on the television display, but with black borders down the left and right hand sides of the resulting television picture. This procedure is likely to be more suitable for archive material not produced for wide-screen presentation;

– the full width of the film frame is scanned and consequently the full height is not scanned. The television picture is completely filled, but information from the top and bottom of the film frame is discarded. This is admissible if the important action in the picture was captured in the inner option of the image ("shoot and protect" method).

In some cases, neither fixed height nor fixed width may offer an acceptable solution from the artistic point of view for wide-screen scanning of the Academy format. More operational flexibility would then be required, with both vertical and horizontal panning and zooming facilities (selective scanning of picture segments). This process has to be used with extreme care, because such a recomposition of the image content may change the artistic integrity of the film creation.

Feature films which are released in the normal wide-screen formats (most frequently 1.66:1 in Europe and 1.85:1 in the United States of America) are highly unlikely to present any problems as both formats are very close to the 16:9 aspect ratio of television. Such prints can be scanned either in full width (1.66:1) or in full height (1.85:1). In both cases, only a small proportion of the film information is discarded.

Finally, there are several options to reproduce material shot in the Cinemascope (2.35:1) format. If the full information has to be retained, the full width must be scanned. As a result black bars appear on the top and bottom of the picture (letter-box method). Another possibility is to scan the full height and underscan the width, which results in a loss of approximately 25% of the total information on both sides of the film frame (central scanning). In order to minimise the effects of this on the television output, it could be necessary, in some rare cases, to allow the scanned part of the image to be panned from side to side within the film frame (pan-scan method). The need for this may be expected to decrease as more material is produced using the "shoot and protect" principle. A compromise solution would be to scan neither

the full height nor the full width, but somewhere in between. If the scene content allows, Cinemascope films could be transmitted, for example, with an aspect ratio of 2.1:1 with some cropping on both sides (about 5% each) and with small black bars on top and bottom (in total 15% of screen area). In any case, more of the picture content of Cinemascope films can be shown on the 16:9 television screen than the 4:3 one.

6 Future considerations

Electronic blanking (hard-masking) should be enabled on horizontal and vertical edges. This is considered to be a necessary facility for cleaning up the pictures edges when overscanning the exposed film image area.

When the letter-box method is used a shifting of the picture area to the top or bottom of the television raster is regarded as desirable by some broadcasters to allow subtitles to be placed outside the picture area. In Japan, a shift of 12 horizontal lines of picture area to the top of raster is selected for some programmes, which are converted from HDTV to conventional television standard, in order to accommodate captions.

7 Conclusion

For the exchange of recorded television programmes transferred from feature films, it is common practice to come to an arrangement-prior to the film to tape transfer-on the scanned area and aspect ratio on the film. In this, not only the various film formats which are normally used for release prints have to be taken into account, but also the aspect ratio of the actual television system which will be used for transmission.

In this Annex, the different possibilities which are conceivable and which are already used at broadcasting organizations are described from the European point of view. In order to facilitate the future exchange of programmes originated on film, it is suggested that:

– telecine scanning should be as fully flexible as possible;

– a limited number of fixed scanning rashers are agreed,

for the transfer of feature films to conventional television systems.