



Channel Four Television Corporation

Technical Requirements

for

Commissioned Programmes



March 2008



Technical requirements for commissioned programmes supplied to Channel 4

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1. Engineering responsibilities for programmes and production

1.1 General Responsibilities

Channel 4's Programme Operations Manager is required to ensure that programme technical quality is maintained to a satisfactory standard throughout the entire programme production chain. He is accountable to OfCom for the achievement of high standards of quality and reliability.

It is therefore essential that Channel Operations has an involvement at all stages in the programme making process from drafting the initial production contract, through shooting and post production, to technical review and transmission.

The Channel Operations department works closely with colleagues throughout Channel Four who are involved with the detailed specification and management of programme commissioning, production and delivery. Working in conjunction with the Business Affairs, Rights, Programme Finance and Programme Management departments, it is our intention to ensure that any technical or related issues are resolved in a swift, constructive and consistent manner.

1.2 Channel Operations liaison

Any enquiries on programme delivery, production, or other technical matters should be initially made to one of our Technical Managers. They have special responsibilities to advise on standard production paths and techniques. Where the intended production techniques do not comply with our normal requirements, reference will be made to the Programme Operations Manager who has specific responsibility for consistent application of Channel Four's technical policy, but has the authority to agree exceptions. Certain matters, however will always require reference to the Programme Operations Manager.

1.3 Channel Operations objectives

It is part of our role to advise on the avoidance of the production equipment or techniques that we know to be technically inferior or contentious and find a practical way forward acceptable to all parties. It is never the intention to frustrate the producers' ambitions to make their programme in the way of their choosing.

1.4 About this document

Most of this document provides statements relating to our general requirements. The appendices give further technical or other detail where appropriate, and provide references to additional information.

Due to the rapid rate of technical development, use of specific equipment is constantly under review. This document will be subject to periodic re-issue to reflect this situation, but please consult the Channel Operations department for the avoidance of any doubt on specific issues.

2. Picture formats - widescreen policy

2.1 Widescreen format compatibility

For some considerable time now, the vast majority of new programmes commissioned by the Channel¹ are in the widescreen picture format aspect ratio of 16:9. To accommodate the majority of viewers on the existing analogue channel using picture displays with an aspect ratio of 4:3, most new commissions in widescreen will be required to 'shoot to protect' the central 14:9 zone within the overall 16:9 picture frame. There may be some productions that require protection of the 4:3 central zone or full 16:9 image only: your contract will specify this where appropriate. Channel Four subscribes to the action and graphics safe area specifications agreed between UK terrestrial broadcasters. In this document, references to graphics and/or captions includes in-vision subtitles.

See [Appendix 1](#) for further details

2.2 Widescreen shooting on videotape

Programmes commissioned in widescreen which are to be originated on videotape shall be shot in 16:9 full height anamorphic. The use of a digital component videotape recording format is essential and must be sustained throughout the entire production process. The camera(s) used must have an image capture device (CCD array etc.) of the correct aspect ratio designed for 16:9 operation. It is **wholly unacceptable** to shoot using a native 4:3 camera and subsequently extract a 16:9 image from the 4:3 original.

See [Appendix 1](#) for further details

2.3 Widescreen shooting on Super 16mm film

Super 16mm film has a 15:9 aspect ratio; therefore picture framing for 16:9 will cause slight cropping at the top and bottom of the Super 16mm film frame. Within this, the central 14:9 zone must be protected, including titling and captioning, to accommodate analogue transmission requirements.

See [Appendix 1](#) for further details

¹ Channel 4; More 4; E4 and Film 4

2.4 Programme production on 35mm film

In order to achieve adequate compatibility between auditorium and television presentation, shooting may be up to a picture ratio of 1.85:1. At this ratio, picture framing must allow for slight cropping at each side that will occur in the production of the 16:9 (1.78:1) television master. Within this, the central 14:9 zone must be protected, including titling and captioning, to accommodate analogue transmission requirements.

See [Appendix 1](#) for further details

2.5 Master copies for domestic distribution

Where non-broadcast distribution is intended for a programme shot in widescreen, consideration must be given to the aspect ratio on the distribution medium. As the proportion of widescreen TVs increases it is likely that our policy will change. For the time-being 14:9 letterbox should be assumed unless the medium permits aspect ratio switching (e.g. DVD) or unless otherwise specified.

2.6 International sales copies

Where a programme requires an international sales copy, this would normally require delivery in 4:3 (pan/scan) format and be produced without captions unless otherwise agreed. A 16:9 letterboxed image would not normally be needed.

In general it is recommended that the original 16:9 picture framing should not explore both edges simultaneously. This will ensure acceptable framing can be achieved in production of the 4:3 version, albeit with the use of pan-scan techniques. Where the aspect ratio of the international sales version varies from the original, this may be produced from the 16:9 master by means of specialist broadcast quality video aspect ratio converter. A general purpose digital video effects unit is not acceptable for this purpose.

Precise delivery requirements for any international sales version will be specified within the individual programme contract.

2.7 Outside Broadcasts in widescreen

OB programmes produced in 16:9 widescreen will require a digital component production facility to output pictures in 16:9 full-height anamorphic format. For productions within the UK, the programme signal interface to the communications truck will be SDV and AES. Stereo analogue audio may be used by prior agreement. The programme feed into Channel Four premises should be digital component over the entire path.

3. Programme origination on videotape

3.1 Videotape formats

Programmes should be shot using the Sony Digital Betacam component videotape format and this approved format may be used for origination without further reference to Channel Four. The use of Beta SP is not permissible for 16:9 origination, and is discouraged for 4:3 origination. In all cases the highest standards of equipment maintenance and tape quality must be ensured.

The use of all other professional videotape formats including DVCPPro, DVcam, Sony SX, Sony Z1 and JVC Digital-S must be referred to the Channel Operations department to consider detailed requirements and specific agreement for use discussed.

In addition, should 'tapeless' systems such as XDCam or P2 be considered for acquisition then it is again recommended that the Channel Operations department be consulted and their advice sought.

In certain circumstances, e.g. shooting covert material or where a high level of mobility is required, the use of a mini DV type camera may be considered acceptable, but again specific agreement must be obtained and its use limited to unavoidable situations. Where use of this format is agreed we will normally require particular attention to be given to sound and lighting considerations.

The use of all other non-broadcast and domestic videotape formats is not permissible except in unique circumstances. Their use must always be fully discussed and agreed in advance.

3.2 Audio requirements

See [Appendix 2](#) for details

3.3 Background music/effects

Introduction

The volume of complaints about background noise drowning out dialogue or commentary in television programmes has prompted organisations representing people with hearing loss to persuade broadcasters to take the problem seriously and to establish awareness of the issue among those who work in programme production and post production.

Please read these guidelines to ensure your programme does not attract these complaints.

The scale of the problem

- Population of the UK – approximately 60 million
- 9 million (over 16 years of age) have a hearing problem
 - 0.7 million are profoundly deaf have a severe hearing loss
 - 8.3 million have mild/moderate deafness
- A peak-time programme attracting an audience of 4.8 million might well include 1 million who are hard of hearing, all of whom will have some difficulty understand speech overlaid with music or effects.
- The problem is going to get worse, not just because of the ageing of our population, but also because an increasing number of young people are putting their hearing at risk by listening to very loud music for extended periods.
- This problem also affects those with no hearing loss who might be watching in a noisy household or on unsophisticated audiovisual equipment. Interestingly, most of the complaints received by Channel 4's viewer enquiries team are from people who do not mention hearing impairment.

Why does the balance between speech and music go wrong?

- FAMILIARITY WITH THE SCRIPT
 - The production team is so familiar with the script by the time a music track is added that undue concentration is placed on the new ingredient, i.e. music. This is likely to be subconscious, with producers/directors ironically doing exactly what hard of hearing people try to do – a mixture of lip-reading and predicting what is said from the context.
- QUALITY OF HOME TVs
 - Most home TV receivers are considerably inferior to the high quality equipment of the professional dubbing suite. Ideally, every final sound mix would be played with someone present who was hearing the programme for the first time. If this is impractical, the final mix should be played through a mono speaker.
- THE VIEWING ENVIRONMENT
 - Sound dubbing suites are specified to provide the very best environment for listening to audio; the home environment is not.

Why isn't the problem solved by increasing the volume or using subtitles?

- Although subtitle provision in peak on the main broadcasters is high, not all programmes are subtitled.
- Not all domestic TVs are capable of decoding subtitles
- Subtitles often irritate others with whom they are watching. Besides, many hard of hearing viewers believe they would hear well enough if only given a sporting chance, i.e. when speech is not masked by music or effects.
- Turning up the volume turns up the background noise too, equally.

What you can do to get the balance right

- Make sure you are convinced of the need for music or effects and especially when considering overlaying speech with music (rather than cutting it before anyone speaks).
- If you are convinced of the need, please take the trouble to ensure that background music or effects never overwhelm the dialogue or commentary
- Play your final sound mix back through a mono speaker, without watching the accompanying pictures.

3.4 Video system standards

All shooting on videotape must utilise the 625-line 50Hz interlaced field-rate standard. Any intention to shoot on the 525-line 60Hz field-rate standard must be referred to the Programme Operations Manager for approval.

See [Section 5.5](#) and [Appendix 5](#) for notes on standards conversion.

4. Programme origination on Film

4.1 Delivery requirements

Channel Four sets very high quality standards for pictures and sound derived from film. Programmes originated and produced on film must be delivered on videotape (see [Section 6.3](#)), but we may specify delivery of the print or negative as well to safeguard future remastering requirements (delivery should also include all relevant EDLs, grading data etc.). Where the uncut camera negative has been used for transfer to tape the negative should be "shoulder cut" to facilitate remastering.

4.2 Film formats

16mm. The normal format for delivery is Super 16mm with SEPMAG or DAT sound tracks. Any proposed use of standard 16mm should be discussed with the Channel Operations department in advance.

35mm. Where a theatre distribution is planned 35mm, Super 35mm, or 2.35:1 CinemaScope are acceptable delivery alternatives together with SEPMAG or DAT sound. Film should be shot in an aspect ratio of 1.85:1 to best accommodate telecine transfer at 16:9.

See [Section 2](#), [Appendix 1](#) and [Appendix 3](#) for further details.

4.3 Film frame rate

Film should be shot at a frame rate of 25fps. Where there is any intention to shoot at 24fps this should be discussed and agreed with the Programme Operations Manager in advance. Film shot at 24fps must be transferred to videotape at 25fps and the sound pitch-corrected using approved equipment following consultation with Channel Operations.

4.4 Sound tracks

Final mix tracks will normally be in stereo and all track allocations must be always be clearly identified on the can label. Delivery of the sound track on DAT or other transportable digital format must be discussed and agreed in advance. Any intention to deliver anything other than the final mix or M&E tracks must also be discussed and agreed in advance and reflected in the Contract. See [Appendix 3](#) for further details.

4.5 Production routes

The following production routes are acceptable:

Cut and graded film print transferred to digital videotape and the addition of titles or tape inserts completed in video post production

Cut camera negative transferred to digital videotape and the addition of titles or tape inserts completed in video post production

Uncut camera negative transferred to digital videotape and all subsequent post production on digital videotape.

The requirements of **Section 4.1** apply to sections ii), iii) and iv).

See **Section 6** for further details of delivery requirements relating to transmission master videotapes.

4.6 Film print stock suitable for delivery or transfer

Whilst the television system is capable of handling a wide contrast range, practical considerations tend to limit the usable contrast range in the domestic viewing environment. This renders a theatre contrast print impractical for television use and the low contrast print was developed to provide an appropriate contrast range for film transfer to tape. In addition the interpositive, print has proved highly successful as a lower generation alternative whilst avoiding any risks associated with the use of the camera negative. If a transfer cannot be done from the original negative, we strongly recommend interpositive or low contrast prints be used for delivery or transfer.

4.7 Film to videotape transfer

Only transfer suites that utilise digital component techniques may be used. Technical details and transfer methods may be discussed and agreed with Channel Operations prior to the start of the transfer process.

4.8 Productions using the 'Digital Intermediate' process

The Programme Operations Manager can give assistance in this area.

4.9 Production on film outside the UK

Film programmes originated in North America, or any other country using 525-line video standards, should be delivered on a 625-line Digital Betacam videotape. Please discuss all requirements with the Programme Operations Manager well in advance. Transfer to a 525-line videotape format with subsequent standards conversion is not permitted in these circumstances.

5. On-line Post-production Techniques

5.1 General requirements

On-line post production work must always be undertaken in equipment areas employing digital component 270 Megabit/s SDV vision and AES (48KHz) audio for all prime interfaces and signal paths unless agreed otherwise. These interfaces must comply with ITU-R BT601 and BT656 specifications as appropriate. Where programme material is originated in analogue component or audio form, only one conversion to SDV/AES at an early stage is acceptable. Subsequent cascaded component video and audio encoding and decoding processes will give rise to deterioration in signal quality and must be avoided.

Control rooms used for production and post-production processes should have viewing and sound monitoring conditions that comply with industry standards thereby ensuring consistent and accurate assessment of picture and sound quality.

In all cases, if the video processing introduces any delay, then compensatory audio delay should be provided.

See [Appendix 4](#) for further details.

5.2 Tape-based linear edit processes

In the rare cases where Beta SP programme origination has been agreed, material must be transferred direct to Digital Betacam as part of any linear edit process. Second or subsequent generation recordings of Beta SP material is not normally acceptable and is particularly detrimental to sound recorded on longitudinal audio tracks. Similarly, where origination on the DV type format (or exceptionally another domestic format) has been agreed, transfer to Digital Betacam prior to any edit process will be required to protect, and allow timecode control of, the source material.

5.3 On-line non-linear edit processes

Non-linear disc-based edit systems employing full-bit data handling (i.e. no data compression) may be used without any reference to the Channel Operations department.

The use of non-linear edit systems employing bit-rate reduction techniques must be discussed and agreed in advance. In general, only devices employing average compression rates of 5:1 or less will be considered. In any case, systems may only be used where SDV input and output interfaces are employed. The submission of test tapes may be required depending upon the different equipment used in the production path, nature of material, etc.

The use of off-line non-linear systems followed by tape-based on-line conforming via EDL does not require prior consultation.

5.4 Film-mode or film-look processing

The use of field-doubling techniques applied to video recordings in an attempt to create the "feel" of film are generally unacceptable and any intention to apply this process in the camera or post production suite must always be referred to the Channel Operations department in advance. The unwanted artefacts generated by the consequential halving of vertical resolution are regarded as a degradation of the picture quality and not a video effect.

Where the video material is sympathetic to such techniques, sophisticated processes can be applied to simulate a film look but this would be very much the exception and generate significant additional programme costs.

5.5 Standards conversion

Programmes may not be shot on the 525-line 60Hz field-rate standard without the specific approval of the Programme Operations Manager in advance. Should such approval be given the material must be shot on a digital component video camera. Subsequent standards conversion must have SDV interfaces and employ motion prediction techniques.

See [Appendix 5](#) for further details.

6. Delivery of Transmission Master Videotapes

6.1 Videotape formats accepted for programme delivery

Sony Digital Betacam is a perfectly acceptable videotape delivery format across all programme genres. In all cases the submitted videotape recording must be fully compliant with the manufacturer's technical specification thus ensuring format compatibility.

6.2 Record reports

Every tape submitted must be accompanied by a completed record report conforming to UK Broadcasters' requirements including full details of programme title and technical information. The record report must provide clear references to any part of the programme content that may attract low grades (especially below grade 3). Failure to deliver a completed record report will result in rejection.

See [Section 7](#) for further guidance on programme grading.

See [Appendix 6](#) for specific details on record report requirements.

6.3 Videotape delivery of programmes originated on film

Super 16mm film origination. Videotape delivery will be from a 16:9 full height anamorphic telecine transfer within which there shall be a 14:9 protected central zone. The 16:9 delivery requirement will result in slight cropping top and bottom of the 15:9 (1.66:1) Super 16 frame.

35mm film origination. Videotape delivery will be from a 16:9 full height anamorphic telecine transfer within which there shall be a 14:9 protected central zone. The 16:9 delivery requirement will result in slight cropping both sides of the 17:9 (1.85:1) 35mm framing.

See [Section 2](#) and [Appendix 1](#) for further details.

6.4 Recordings spanning more than one tape

Individual programmes should always be delivered on one videotape wherever possible. Where this is unavoidable and a single programme is recorded across two or more tape spools the following requirements must be observed:

The tape box, record report and leader clock details must clearly indicate the spool number in the sequence and the total number of spools comprising the complete programme, e.g. 1 of 2.

There must be no overlapping vision, sound, timecode or subtitles between tape spools.

Each tape spool should always contain discrete parts. Where this is not possible due to continuous recording in excess of the individual tape duration, the break must occur at a suitable point within the programme material preferably at a fade to black and silence.

See [Appendix 2](#) for further details

6.5 Compilation tapes

Programmes of short duration may be delivered on compilation tapes where this has been agreed in advance and specified in the contract. The following requirements must be observed:

The tape box and record report must clearly identify the separate programmes on the cassette.

Each programme must be preceded by a leader clock clearly identifying individual programme details

Standard timecode practices must be observed over the recorded length of the tape.

See [Appendix 2](#) for further details

6.6 Teletext Subtitling

A majority of programmes are transmitted with closed subtitles. These are provided for deaf or hard of hearing viewers and for others who derive benefit from the addition of subtitles, currently estimated to total about 10% of viewers.

Subtitle preparation is a time-consuming activity. To aid this process a copy of the script on 3.5" floppy disk (in any common word processor format) and a VHS copy of the programme (with VITC and burnt-in timecode) should accompany the master tape delivered for transmission.

Deliveries of programmes with subtitles recorded on line 335, conforming to the relevant sections of the teletext standard ETS 300 706, are acceptable. When this option is chosen details must be clearly stated on the record report.

6.7 General technical requirements

General technical details including line-up, clock, timecode, and track usage requirements together with acceptable limits of technical parameters must be observed.

The signal levels on the recorded tape should be in accordance with the specifications published by the tape and VTR manufacturers, and the technical parameters should correspond to the recorded reference line-up levels. The technical parameters of the recorded programme must not at any point exceed either the audio system limits, component gamut system limits, or the derived analogue system limits. Particular care must be taken to avoid illegal colours when using caption generators, graphics equipment etc. This can be achieved by adhering to EBU recommendation R103-2000.

http://www.ebu.ch/CMSimages/en/tec_text_r103-2000_tcm6-4677.pdf

If these requirements are not met (within close tolerances), the programme will be rejected at technical review.

See [Appendix 2](#) for further details.

7. Technical Acceptance Procedures

All programmes delivered on videotape will be subject to a full technical acceptance review prior to transmission. Any programmes failing to meet the required technical standards, or in breach of other acceptance requirements will be referred back to the supplying production company for rectification.

7.1 Technical quality grading

Overall quality of sound and vision will be separately assessed in controlled monitoring conditions and any impairments noted. At the end of the technical review the programme will be judged for sound and vision quality against the ITU-R 5-point quality grading scale as shown below:

Grade 5	-	Excellent
Grade 4	-	Good
Grade 3	-	Fair
Grade 2	-	Poor
Grade 1	-	Bad

OfCom expects new commissioned programmes delivered on tape and based on electronic production to meet a minimum of grade 4 for sound and vision quality. The minimum acceptable quality for any programme is grade 3 unless there are valid reasons for technical exemption, in which case details should be clearly stated on the record report.

7.2 General picture quality requirements

The pictures should be appropriately sharp, free of excessive overshoots and normally exhibit no perceptible levels of noise. Black or white crushing in the main areas of interest should be avoided and colours, especially skin tones, should be natural.

7.3 General audio requirements

Sound tracks must be suitable for reproduction in a domestic environment. Dynamic range should be restricted and changes in loudness controlled so that the viewer has no need to adjust volume during or between programmes. All stereo recordings must provide good mono compatibility.

See [Appendix 2](#) for technical details.

7.4 Sound to vision synchronisation

The relative timing of sound to vision should not exhibit any perceptible error. Sound should not lead or lag vision in excess of 1 field ($\pm 20\text{mS}$). A sound delay of greater than 1 field ($>20\text{mS}$) can be acceptable where this occurs in context to give a perception of distance.

7.5 Technical exemption categories

All programmes are expected to meet our required technical standards. The recognised exemption categories are tightly constrained by OfCom qualification and may not be invoked for the general convenience of programme makers. Notwithstanding other requirements, it is expected that the technical quality of a programme will be the highest that can reasonably be achieved.

Where programmes fail to meet full broadcast technical specifications and fall outside these exemption categories it will be necessary to apply to OfCom for special exemption. In such cases the Production Company should consult the Channel Operations department prior to the start of production. This will allow discussions with OfCom to proceed at an early stage and, although in no way guaranteed, it will reduce the likelihood of subsequent difficulties.

See [Appendix 7](#) for further details of exemption categories.

7.6 Flashing images and repetitive patterns

Some viewers find rapidly alternating picture brightness levels irritating. However, those affected by the medical condition photosensitive epilepsy may suffer epileptic convulsions when presented with sequences of flashing images (e.g. disco strobe lighting) or certain high-contrast patterns. Channel Four and OfCom consider the potential risk to these viewers a serious matter and ignoring the relevant guidelines may result in programme rejection. Any producer considering including such sequences in their programme is strongly advised to consult the Channel Operations department for initial guidance before proceeding.

See [Appendix 8](#) for further details.

8. Live and pre-recorded outside broadcasts

8.1 Responsibility for programme links to Channel 4

The production company will be responsible for arranging all necessary lines, microwave or satellite links from the OB production centre. Channel Four's Channel Operations department will arrange for downlinks (either internally, externally or any combination) and/or local ends into Channel 4's premises. This applies to all programme signals and production communications unless otherwise agreed and reflected in the programme contract. Any lines charges incurred by the Channel Operations department for linking programme signals from the OB production centre to BT Tower or other local gateway will be passed on internally to the programme budget. In instances where existing local end circuits are readily available between a London-based production facility and BT Tower switching centre, these charges will normally be waived.

Note that responsibility rests with the production company to arrange all communication links for remote programme contribution into the production centre itself and costed against the programme budget. However the Channel Operations department will happily advise on these matters upon request.

A separate document is currently being written to define the requirements for OB and satellite feeds into CH4.

8.2 Types of programme and communication links

Landline, microwave and satellite programme paths may be required individually or in any combination to link programme vision and sound from the OB production centre to Channel Four premises. Most live events will require the prime programme signal path to be supplemented by a diversely routed backup path over the entire route. This backup may be via fibre or satellite.

OB programmes produced in the 16:9 widescreen format will require a digital component production facility to output pictures in 16:9 full-height anamorphic format. For productions within the UK, the programme signal interface to the communications truck will be SDV and stereo analogue, however AES should be used where available. The primary programme signal link into Channel Four premises will be digital component over the entire path.

4-wire (ISDN) production control communications between the OB production gallery and Channel 4 Presentation control, and 2-wire technical co-ordination communications between the production Engineering Manager and Channel 4 MCR will be required prior to and throughout the event. Co-ordination communication links may be of the dedicated or dial-up type. The 'SystemBase' or 'BluePhone' protocols are equally acceptable.

8.3 Notification of programme link requirements

Details of all requirements for programme links into Channel 4 must be notified to the Programme Finance manager, Business Affairs Negotiator and the Lines Co-ordinator in Channel Operations at an early planning stage and confirmed with adequate notice. Any technical issues in respect of these will be dealt with by the Lines Co-ordinator or designated Technical Manager. Early and stable notification of requirements is most important; late changes may incur additional cost at best and place the programme in jeopardy at worst.

8.4 Technical line-up and signal stability

The OB facility must be able to originate vision and audio line-up signals. These should comprise 100% colour bars (75% if the video is to be linked via satellite) and a 1KHz reference tone. Duo-tone identifying left and right is preferable for stereo. Programme signal levels should relate to line up signal levels as detailed in [Appendix 2](#).

Line-up signals must be available on the facility's monitored output at least 30 minutes prior to the programme start time and an engineer designated to liaise with Channel Four MCR Engineering staff. If the line up signals reveal a defect in the path feeding the programme, then sufficient time may then be available to rectify the fault and thus safeguard the programme.

The incorporation of remote sources to the OB must be arranged so as to ensure stable synchronising signals at all times, and the facility output video signal must be continuous and stable in all respects throughout the broadcast period.

8.5 Formal completion and delivery of programme material

Where any post-production of a programme will occur after programme material is received by Channel Four over programme signal links, delivery will not be deemed complete until all the requirements of the Programme Specification to the Contract have been satisfied.

8.6 Compliance Delays

The use of compliance delays should be discussed with Channel Operations well in advance of programme transmission (ideally at the planning stage). Fixed delays should be avoided at all costs.

8.7 Synchronism of cameras into OB trucks

With the increasing use of radio cameras and other mobile equipment, it is imperative that, with the varying delays between cabled and wireless systems, audio to video synchronism is maintained such that there is no perceptible lip sync error when cutting between cameras from different sources.

8.8 Legal requirements regarding the use of radio frequencies

All radio microphones, radio talkback, communication and radio links used for OB and location recording require an appropriate and specific licence prior to use. Within the UK, use of radio frequency channels for these purposes is co-ordinated by the Joint Frequency Management Group Limited (JFMG Ltd) acting as agent to the Department of Trade and Industry.

Independent programme makers are responsible for making the necessary arrangements and paying for their own licences. There is a variety of tariffs payable depending upon the type of service and the period over which it will be used. Full details of the options available and the requisite licences can be obtained from:

JFMG Ltd 33-34 Alfred Place London WC1E 7DP UK	Phone: 020 7299 8660 Fax: 020 7299 8661 e-mail: info@jfmfg.co.uk Web site: http://www.jfmfg.co.uk/
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9. Other forms of programme delivery

9.1 Delivery by file (MXF)

Channel 4 television has no plans at present to take delivery of programmes in this manner. We do expect to begin testing alternative methods of delivery in the next few months.

10.1 Origination formats

35mm film origination is acceptable if originated in telecine at 1080 directly to HDCam-SR². A cross-conversion from HDCam is not acceptable.

Super 16mm may be acceptable for certain essential programme inserts but only by special agreement as the compression used in the production, post production and transmission chain, when added together (known as concatenation), could degrade the pictures to an unacceptable level.

1080-based tape formats HDCAM and HDCAM-SR², D5-HD, and DVCPRO-HD-100, are acceptable for acquisition, as are the Panavision 'Genesis', Arri D20, Dalsa, Thomson Viper and Red cameras.

The HDV format (and any other cameras with a sensor smaller than 1/2") may only be used by special agreement. Again, this is because of concatenation of compression. Similarly, XDCam-HD and XDCam EX-HD are currently under review and should not be used for acquisition without first speaking with the Programme Operations Manager.

Material up converted from 720 to 1080 will not be acceptable. The Panasonic **VariCam**, if used in its 'variable frame rate' mode, is the only 720 camera currently available. Until a 1080 equivalent exists, we will only accept 'overcranked' material shot using this camera.

² Deliveries on HDCam-SR are to be at 440Mb/s and in 4:2:2 colour space, although **acquisition** at 4:4:4 is permitted, provided that **delivery** is 4:2:2.

10.2 Standard Definition up-converted to HD

A maximum of 10% of the programme, with no one sequence being more than 1 minute long, except by special agreement. HD Programmes that fail to meet these percentages and/or timings must be delivered in SD (at the production company's expense).

Up-Conversions must be by professional up-converters such as the Snell & Wilcox Ukon, Quasar Ph.C. or Alchemist HD Ph.C.

10.3 Editing

On line editing from agreed origination tape formats to HDCAM-SR² is acceptable. If converting from HDCam to HDCam SR² then extreme care must be taken when converting from 3:1:1 to 4:2:2 sampling.

Material shot at 1080 must not be down converted to 720 for editing and then upconverted again for delivery

Non-Linear disk-based editing systems must be 1:1 uncompressed.

10.4 Delivery tape formats and frame rates

HDCAM-SR² at 1080 50i. HDCam SR² at 25PsF for film origination.

Sound Tracks

HDCAM-SR² should have Stereo final mix on AES1 and discrete Dolby™ 5.1 (if available) on AES 2 to 4.

Audio track allocation for discreet 5.1:

VTR Track (SR)	Content
1	Stereo Left (Lt)
2	Stereo Right (Rt)
3	L Front
4	R Front
5	Centre
6	Sub (LFE)
7	L Surround
8	R Surround
9	
10	
11	Audio Description
12	Audio Description

Audio description data will usually be added post delivery by Channel 4.

10.5 Dolby™ E and associated Metadata

It may be acceptable to deliver audio encoded to the Dolby E standard. This will be clarified in a later version of this document. Should Dolby E be acceptable, then the track allocation must be as follows:

		VTR Track	Content	
HDCam	HDCam SR	1	Stereo Left (Lt)	
		2	Stereo Right (Rt)	
		3	Dolby E – Final Mix	
		4	Dolby E – Final Mix	
			5	Dolby E – M&E (Only if available)
			6	Dolby E – M&E (Only if available)
			7	Currently blank
			8	Currently blank
			9	Currently blank
			10	Currently blank
			11	Currently blank
			12	Currently blank

Audio track allocation within the Dolby E data stream:

Audio Track	Content
1	L _{Front}
2	R _{Front}
3	Centre
4	Sub (LFE)
5	L _{Surround}
6	R _{Surround}
7	Currently blank
8	Currently blank

Metadata

The preferred metadata parameters are listed below. Any deviation from these settings must be documented with the delivered tape(s) so we can verify the Dolby™ E Metadata (if available) is correct. Required information in **Bold**.

These metadata setting will also be assumed and applied to tapes delivered with discreet 5.1 audio.

Bitstream Mode for soundtracks other than Main (TX) should be set appropriately (M&E etc.)

Dialogue Level (Dialnorm)	-27dB
Channel Mode	3/2
LFE Channel	Enable
Bitstream Mode	Complete Main (CM)
Line Mode Compression	Film Standard
RF Mode Compression	Film Standard
RF Overmodulation Protection	Disable
Centre Downmix Level	0.707 (-3.0dB)
Surround Downmix Level	0.707 (-3.0dB)
Dolby Surround Mode	Not Indicated
Audio Production Information	Yes
Mix Level	80dB
Room type	Small
Copyright Bit	Yes
Original Bitstream	Yes
<i>Preferred Stereo Downmix</i>	<i>Lt/Rt preferred</i>
<i>Lt/Rt Centre Downmix Level</i>	<i>0.707 (-3.0dB)</i>
<i>Lt/Rt Surround Downmix Level</i>	<i>0.707 (-3.0dB)</i>
<i>Lo/Ro Centre Downmix Level</i>	<i>0.707 (-3.0dB)</i>
<i>Lo/Ro Surround Downmix Level</i>	<i>0.707 (-3.0dB)</i>
<i>Dolby Surround EX Mode</i>	<i>Not Indicated</i>
<i>A/D Converter Type</i>	<i>Standard</i>
DC Filter	Enable
Lowpass Filter	Enable
LFE Lowpass Filter	Enable
Surround 3 dB Attenuation	Enable
Surround Phase Shift	Enable

10.6 Safe Areas

Programmes for Analogue SD simulcast or repeats may require to be Shot-To-Protect 14:9, otherwise standard 16:9 Protection applies. This will be specified in the programme contract.

10.7 HD Acquired Programmes

Movie acquisitions and many US Series productions are at 24p or 24PsF film-based.

Conversions to 25 frame/sec should be by speed-rate processing from 24 frame/sec originals, not from 30/60 versions that have been through a 2:3 Pulldown removal process.

Material originated on tape at 1080 30p or 60i must be converted to 50i by a professional cross converter such as Ukon or Alchemist Ph.C HD, to minimise motion artefacts resulting from converting the differing frame rates.

11. Access Services

11.1 Subtitling

- File-based subtitles must comply with the EBU tech 3264-E data exchange format specification.
- BBC Broadcast is responsible for the successful electronic delivery of these files to Channel 4's main and backup Softel File servers.
- Electronically delivered files will be identified by Programme Material ID or other identifiers advised to BBC Broadcast from time to time.
- Provision must be made for delivery by 3.5" floppy disk if required. These will be identified by Programme Material ID and programme title.
- Access to programme material will normally be via the Channel 4 VideoBrowse system providing an MPEG-1 programme file. An agreed backup system using recorded media (e.g. VHS) will be required.
- Live subtitle data must be delivered in the 'Newfor' format using the TCP/IP ethernet protocol or other protocol by agreement

11.2 Audio Description

- Material shall be supplied on Digital Audio Tape ("DAT"). Wherever possible there shall be only one complete programme per delivered tape. If it is not possible to contain the programme on one tape, there must be no overlap from the first to the second tape. The junction must be in silence and not within a passage of description. Eventually, Channel 4 will require file delivery (probably as BWF). We will issue an update to the specification when this happens.
- The audio description must be suitable for UK 625/50 transmission, i.e. the sound speed shall be 25 fps.
- The audio description sound quality must have good frequency response and be free from excessive reverberation, background noise, hiss or hum with no appreciable wow or flutter. The dynamic range of the describer's voice should be well controlled such that it is normally within the range PPM 4 to PPM 5 (0dBm to +4dBm).
- The audio description recording and production process must ensure the signal is not digitally compressed at any stage without the prior agreement of Channel Operations.

- The audio description soundtrack shall be recorded on the left track (track 1) using full bandwidth audio according to the AES-3/EBU digital audio specification. This track shall carry a reference sync blip of one frame duration at -3 seconds before start of programme.
- The fade and pan control information shall be recorded on the right track (track 2) in accordance with the specification PCM-44 rev1 - A Transport Mechanism for Audio Description Fade and Pan (31st March 1999).
- Timecode shall be recorded on the designated track according to the SMPTE/EBU timecode specification, and shall match exactly the timecode of the programme transmission master tape to which it relates.
- Full details of the Programme ID number, title, episode/subtitle and audio description production facility must accompany the DAT.

11.3 Signing

The delivered signing master tapes must meet the following requirements:

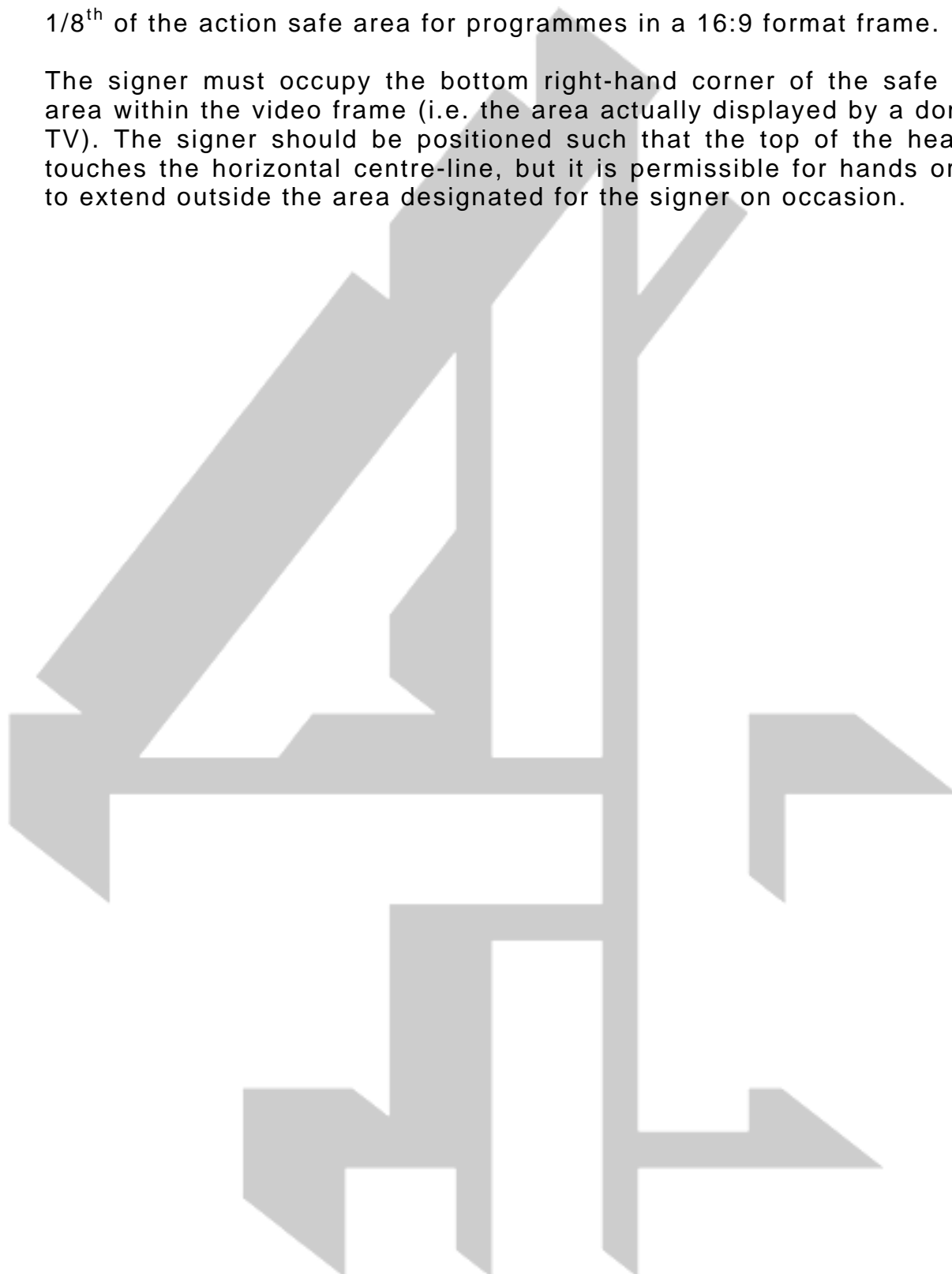
- A pre-shrunk image that has been sized and positioned correctly in order to overlay the associated programme material.
- The signer image must be shot using a high quality 3 chip CCD camera with studio lighting set to illuminate the signer and their facial expressions clearly.
- The programme should be delivered to C4 on the Sony Digital Betacam tape format containing timecode synchronous with that of the master programme tape.
- The delivered tape must meet all normal C4 delivery requirements.
- The VT leader clock must include the programme ID in the standard C4 format relating to the programme master transmission tape, and include the programme title and episode number. The supplier must ensure the accompanying documentation correctly links the signed tape with its associated programme transmission master tape. The clock must indicate that the tape contains the signer only.
- The full-frame background to the signer's image must comprise video black at blanking level to enable self-keying of the signer over the programme material. This background must be electronically generated, replacing the coloured background used during the recording process. The black reference of the signer's image should be lifted to 5% (35 mV) above the background black reference level.
- Channel 4 will inform BBC Broadcast of the correct aspect ratio and the material shall be delivered by BBC Broadcast with the correct aspect ratio for each Programme. Note: 16:9 material protected to 14:9 for analogue transmission should be treated as 16:9, since we intend the signed image to be transmitted to the digital platforms only.

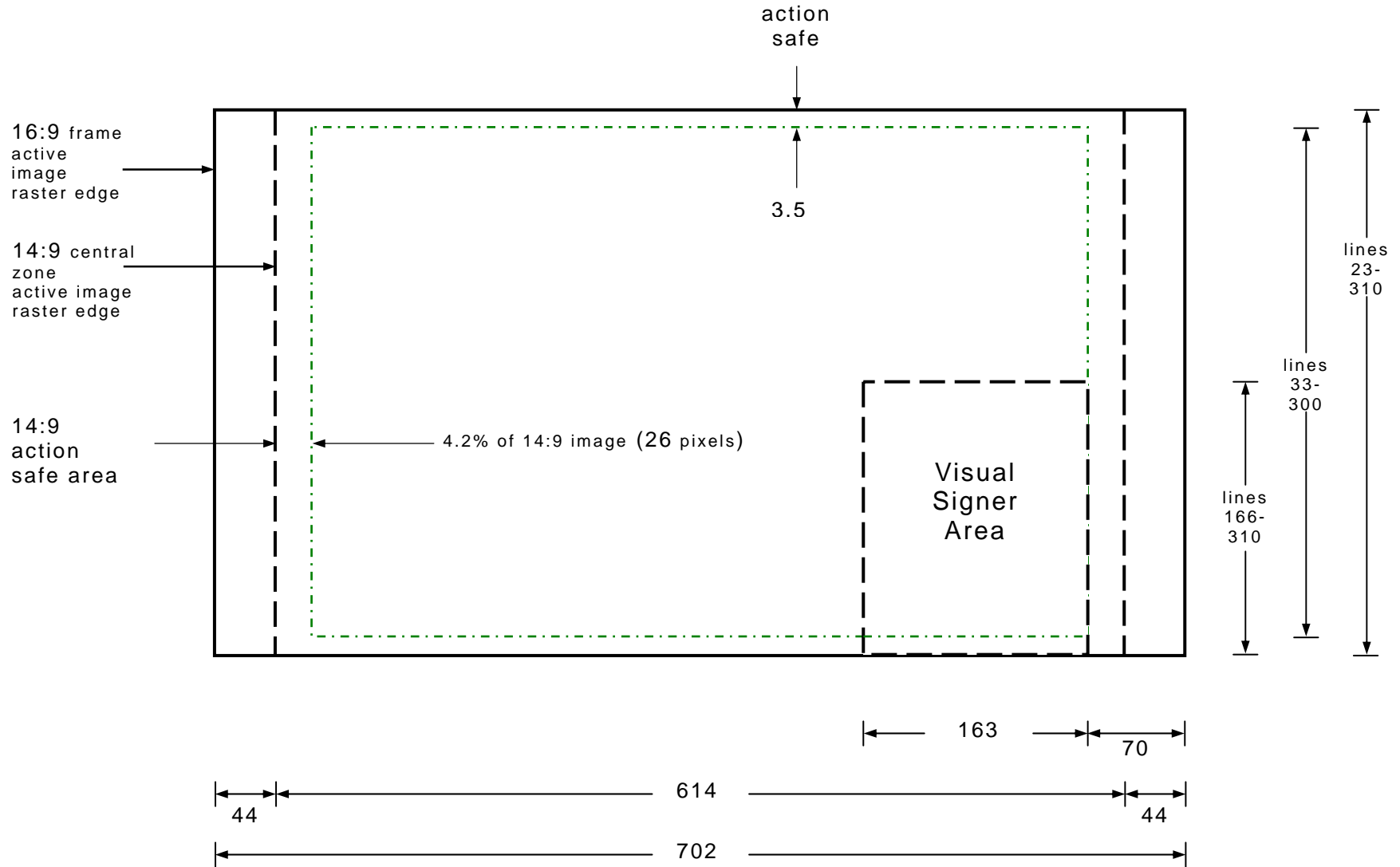
- The screen area occupied by the head and trunk of the signer should be as follows –

1/6th of the action safe area for programmes in a 4:3 format frame.

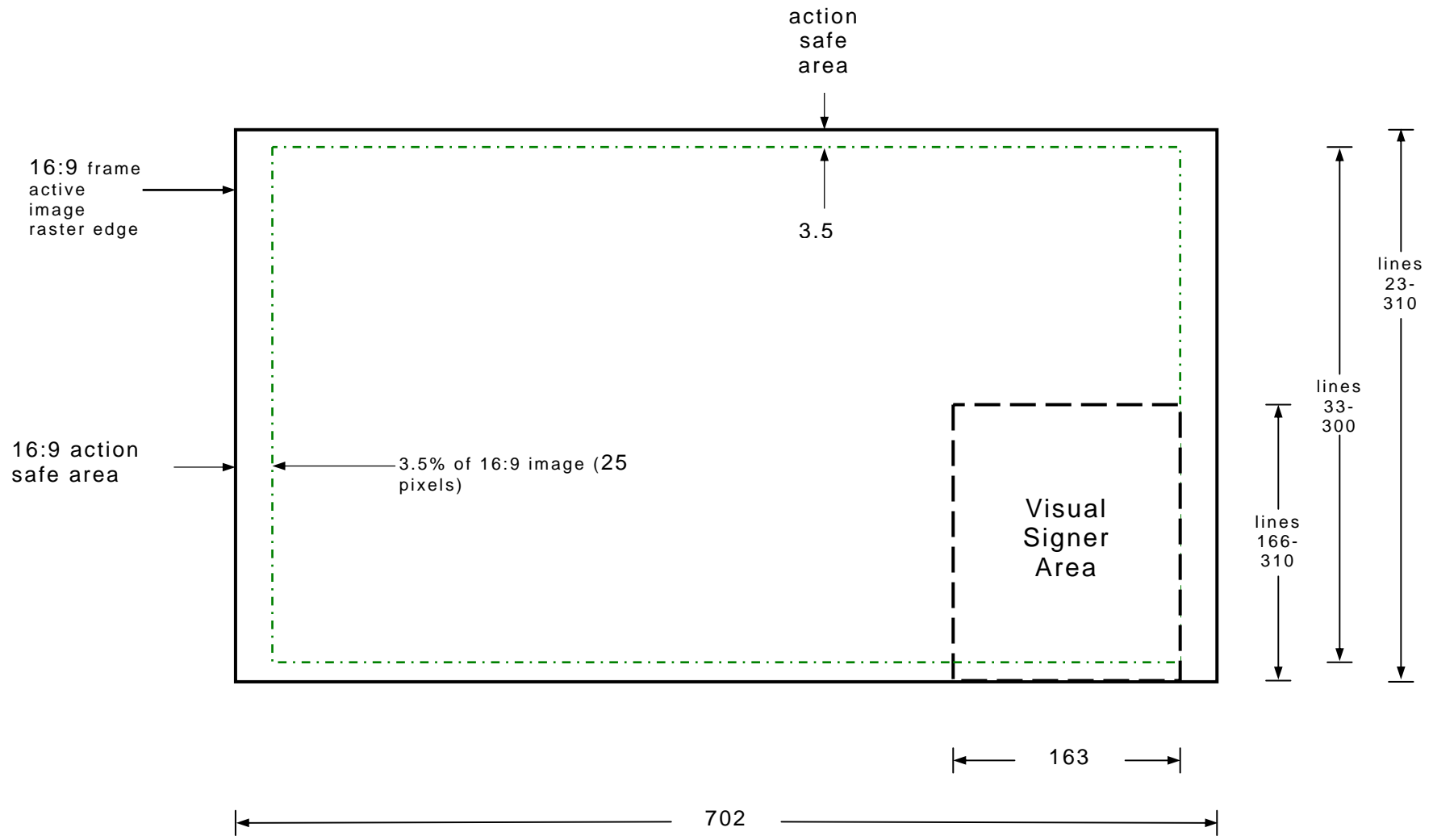
1/8th of the action safe area for programmes in a 16:9 format frame.

The signer must occupy the bottom right-hand corner of the safe action area within the video frame (i.e. the area actually displayed by a domestic TV). The signer should be positioned such that the top of the head just touches the horizontal centre-line, but it is permissible for hands or arms to extend outside the area designated for the signer on occasion.

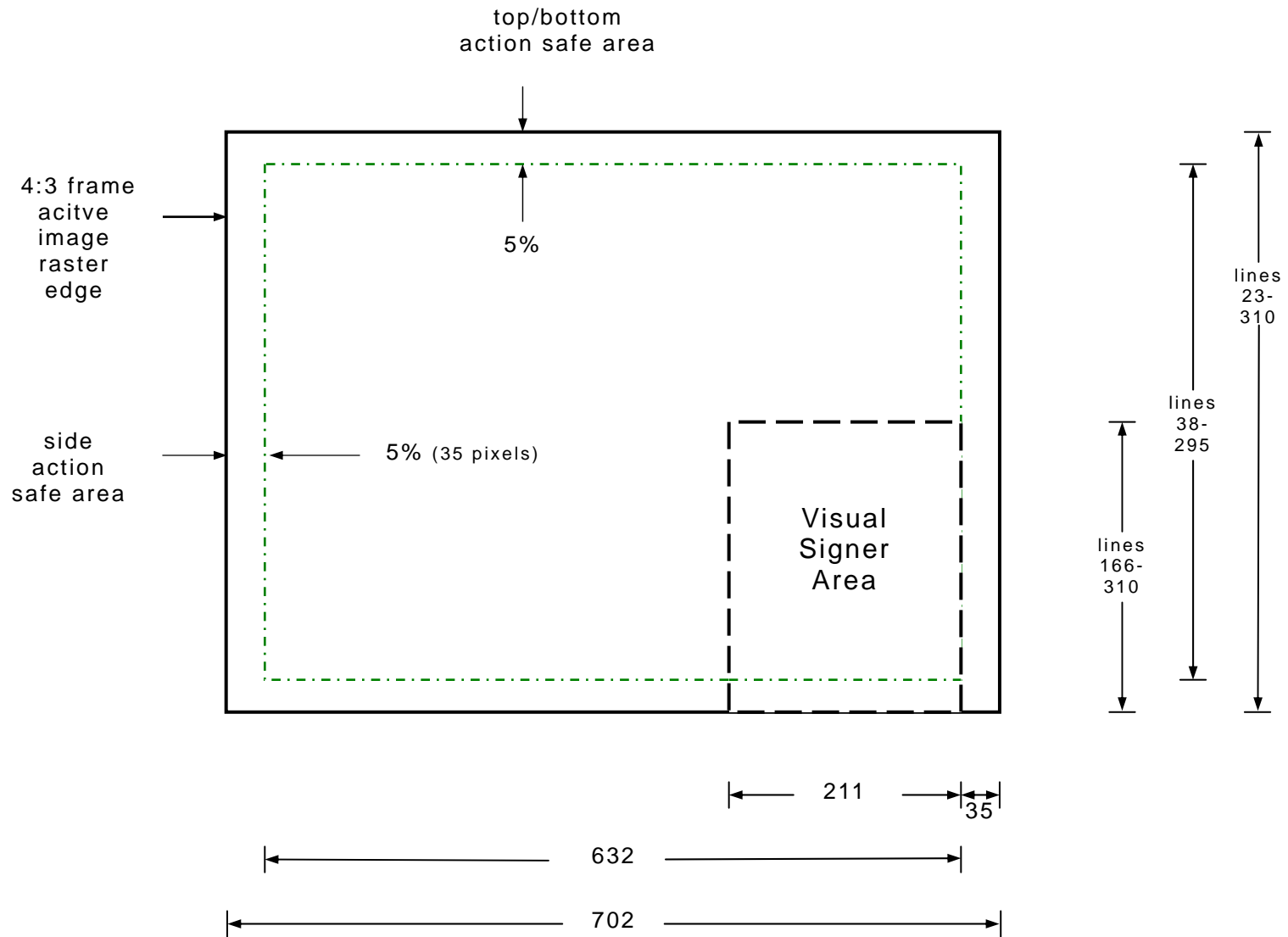




Visual Signer Area 16:9 Frame Format (14:9 safe)



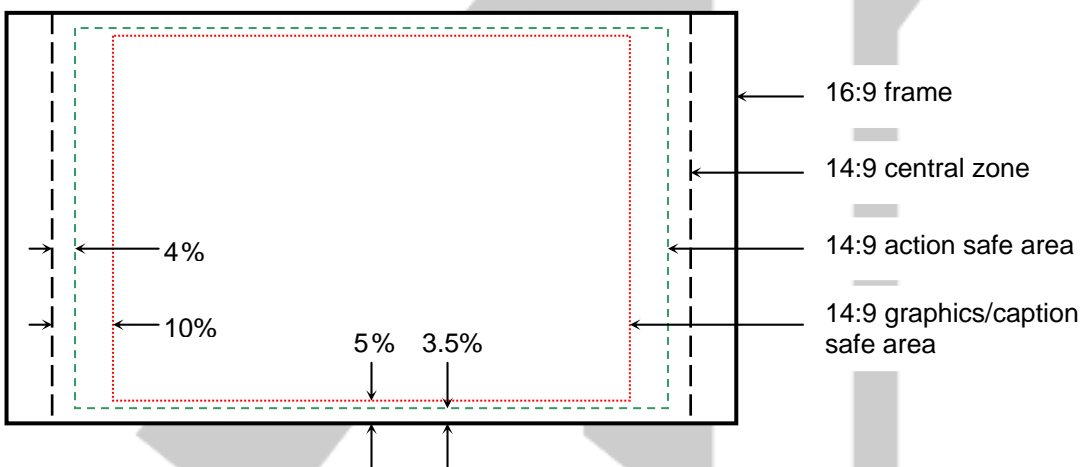
Visual Signer Area 16:9 Frame Format (16:9 safe)



Visual Signer Area 4:3 Frame Format

Widescreen shooting on videotape

- All programmes commissioned in widescreen to be originated on videotape shall be shot in 16:9 full height anamorphic format. The use of a digital component videotape recording format is essential and must be sustained throughout the entire production and post production process.
- Picture framing must protect the central 14:9 zone to accommodate analogue transmission requirements.
- Within the 14:9 central zone the safe action and graphics/caption areas shall be observed as shown in diagram 1 below.



1. **Diagram 1** - video

- The normal requirement will be to shoot to protect the 14:9 central zone, but in some circumstances there may be a need to shoot to protect the 4:3 central zone or the full 16:9 image only. Where this is contractually required the agreed policy between UK terrestrial broadcasters is explained on the following pages, with diagrams 2, 3 and 4 showing detailed specifications.

16:9 Widescreen Production - Shoot to Protect Safe Areas

Agreed Policy between representatives of all UK Analogue Terrestrial Broadcasters

The remaining sections of appendix 1 form the definitive guide to safe areas for adoption in electronic 16:9 widescreen programme production. It is aimed primarily at those involved in all stages of the programme-making process and manufacturers of production equipment.

It defines recommended safe areas within the 16:9 widescreen picture area for protection of:

The 14:9 central zone

The 4:3 central zone

The full 16:9 widescreen image

The safe areas have been specified on the premise that modern domestic television receiver display overscan will normally be in the range $3.5\pm 1\%$ of overall picture width or height, but any one picture edge should not exceed 4% of total picture width or height.

It is worth re-iterating here that, when calculating the safe areas, an active picture width of 702 pixels, should be used. This corresponds with the analogue system defined line duration of $52\mu\text{s}$. References to a line length of 720 pixels in some works on digital video include 8 'pseudo' pixels at the start and end of each line which correspond to the 'start of active video' and 'end of active video' codes. 720 samples equates to a line length of $53.33\mu\text{s}$, which, if used for safe area calculations, could cause content to exceed the safe area by approximately $1.5\mu\text{s}$.

16:9 Widescreen Shoot to protect the 14:9 central zone

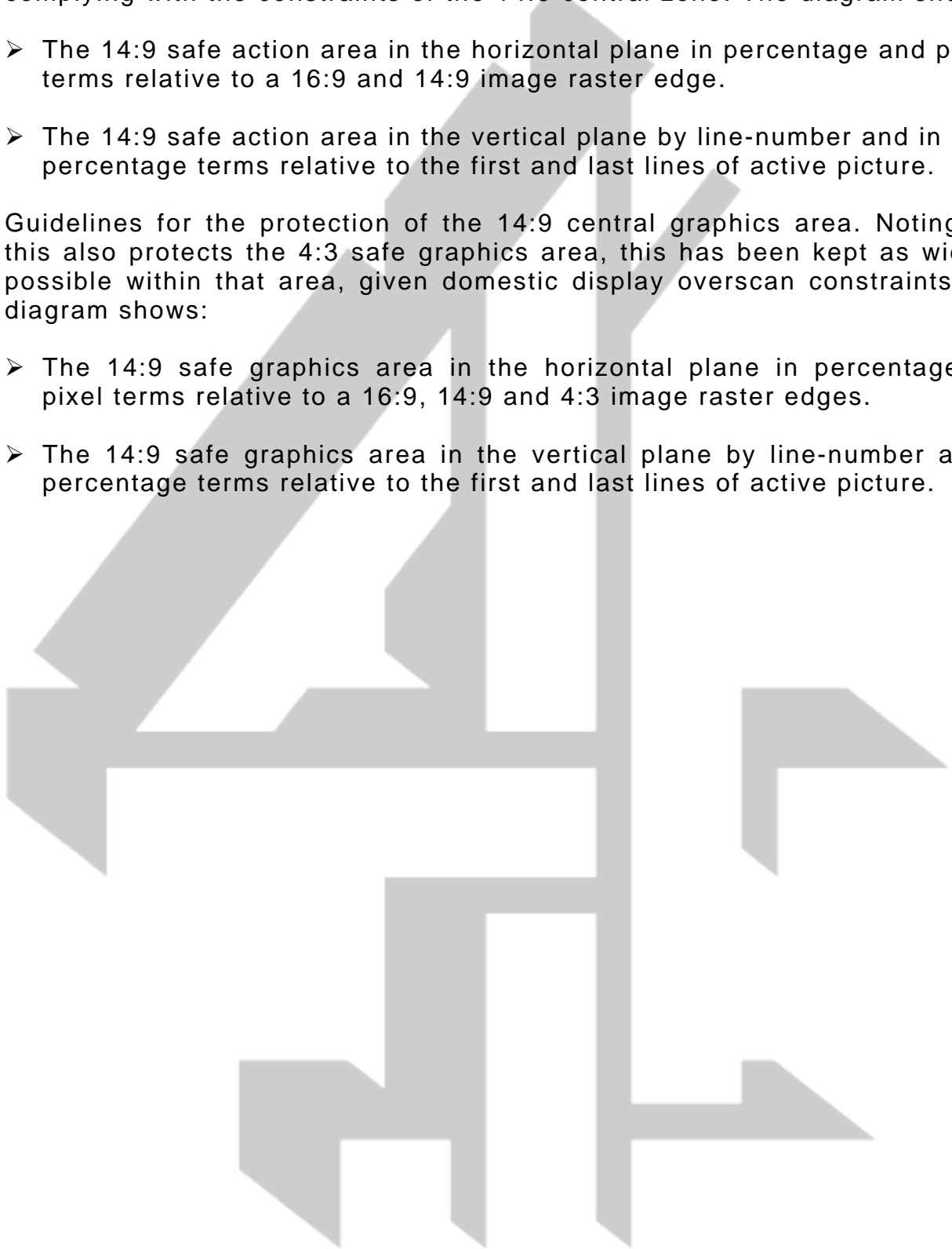
For detailed specification see **diagram 2** (overleaf).

Clearly the aspect ratios of 16:9 images and 4:3 displays are mutually incompatible, but many UK broadcasters consider a 14:9 centre cut-out letterbox image provides the best compromise when viewing a 16:9 widescreen production on a 4:3 display. Note that whilst the safe action area is 14:9, the safe graphics area is constrained to the 4:3 central zone. This is considered to be the most logical option for the time-being given the need to ensure that graphics and captions within a 16:9 widescreen production are adequately protected when viewed using the 4:3 centre cut-out option on a DTT receiver in conjunction with a 4:3 picture display.

For many programme genres protection of the 14:9 central zone will provide the most appropriate option for 16:9 widescreen programme production whether viewed on a 16:9 or 4:3 television display.

Diagram 2 specifies:

- Guidelines for the protection of the 14:9 central action area. This is intended to give maximum creative freedom within the 16:9 image area whilst complying with the constraints of the 14:9 central zone. The diagram shows:
 - The 14:9 safe action area in the horizontal plane in percentage and pixel terms relative to a 16:9 and 14:9 image raster edge.
 - The 14:9 safe action area in the vertical plane by line-number and in percentage terms relative to the first and last lines of active picture.
- Guidelines for the protection of the 14:9 central graphics area. Noting that this also protects the 4:3 safe graphics area, this has been kept as wide as possible within that area, given domestic display overscan constraints. The diagram shows:
 - The 14:9 safe graphics area in the horizontal plane in percentage and pixel terms relative to a 16:9, 14:9 and 4:3 image raster edges.
 - The 14:9 safe graphics area in the vertical plane by line-number and in percentage terms relative to the first and last lines of active picture.



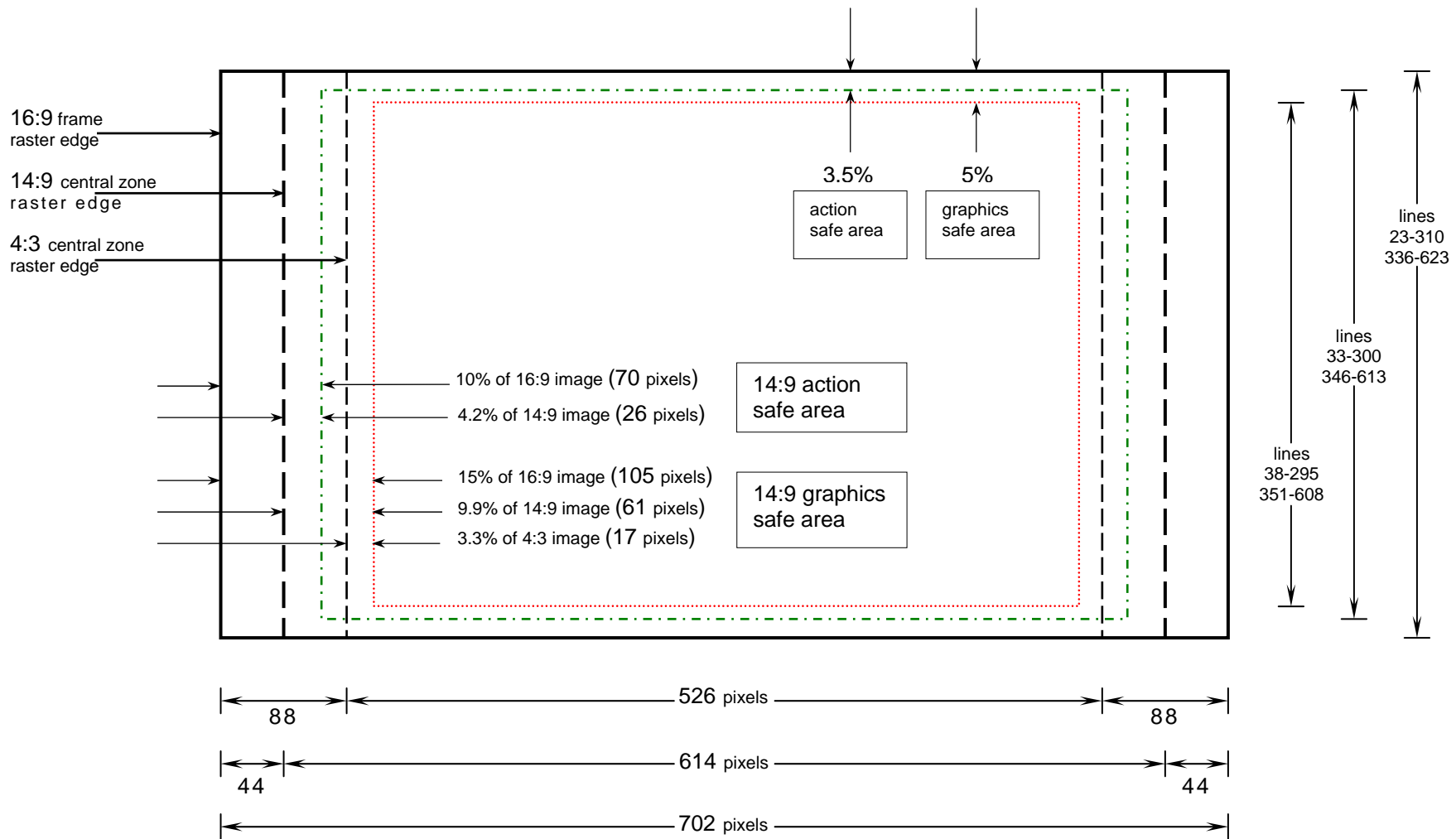


Diagram 2.

16:9 Shoot to Protect 14:9, defining action and graphics safe areas

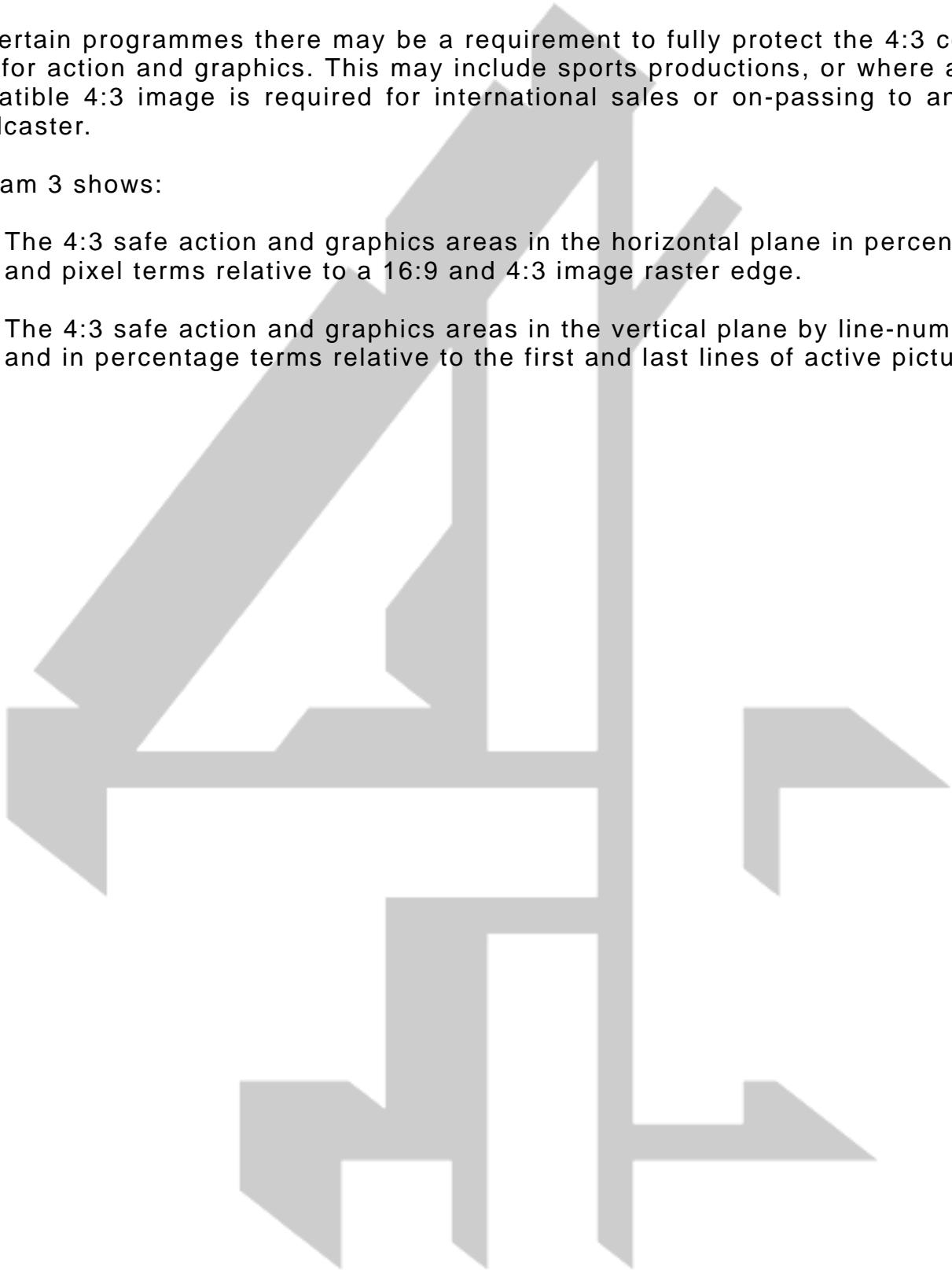
16:9 Widescreen shoot to protect the 4:3 central zone

For detailed specification see **diagram 3**.

For certain programmes there may be a requirement to fully protect the 4:3 central zone for action and graphics. This may include sports productions, or where a fully compatible 4:3 image is required for international sales or on-passing to another broadcaster.

Diagram 3 shows:

- The 4:3 safe action and graphics areas in the horizontal plane in percentage and pixel terms relative to a 16:9 and 4:3 image raster edge.
- The 4:3 safe action and graphics areas in the vertical plane by line-number and in percentage terms relative to the first and last lines of active picture.



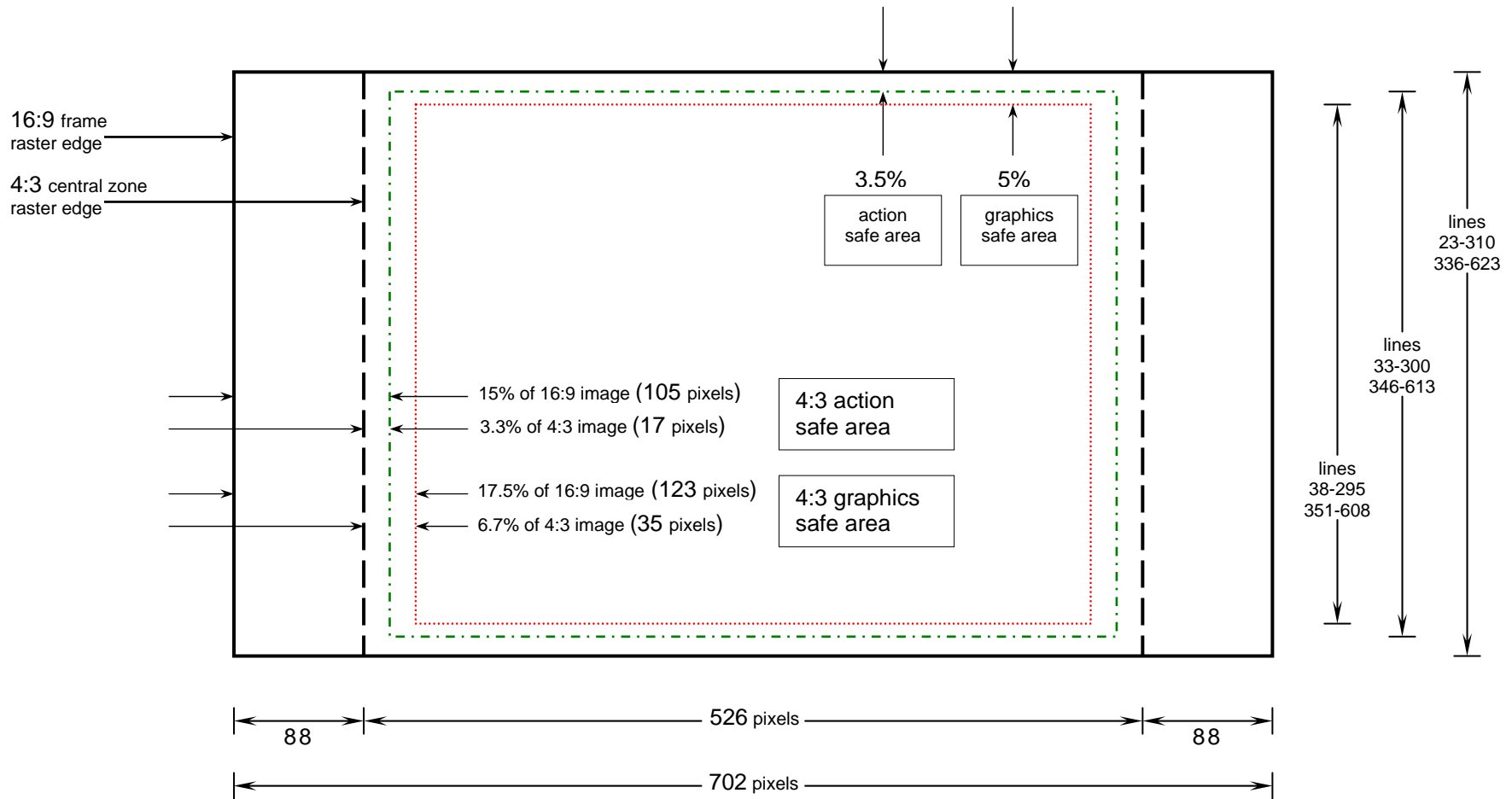


Diagram 3.

16:9 Shoot to Protect 4:3, defining action and graphics safe areas

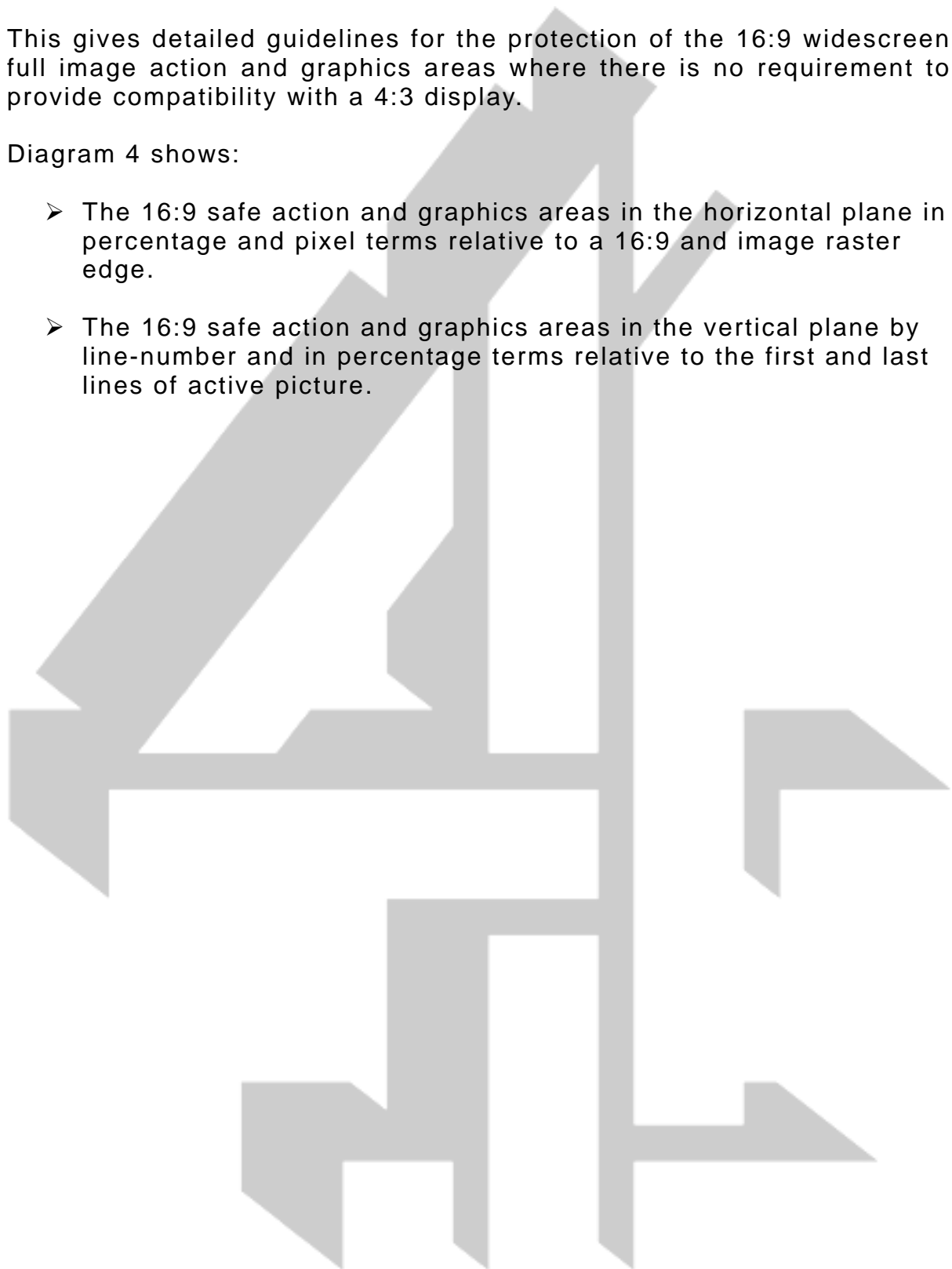
16:9 Widescreen Shoot to protect the 16:9 full image

For detailed specification see **diagram 4**.

This gives detailed guidelines for the protection of the 16:9 widescreen full image action and graphics areas where there is no requirement to provide compatibility with a 4:3 display.

Diagram 4 shows:

- The 16:9 safe action and graphics areas in the horizontal plane in percentage and pixel terms relative to a 16:9 and image raster edge.
- The 16:9 safe action and graphics areas in the vertical plane by line-number and in percentage terms relative to the first and last lines of active picture.



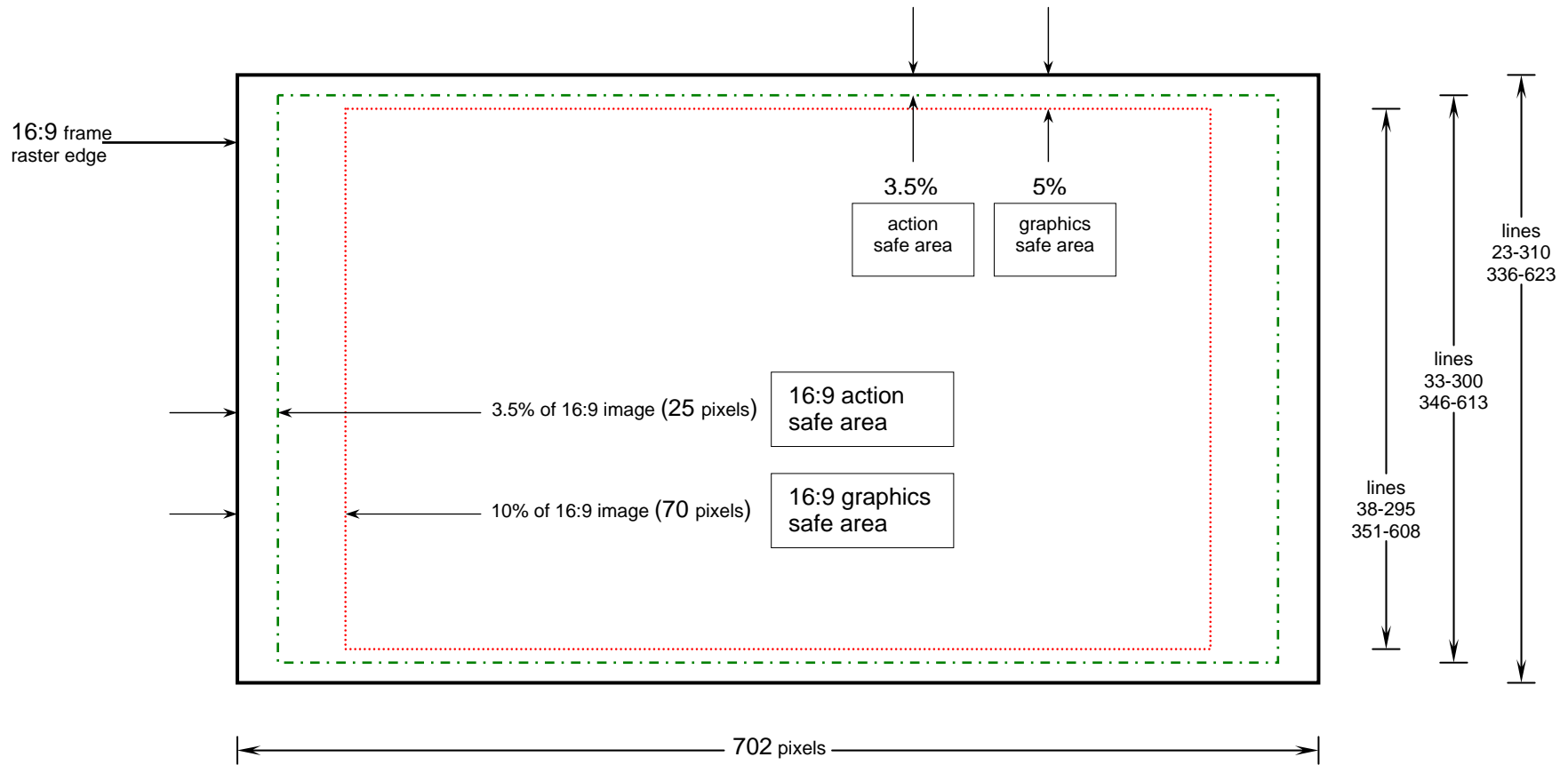


Diagram 4.

16:9 Full Image, defining action and graphics safe areas

Widescreen shooting on Super 16mm film

- i) Picture framing must allow for slight vertical cropping (approximately 3% top and bottom), and protect the 14:9 central zone to accommodate analogue transmission requirements.
- ii) Within the 14:9 central zone safe action and graphics/caption areas shall exist as shown in diagram 5 below.

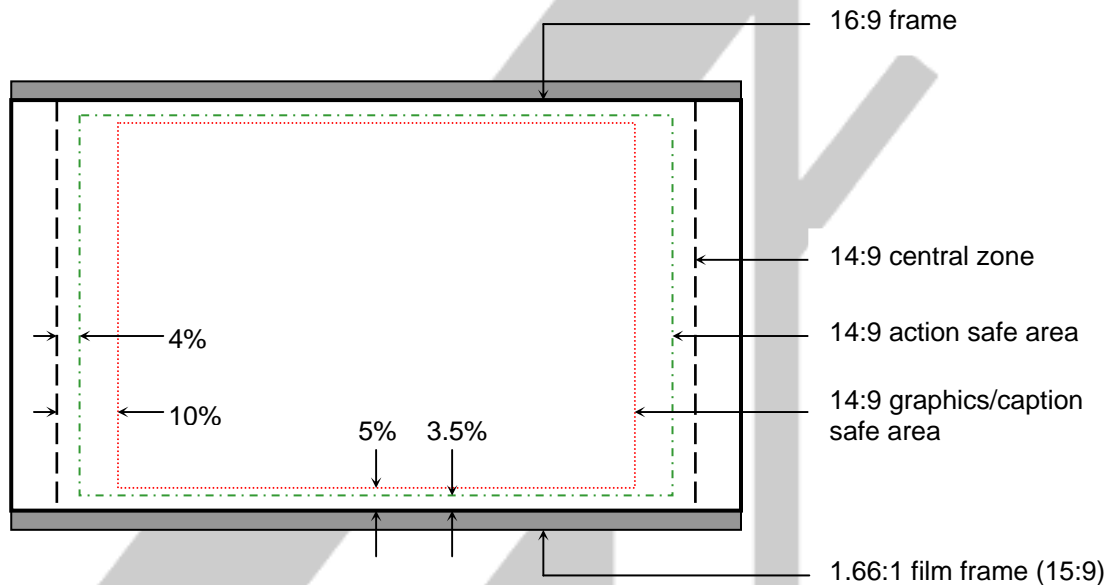


Diagram 5

Super 16mm film, defining action and graphics safe areas

Programme production on 35mm film

- i) In order to achieve adequate compatibility between theatre and television presentation, shooting should be at a picture ratio of 1.85:1 (16.7:9).
- ii) When shooting at a picture ratio of 1.85:1 (16.7:9), framing should allow for slight horizontal cropping (approximately 2% each side) which will occur in the production of the 16:9 television master.
- iii) Within the 14:9 central zone safe action and graphics/caption areas shall exist as shown in diagram 6 below.

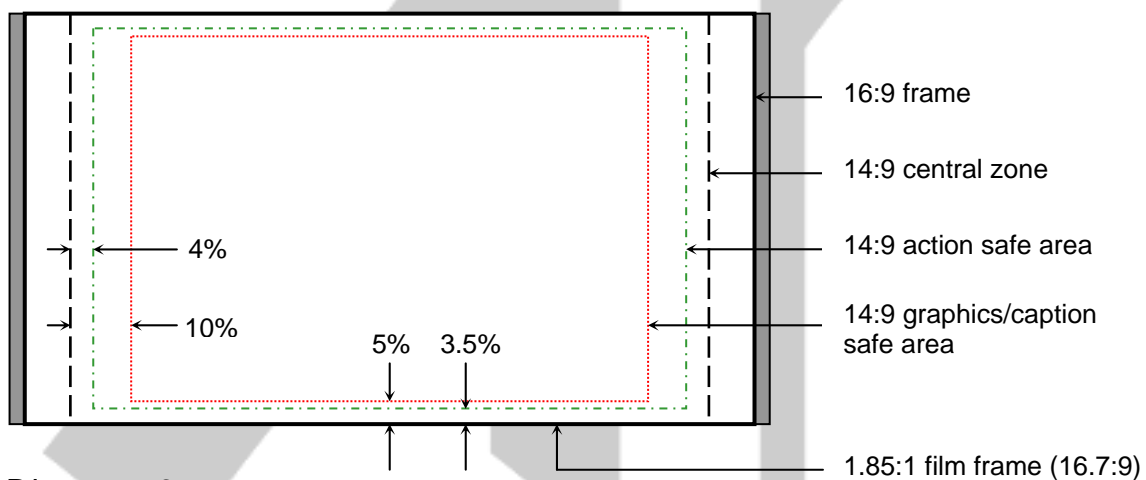


Diagram 6

35mm film (framed 1.85:1) defining action and graphics safe areas

Line-up Test Signals and Leader

The start of programme and any subsequent part should be preceded by a countdown clock indicating programme title, subtitle or episode number, part number, AFD and contract number where known. It must provide a clear countdown of at least 20 seconds fading to black at 3 seconds prior to first programme pictures.

The start of the test signal recording should be as close to the beginning of the tape as is practical. There should be no lengthy sections of black and silence or other unrelated material recorded between the test signals and the clock, in between parts or after the end of the programme(s), however, a minimum of 30 seconds (including clock) should be left between programme parts to allow for our server systems to ‘housekeep’ between ingest recordings.

The following specification conforms to the UK Broadcasters Unified Line-up Requirements. The line-up sequence should be as follows:

<u>Timecode</u> (e.g.)	<u>Picture</u>	<u>Audio 1</u>	<u>Audio 2</u>
09.58.00.00	Colour Bars	Interrupted Tone	Continuous Tone
09.59.30.00	Ident & Clock	--- optional step-tone ---	
09.59.40.00	Ident & Clock	Silence	Silence
09.59.57.00	Black	Silence	Silence
10.00.00.00	Programme	Programme Audio left	Programme Audio right

The aspect ratio of the clock must match that of the programme.

The use of 100% colour bars is expected although EBU bars are an acceptable alternative where appropriate.

Audio line-up should consist of coherent 1KHz tone recorded at the reference level (0dBu). Interrupted tone identifying the left channel of a stereo recording should be broken for 0.25 sec every 3 sec. Optional step-tone sequence should comprise 100Hz, 1KHz and 10KHz sine waves at a level of 0 ± 0.1 dBu and with negligible distortion.

Recorded signal levels

The reference level of AES recordings must correspond to -18dBFS with respect to maximum coding level. AES pre-emphasis should not be used. Tones at -20dBFS are not acceptable.

Where (exceptionally) programme delivery is accepted on the BetaSP tape format, special attention must be given to audio record levels. The audio record levels on tracks 1 and 2 should be set such that when a standard level 1KHz tone is recorded, the replay level of that tone is -4dB relative to the level from a Sony standard alignment tape CR8-1BPS. The alignment tape replay level should be monitored with Dolby™ switched off.

Programme sound may not exceed the level corresponding to the recorded reference tone by more than 8.5dB (a little over PPM6). In the digital domain, this maximum level would be defined as -9.5dBFS.

Recorded YUV video component signals must always be within gamut limits. It is not possible to assess the legality of video components directly from a waveform monitor displaying YUV signals. This measurement must be undertaken in RGB form, preferably using a broadcast standard lightning or diamond display.

Compared with the recorded colour bar line up signal:

R, G and B signals must lie in the range -5% to +105%, and

The resultant luminance signal must lie in the range -1% to +103%.

For more information see EBU recommendation R103-2000.

www.ebu.ch/CMSImages/en/tec_text_r103-2000_tcm6-4677.pdf

Programmes exhibiting illegal colours will be rejected at technical review.

Care must be taken when recording that associated SDV and AES signals are co-referenced. Failure to do so will result in the inability of the recording VTR to consistently co-phase the AES and SDV signals, and subsequent processing in post production or transmission equipment may produce audio instability.

Audio track allocation

Audio track allocation must conform to the following standards unless stated otherwise in the programme contract.

Track	1	2	3	4
	Programme		M & E	
Stereo	Left (A)	Right (B)	Left	Right
Mono	Final mix*	Final mix*	M & E	Blank

*Final mixes on tracks 1 and 2 must be phase coherent.

Record report and box labelling must clearly indicate audio track contents. Mono derived from stereo should equal $\frac{A+B}{2}$.

Peak sound levels within the programme must not exceed +8dB (PPM 6) with respect to the reference level (0dBu, PPM4) when measured on a Peak Programme Meter type IIa as specified in BS6840 part 10. Such levels are only acceptable for sound peaks of very short duration.

Programme Loudness

Sustained variations in loudness within and between different programme items can give rise to significant irritation on the part of viewers. It is inevitable and desirable that loudness will vary throughout most programmes to give appropriate "light and shade" to the programme content, but care should be taken to ensure levels of perceived loudness remain within acceptable limits. Dynamic range should be constrained such that it is appropriate for reproduction in a domestic environment. Normal peaks of audio level should be controlled in accordance with the following guidelines.

Uncompressed speech	PPM 5 - 5.5
Uncompressed/lightly compressed music	PPM 4.5 - 5
Music compressed in the ratio of 2:1	PPM 4 - 4.5.

Sustained high levels of heavily compressed material are not acceptable.

See the *OfCom Handbook of Technical Standards for TV Production, Part B* for further general guidance.

Broadcast quality loudness meters will give accurate measurements of perceived loudness and these are in general use throughout the technical areas at Channel Four. They are valuable in ensuring an acceptable consistency of programme loudness at the production/post-production stage regardless of the nature of sound content and any compression applied. Contact the Channel Operations department for more information.

Timecode

Both longitudinal timecode (LTC) and vertical interval timecode (VITC on VBI lines 19 and 21 line-pairs) must be recorded throughout the line-up, clock and programme and comply with the EBU specification. Timecode must be contiguous, coherent and not pass through zero at any point from the start of the first countdown clock to beyond the end of the programme. LTC and VITC must be identical. Timecode must have the correct phase relationship with the corresponding video signal.

Appendix 3	Sound track requirements for film delivery
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Delivery of SEPMAG sound tracks is preferred.

It is important to confirm the Contract requirement for M&E tracks as these are best transferred at the same time as picture and the final sound mix.

The use of Dolby™ ‘SR’ or Dolby™ ‘A’ noise reduction is encouraged. The method of noise reduction should be clearly indicated on the label. A minimum of 10 seconds Dolby™ tone/pink noise should be recorded on each track at the head of each reel.

SEPMAG tracks should include 30 seconds of 1KHz 0dBu line-up tone with programme peaks no more than 8dB above this level. A sync mark shall be placed in both picture and sound leaders to allow correct synchronisation.

For stereo programmes the track allocation should be as follows:

<u>35mm</u>	<u>16mm</u>
Stereo left	Track 1 - Centre track
Stereo right	Track 2 - Edge track

Where the contract requires delivery of M&E tracks, these may be supplied as a separate spool using the same configuration, or on the same spool by using a 35mm 4 or 6 track format recording, with the left and right M&E signals recorded on tracks 3 and 4.

For mono programmes, the track allocation should be:

	<u>35mm</u>	<u>16mm</u>
Mono final mix	track 1	centre track
Mute	track 2	-
M&E (if requested)	track 3	edge track

If delivery of anything other than the final mix or final M&E is proposed this must be discussed in advance with the Channel Operations department and should be reflected in the Contract.

The dynamic range of sound tracks should be constrained so as to be suitable for reproduction on televisions in domestic environments. Stereo programmes and those using surround-sound techniques must provide good mono compatibility and freedom from phase cancellation effects. The use of surround-sound audio must be clearly indicated on accompanying paperwork.

During recording, telecine transfer and post-production, picture and sound quality should be assessed with a view to satisfying the technical acceptance criteria established in [Section 7](#). The environment within control rooms and viewing rooms used for this purpose should be such as not to affect the subjective luminance, colour content or resolution attributes of the picture. ITU-R 500 (SMPTE Rec T14) and EBU Rec R23-1987 (SMPTE RP71) give the necessary guidance.

Sound quality should be assessed in a controlled listening environment with the acoustics of the monitoring room designed to meet EBU Rec. R22-1994. Parameters requiring critical appraisal are volume and loudness balance, intelligibility, distortion, stereo image and mono compatibility. Sound balance should be judged at levels not exceeding 80dBA on professional sound monitoring equipment, and reference to domestic quality loudspeakers may be beneficial in some circumstances.

See the OfCom publication "Handbook of Technical Standards for Television Production Part B" section 5.

Programmes that are delivered on film or 625 line master videotape will always produce the best picture quality. In unusual and exceptional circumstances where this is not possible, standards conversion using motion prediction techniques is the only acceptable alternative. Use of standards conversion for any part of a commissioned programme must always be discussed and agreed with the Channel Operations department prior to programme delivery.

Standards Conversion and Motion Prediction

Standards conversion is achieved by reading the input signal into a digital electronic store at, for example, the 525 line 60 fields per second rate and reading it out at the 625 line 50 fields per second rate.

Motion prediction is a process that estimates where each element (pixel) of the input (525/60) picture will have moved to by the time it is required by the output (625/50) picture. Each new output picture frame is reassembled from the 'knowledge' of the positional history of each of the thousands of pixels making up the stored input picture. It is a formidable computer calculation and special detection is needed to avoid wrong predictions. When foreground moves over background at the same time as a camera pan, prediction becomes a complex matter and an algorithm is needed to prevent background pixels being wrongly predicted over the foreground. When correctly applied, motion prediction overcomes the jitter that occurs on standards conversions not using this technique.

Noise reduction and electronic aperture correction

Many converters incorporate noise reduction together with vertical and horizontal enhancement to compensate for the reduced bandwidth of pictures of non-UK standards when they are converted to 625 lines. These enhancements can be beneficial but must be used with caution as over-application can produce unwanted artefacts that are more objectionable than the original picture deficiency.

Sound Synchronisation

Standards conversion equipment introduces a significant delay to the video signal, which varies according to the relative timing of the input and output pictures. Sound synchronisation should be maintained by the use of a compensating audio delay referenced to both the input and output picture of the converter.

Colour correction

Colour balance must be optimised for all sections of standards converted material, with particular attention paid to accurate colour rendition of flesh tones.

Video levels

Video line-up should consist of 100% colour bars. Converted NTSC bars are not acceptable. Careful attention should be paid to all video parameters of the standards-converted programme, most especially variations in black level. The standard of quality control at the post production stage of any commissioned programme should be very high resulting in close adherence to level tolerances throughout. A YUV limiter, to ensure legal levels, should only be employed in the conversion path where there has been a failure in this respect.

The production company must ensure every commissioned programme submitted for technical acceptance is accompanied by a detailed record report. The report should ideally be a printed throughout, but if a hand-completed pre-printed form is used, all information must be legible.

The following details must be included.

Programme main title
Programme episode number/title
Tape spool number
Reel number (x of n)
C4 programme/contract number
Tape Status (e.g. Tx master, International version, etc.)
Videotape format type
Recording standard
Colour/monochrome/mixture
Stereo/dual mono/surround sound
Audio track allocation details
5.1 Metadata (see Section 10.5)
Aspect ratio and AFD code.
Geometric linearity i.e. normal/anamorphic
Line-up vision and sound details and timecodes
Programme start/end/part number timecodes
Total recording duration
Vision & sound comments e.g. archive content/non-broadcast material
Recording facility name/address/phone/fax/e-mail numbers
Recording Engineer/VT Editor reference details

All programmes are expected to meet the required technical standards as set out in this document. Where it is known that a programme will fail to meet full broadcast technical specifications and that it also falls outside the categories shown below, it will be necessary to apply to OfCom for special exemption before the programme can be transmitted. It should not be presumed that this exemption will be granted.

In such cases the production company should consult the Channel Operations department, preferably prior to the start of production. This will allow discussions with OfCom to proceed at an early stage and, although in no way guaranteed, it will reduce the likelihood of subsequent difficulties.

There are five recognised categories for technical exemption:

Artistic interest

Innovative or experimental productions that are, **of necessity**, made by those who do not have access to equipment or facilities meeting broadcast quality standards. Inadequate funding is not an admissible criterion in this category.

Historic interest

News or programmes of a documentary nature that show historic events or whose subject matter requires the use of archive material.

Actuality material

News, features or documentaries of an actuality nature where better quality has not been possible because of limitations placed on the format or physical size of equipment used. Such limitations are those incurred as a result of shooting in difficult areas such as war zones, isolated locations or confined spaces.

Early television and cinema

Excerpts from historical archives where low technical quality was due to the then current performance of equipment used in its creation or where quality is now lower than at the time of original showing because of film or video ageing.

Home videos

Programmes which employ excerpts using domestic video equipment in which the context requires that these be used. Domestic equipment may not be used in non-contextual circumstances except by prior agreement.

It is possible that certain types of flickering images can cause convulsive fits amongst those viewers who are susceptible to Photo Sensitive Epilepsy. Such sequences should be avoided.

For this purpose, OfCom have published criteria against which the occurrence of flashing images in a programme should be judged. These criteria are currently under review, and the following links may assist programme makers in assessing the severity of any such occurrences.

http://www.itc.org.uk/itc_publications/codes_guidance/flashing_images/index.asp

http://www.itc.org.uk/itc_publications/codes_guidance/programme_code/section_1.asp

If any doubt remains, it is recommended that the Channel Operations department is contacted for further advice.

When considering the options, it should be borne in mind that resizing a picture will reduce detail definition in the direction of the 'stretch' if any. Clearly this is undesirable. Picture detail, once removed, cannot be restored. Additionally, the final 16:9 programme will, for the time being, be aspect ratio converted to be shown as 14:9 on 4:3 receivers, i.e. height restricted by 23 lines, and the sides cropped by 12½% in order to maintain linearity (see [appendix 1, diagram 2](#)). On a 16:9 display of course, the whole picture is displayed.

There are several options when considering how to incorporate 4:3 pictures into a 16:9 programme. In discussing these options below, we shall take the following 4:3 picture as an example:



1) As a full height central portion of the picture.

16:9 display. This will mean that 25% of the width of the display will be black (12½% on each side) for the period of the insert.



4:3 display. Following the 14:9 conversion, the picture will be shrunk with 23 lines of black displayed at the top and bottom, and the black areas to the sides will be cropped to 6¼% resulting in a 'postage stamp' effect for the period of the insert.



2) The insert can be converted to 14:9.

16:9 display. The picture will be full height, and cropped by 23 lines top and bottom. There will be black areas to the sides of the picture comprising 12½% of the display.



4:3 display. The derived 16:9 picture above will itself be converted to 14:9. This will result in the *cropped* height of the picture now having black areas above and below. The full width of the picture will be displayed.



3) The picture can be converted to 16:9.

16:9 display. In this case, the picture will be more heavily cropped top and bottom, and there will be no black areas at the sides. There will be a loss of vertical resolution.



4:3 display. The derived 'full screen' 16:9 picture will now be converted to 14:9. The picture will be cropped top and bottom and have black lines, and additionally the sides will be cropped.

