DQ Version Information for: BBC Technical Standards for Network Television Delivery

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DQ Content Authority	HoT TV (Wes Curtis)			
Contact(s) for Help	Wes Curtis			
Description	**Intended Audience**: production staff, including technicians and producers, and independent production companies. **Use**: This document covers the technical requirements for programmes that have been commissioned by BBC Television for London delivery, either directly or on tape. It is also available on bbc.co.uk.			
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BBC Technical Standards for Network Television Programme Delivery
(BBC One, BBC Two, BBC Three, BBC Four, CBeebies and the CBBC Channel)

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1 Scope of Document

This document defines the technical standards for programmes that have been commissioned by BBC Television for London delivery, either directly (eg studio or OB contributions) or on tape (e.g. Digital Betacam). While the document deals primarily with material for transmission, there are other factors to take into account and these will be reflected in the commission, such as for re-versioning.

Although this document is titled “Technical Standards” it also contains certain elements from “The Production Guide” and “BBC Delivery Requirements” in order that it can be used as a more compact reference for operational staff charged with delivering programme material.

Programme delivery to BBC Worldwide, BBC Regions and BBC Nations may have differing requirements. For more in depth information on international delivery please see BBC WorldWide Technical requirements via http://www.bbc.co.uk/guidelines/delivering_quality/delivery.shtml.

This document does not cover programme delivery for other co-producers. Whatever the requirements of the co-producer, these standards must be met for material delivered to BBC Television.

2 Introduction

It is not intended to frustrate producers’ ambition to make their programme in the manner of their choosing. The purpose of this document, and associated material, is to set out the technical requirements to ensure that material delivered is of a satisfactory standard. This document also draws attention to areas that may impact upon technical parameters and quality of programmes.

Particular types of delivery, such as via tape, have their own requirements for technical standards, quality and delivery issues. Each type has to meet the General standards but then can be modified and added to by issues laid out in their own section within this document.

As noted in section 1, this document also contains relevant requirements that are not strictly technical standards but combine together to form a useful reference for operational staff. The content will be found within 3 types of section:

Technical Requirements	These sections describe the technical standards required to deliver material to the BBC in such a way that the programme is fit to perform the purpose(s) for which it was commissioned and will pass flawlessly through the broadcasters systems. These are broadly pass / fail objective measurements.
Quality Requirements	Quality requirements deal with broadly subjective quality issues with the pictures and sound. Careless shooting, inappropriate production methods and faulty or substandard equipment can cause avoidable impairment to sound or vision. The ITU / CCIR 5 point grading scale is often used to assess programmes broadcast for quality and the commissioner should indicate what level of standards are required.
Operational Requirements	All material delivered must be to the correct standard, be accompanied by the correct line-up sequences and accompanied with the correct information for the “Ingest” or delivery process. These requirements are specific to the delivery method e.g. via Digital Betacam. The full requirements to be met when delivering programmes to be broadcast are defined on the Delivery website, www.bbc.co.uk/delivery

There are some aspects that fit into more than one category, for example the requirements on avoiding the use of material which may cause photo-sensitive epilepsy in the audience.

Due to the rapid rate of technical development, use of specific equipment is constantly under review. This document will be subject to periodic updates to reflect this reality, but please consult your resource provider for advice on specific issues.

3 Technical Responsibilities for Programmes

3.1 General Responsibilities

The BBC's Chief Technology Officer is required to ensure that broadcast programme technical quality is maintained to a satisfactory standard.

This document is the responsibility of the Delivering Quality Manager, tel +44(0) 20 8008 1971 (dqm@bbc.co.uk).

3.2 Technical Liaison

The Presentation Engineering Co-ordinators (PECs) are the main round-the-clock operational point of contact working closely with the BBC Broadcast Editor. The point of contact for technical enquiries affecting immediate delivery matters should be made to them.

- Presentation Engineering Co-ordinators, tel: +44(0) 20 857 **60090**

For all other enquiries please contact the DQ web site
http://www.bbc.co.uk/guidelines/delivering_quality/consultation.shtml

3.3 Relaxation of Standards

All programmes are expected to meet our required technical standards. The recognised exemption categories are tightly constrained and may not be invoked for the general convenience of programme makers.

Where programmes fail to meet full broadcast technical specifications and fall outside these categories it will be necessary to apply for special exemption. Any proposal to deliver programme material which does not conform to the technical standards in these guidelines must be agreed beforehand with the Genre Commissioning Team. (For contact details, please see http://www.bbc.co.uk/commissioning.) Copies of any written agreements must then be supplied on the transmission form to assist the reviewer. This will allow discussions 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 which are made, of necessity, by those who do not have access to equipment or facilities meeting broadcast quality standards.

Historic interest: News or programmes of a documentary nature which show historic events taking place 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, confined spaces or other difficult environments.

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.

Domestic equipment: Programmes which employ excerpts made using domestic equipment in which the context requires that it is used.

4 General Technical Requirements

Technical requirements must be met so that programme material is in the required format, which can be used reliably without any user intervention and can be passed through systems without noticeable impairment to the viewer.

4.1 Video General Technical Requirements

Although the bulk of programming is now produced and delivered digitally, the signals must still be compliant with analogue standards. For example excessive (illegal) levels are likely to cause severe picture disturbances when copied to analogue tape formats such as Betacam SP or sound buzz on analogue transmission.

4.1.1 Video Standard

All signals and recordings supplied shall be of the 625/50 interlaced standard unless agreed otherwise beforehand.

Composite material shall meet PAL System I in all aspects of timing, frequency response and bandwidths.

When signals are delivered digitally they will be assessed according to the recommendation CCIR Rec. 601 or ITU-R BT601-5 Part A.

4.1.2 Video Levels and Gamut (illegal signals)

Video levels including any line-up shall be received within the specified limits so that the programme material can be used without adjustment.

Video levels are based on the PAL System I which specifies 0 to 100% RGB Limits. We require that signals meet the easier EBU Recommendation R103-2000:

Luminance limits	-1% and 103%
Chrominance	105% max - RGB values to not exceed limits -5% to +105%

Overshoots can be ignored by the use of a low pass IRE filter. Single lines with larger errors caused by vertical processing such as aperture correction and aspect ratio conversion are permitted if they do not exceed the -1% Luminance limit.

4.1.3 Line-Up

Line-up signals serve to identify individual signal channels and to provide reference levels to confirm that the programme transmitted is likely to be within the signal level limits and will be as the producer intended.

Preferred line-up signals are given under 4.2.3 for recordings and 9.1 for direct feeds.

Programme video and audio signal levels must be accurately related to their associated line-up signals but not exceed the limits set in 4.1.2. The maximum deviation of programme levels from that indicated by the line-up signals shall be:

Video Luminance	3%
Video Chrominance	5%

Line blanking level shall be used as a black reference for the programme.

See Operational Requirements, section 6.2.1, for usage of Line-up signals.

4.1.4 Video Signal Timings.

Digitally delivered pictures are considered to have a nominal active width of 702 pixels (52us) starting on the 10th pixel and ending on the 711th pixel in a standard REC 601 (720 sample) width. A minimum width of 699 pixels (51.75us) within these limits must be achieved. Additional active pixels outside the above limits must be an extension of the main picture.

Vertical Blanking must not exceed 26 lines per field.

Line 23 may contain a whole line of picture, be totally blanked, or the last half may contain picture relevant to programme. Line 23 must not contain any form of signalling as it is likely to appear in picture during letterbox style presentation.

Likewise picture content in line 623 is also optional, but if present it must be related to the programme.

4.1.5 Aspect Ratio.

Programmes will be commissioned either for 16:9 Widescreen or 4:3 Standard presentation.

16:9 Widescreen presentation is also known as “16:9 Full Height Anamorphic” (FHA).

Letterbox delivery of entire 16:9 programmes is not acceptable.

Short sections of a programme may however contain “floating images” for intentional artistic effect. Note however, that widescreen consumer TV sets operating in Auto Zoom / Auto mode often interpret large black borders at the top and bottom of the screen as being letterbox, so are likely to enlarge the picture while such borders are present. For this reason the use of black at top and bottom of screen is ill advised, because the resulting unpredictable picture zooming during a programme can be annoying for the viewer and undermine the artistic intent.

Format changes within the programme to maintain the 16:9 presentation should not be required.

Active picture width is 52us / 702 pixels. All aspect ratio calculations are based on this. Any processes based on 720 pixel width may introduce unwanted geometry or safe area errors.

4.1.6 Safe Areas for Action and Captions

Captions and action shall be within the safe areas specified for delivery.

There are four standard safe areas defined for UK transmission which are generally applied depending on the aspect ratio and type of programming. Currently (April 2002) it is Television’s policy to commission programmes in 16:9 (protected for 14:9), except for Sport which is 16:9 Widescreen protected for 4:3 centre cut-out, and feature films which are in unprotected 16:9 Widescreen. In addition, certain types of programming such as Promotions, BBC Worldwide and BBC Sport frequently require full 4:3 protection - the details of which are shown in the table below as e.

In Transmission Review (see 6.1.1) programmes are assumed to be Widescreen and 14:9 Protected unless otherwise specified.

Note: For widescreen programmes protected for 14:9, captions taken to the very edge of 14:9 caption safe are likely to be clipped when viewed on a poorly set-up domestic 4:3 receiver / Set Top Box combination. For this reason, 14:9 caption safe is best regarded as the maximum allowable width. Productions preparing for Worldwide delivery should refer to the separate BBC Worldwide standards document, as 14:9 is currently a UK-only protection standard.

A table of typical requirements is given below. Detailed diagrams of the UK TX standards are in the Appendix, section 7.

Format and protection required.	Action Safe	Caption Safe
a. Standard for 4:3 delivery.	90% of Active Width 90% of Height	80% of Active Width 80% of Height
b. Widescreen 16:9 protected UK TX	93% of Active Width 93% of Height	80% of Active Width 90% of Height
c. Widescreen 14:9 protected UK TX	80% of Active Width 93% of Height	70% of Active Width 90% of Height
d. Widescreen 4:3 protected UK TX	70% of Active Width 93% of Height	65% of Active Width 90% of Height
e. Widescreen 14:9 Action, Full 4:3 Delivery Caption protection	80% of Active Width 93% of Height	60% of Active Width 80% of Height

Note: Active Width is 52us / 702 pixels as defined in 4.1.4.

4.1.7 Time-code

Vertical interval time-code (VITC) is mandatory and shall occur on lines 19 / 21 / 332 /334.

Longitudinal (LTC) is mandatory and shall be 8 field locked to the relevant video source and be phase accurate to less than 10mS (½ field) error.

The time information in VITC and LTC must match.

4.2 Audio General Technical Requirements

4.2.1 Audio Standards

Programmes shall be delivered in Mono or Stereo Format as required. The use of pre-emphasis and/or noise-reduction schemes during acquisition and post production is acceptable. However, the programme for final delivery should have no pre-emphasis or noise reduction scheme applied unless specifically required.

Left audio shall be present on the A leg or Channel 1.
Right audio shall be present on the B leg or Channel 2.

Mono shall be in Dual Mono format with identical and coherent audio on both Left and Right channels. This is so that it may be used amongst stereo programmes.

Finished programme material intended for transmission with stereo sound, whether recorded on videotape or for live transmission, must carry sound in A/B (Left/Right) form. M/S (Mid/Side) is not acceptable for delivery.

4.2.2 Audio Level, Reference Level and Measurement

Programme audio levels shall always be measured by Peak Programme Meters (PPM) to BS 5428.

The Maximum or Peak Programme Level shall be measured with a PPM and shall never exceed 8dBs above the programme's Reference Level.

Reference Level shall represent a level which is 8dB less than the maximum allowed during the programme as measured with a PPM. Within the BBC Reference Level is often referred to as "Zero Level" , "Line-up Level", "0dB", "0dBu" or PPM4.

Digital Audio Reference level is defined as 18dB below the maximum coding value (-18dBFS) as per EBU recommended practice R68.

Notes: BBC Type PPMs to BS 5428 are scaled in 4dB steps numbered from 1 to 7 with increasing signal level. They are calibrated so that line-up Level will read PPM 4 and thus Peak Programme Levels shall not read higher than PPM 6.

Digital “true” peak reading meters such as on VTRs and DAT recorders will typically read 4dB higher than a BS 5428 PPM on programme material though they should agree on steady tone. As it is unusual for digital level meters to match a BS 5428 PPM when measuring programme material, suppliers should never use “peak reading” meters to assess programme levels accurately unless they are known to meet BS 5428.

Mono derived from Stereo shall be to the M6 practice where the Mono signal is derived according to: “Mono = (L+R) - 6dB”

Requirements for M3 exist in the BBC but only in areas outside the scope of this document.

4.2.3 Line-up Tones

Line-up Tones serve to identify individual signal channels and to provide Reference Levels to indicate that without adjustment the programme transmitted will be within the signal level limits specified in 4.2.2 and will thus be broadcast as the producer intended.

All tones must have been sourced to a tolerance of +/- 0.1dB.

Mono Line-up Tone shall be at a frequency of 1kHz +/- 100Hz and represent 8dB less than the maximum allowable peak.

For Stereo sources, Stereo Line-up Tone shall be provided at a frequency of 1kHz +/- 100Hz and shall indicate the Left and Right programme legs: namely, EBU / ITC Stereo Tone at -8dB (PPM 4 / Zero Level) with only the left leg identified by breaks.

All tones must be sinusoidal, free of distortion and shall be phase coherent between channels.

Optionally, Step Tone sequences may be provided but if so then all tones must have been sourced at the same level and be phase coherent on Stereo feeds / tracks.

See Operational Requirements for specific usage of tones.

4.2.4 Stereo Balance and Phase

The two stereo legs, when sending identical programme (Mono), shall match within 0.5dB and be phase coherent to less than 15 degrees at 10kHz (-20 dB for an “S” reading meter / 4us delay). Note: one sample of 48kHz is 75 degrees at 10kHz.

4.2.5 Sound to Vision Synchronisation (Lip-synchronisation)

The relative timing of sound to vision should not exhibit any perceptible error. Sound should not lead or lag the vision by more than 10ms.

This synchronisation must be achieved at the last point at which the programme supplier, or their facility provider, has control of the signal.

5 General Quality Requirements.

5.1 Technical Quality Grading

Subjective quality of pictures and sound is difficult to assess. The ITU / CCIR 5 point scale for impairment is given below:

Grade 5	Imperceptible impairment.
Grade 4	Perceptible but not annoying impairment.
Grade 3	Slightly annoying impairment.
Grade 2	Annoying Impairment.
Grade 1	Very annoying impairment.

Newly commissioned programmes shall meet a minimum grade 4. In other cases, the absolute minimum is grade 3, unless there are valid reasons for exemption.

5.2 General Vision Quality Requirements

We wish to encourage the use of innovative programme making techniques. Nothing in this document should prohibit the use of any production technique provided that a suitable quality product results. It is inherently difficult to define precisely what a suitable quality product is, and therefore there will be some subjective descriptions leading to imprecise advice. This is an unavoidable consequence of the rapid technical developments at this time. A competent resource provider should be able to give advice on achieving good quality results. The expectation of the picture quality is set by the commission.

In general:

a) The picture must be sharp and well lit (unless artistic considerations require otherwise).
b) The video signal must be free of excessive black crushing and highlight compression. Transient response shall be such that streaking, ringing, smear, echoes and overshoots are not noticeable. Moiré, and other patterning shall not be visible. Hum, cross-talk and other spurious signals must not be apparent.
c) Colour rendition, especially skin tones, must be a realistic representation of the scene portrayed unless artistic considerations require otherwise.
d) Widescreen production shall always use component video techniques.
e) Material from 4:3 native cameras and aspect ratio converted shall not be used for 16:9 origination without the commissioner's approval.
f) Video processing (e.g. effects devices) must not introduce unintentional changes to luminance and chrominance levels nor cause perceptible timing shifts on entry or exit from the effect.
g) Appropriate audio or video delay must be used to compensate for lip-sync errors.
h) There must be no visible contouring / artefacts caused by multiple D-A and A-D conversions or compression. Quantisation Noise shall not be apparent. In general, recordings made "off-air" from digital sources (DTT, DSAT and D-Cable) should not be incorporated into new programming as these signals have already been significantly compressed.
i) In certain circumstances, for example shooting actuality material or where a high level of mobility is required, the use of a "DV palmcorder" type camera may be considered acceptable for acquisition. Specific agreement from the Genre Commissioning Team must be sought before using this. Where use of this format is agreed we require particular attention to be given to sound and lighting considerations.
j) Producers shall follow the Guidelines for a Visually Impaired Audience - Section 8.

k) Material will be assessed at 625/50. If material originating in other formats is incorporated, care must be taken to achieve the overall quality required.
l) Many DV and DVCam camcorders offer a menu option labelled "Widescreen" which creates a Widescreen image by discarding horizontal strips of the 4:3 picture (25% of the vertical picture information is lost). Use of this mode should be avoided. Shooting 4:3 (with subsequent quality Aspect Ratio Conversion) is preferred. See (e) above.
m) In order to aid trail production and reversioning, cuts in material must happen on frame boundaries (i.e. between field 2 and field 1). Motion on frame based material such as film or 'progressive scan' video should occur between field 2 and field 1 (i.e. field 1 dominance).

5.3 Standards Conversion

5.3.1 Standard Definition

Where preparation of programme material has been produced in the 525/60 (NTSC) standard, conversion to 625/50 (PAL) can introduce undesirable and visible artefacts. There are 3 categories of converters commercially available for use. In order of quality / expense:

a) "Interpolating" converters. Ranging from the simplest and earliest converters, the interpolation process inevitably produces multiple images and periodic blurring on movement. Interpolation is most noticeable on fast panning material such as motor racing or on scrolling credits. Interpolating converters are not capable of maintaining Grade 4 impairment.

b) "Motion predictive", "Motion vector", "Motion Compensated" or "Frame integrity" converters. These are significantly better at preserving the original picture quality than Interpolation. Low impairment (Grade 4+) programming shall use these methods as a minimum requirement.

c) converters for ***film*** originated material. These are specialist converters designed for converting telecine transfers of film shot at the standard 24 fps. They remove the artefacts of the 3:2 pull down "NTSC" telecine process and produce a conversion result equivalent to running the film at 25 fps. High quality film originated programming (Grade 4+) shall use these methods as a minimum requirement.

    Note that "3:2" converted programmes will run fast: their duration will be shorter by exactly 4%.

5.3.2 Standards conversion between HD standards

The choice of HD standards should be made in the context of a 625/50 delivery, bearing in mind that the choice may introduce unnecessary standards conversion.

The new High Definition standards refer to the number of lines used for picture information – 1080 lines – and this is the same for a range of picture-rates and picture formats. For digital pictures it is also necessary to standardise the number of picture elements, or digital samples, along the lines as 1920 per line.

Interlace formats at 50 and 59.94 fields per second are used and are written as 1080/50i and 1080/59.94i. Progressive, or non-interlace, formats at 24 frames and 25 frames per second are also used: these are written as 1080/24P and 1080/25P.

There is a problem with standards conversion. Whereas it is normal to achieve good quality pictures when standards converting between 625-line and 525-line standards, high quality motion compensated standards converters are not yet available for High Definition standards. So the results of converting from 1080/50i to 1080/59.94i are generally unsatisfactory.

On the other hand, conversions between 1080/24P and 1080/25P involve slight speed changes and can be achieved readily by adjustment of studio videotape recorders, notwithstanding the change in sound pitch associated with televised film.

5.4 Flashing Images / Visual Patterns - Photosensitive Epilepsy (PSE)

Flickering or intermittent lights and certain types of repetitive visual patterns can cause serious problems for some viewers who are prone to photosensitive epilepsy. Teenagers are a group where photosensitive epilepsy is considered to be a particular problem.

Television is by nature a flickering medium (because of the 50 Hz refresh rate of typical receivers and the 25Hz effects of interlaced scanning) and it is therefore not possible completely to eliminate the risk of television causing convulsions in viewers prone to photosensitive epilepsy. However steps can be taken to reduce unnecessary risks and to reduce the incidence of seizures to an acceptable level, **although they cannot remove the risk entirely.**

5.4.1 PSE Guidelines

Ofcom issues guidelines for PSE which, although currently the BBC branded channels are not bound to meet, **provide a suitable standard and should be followed**. They can be found on the Ofcom website at
http://www.ofcom.org.uk/codes_guidelines/broadcasting/tv/vrs_code_notes/flsh_imgs/?a=87101
The following guidance on the major factors involved is provided for reference. However, the Ofcom guidelines should be consulted for complete information.

- Rapidly flickering images should not change at a fast rate (i.e. less than 9 frames between each flash).
- If brightness changes for a given area of a picture are less than 25% of screen maximum brightness then that area may be discounted.
- In marginal cases such images should be avoided if they are positioned near the centre of the screen.
- Changes in colour are not a problem unless they affect the red channel substantially.
- Prominent and regular patterns which cover a large proportion of the picture area should be avoided, especially if they represent bars, spirals, or ‘dartboard’ patterns. Moving or flickering regular patterns are particularly hazardous.
- Care needs to be taken also with computer generated images, which, if highly detailed, can cause a high degree of 25Hz inter-line flicker in the displayed television picture.
- Video luminance level as measured on a waveform monitor does not simply equate to screen luminance (brightness) and cannot be used to assess brightness without correcting for Gamma.

Note: The “UK” channels which transmit a great deal of BBC programming are bound by Ofcom PSE regulations.

5.4.2 PSE - On Screen Warnings

On screen warnings at start of programme may only be used in exceptional circumstances when and only if:

1. Transgressions that exceed the guidelines are ***extremely minor*** in nature.

and: 2. The relevant content is ***completely integral and necessary*** to the context of the programme.

and: 3. Permission to use the relevant content has been ***cleared in writing by those responsible for commissioning /editorial content.***

Details must then be supplied to BBC Broadcast on the transmission form so that an on screen warning can be made if appropriate.

5.5 General Audio Quality Requirements

a) The audio shall be free of spurious signals such as noise, hum and cross-talk.
b) Sibilance and distortion, wow and flutter shall not be apparent.
c) The audio shall not show dynamic and frequency response artefacts as a result of the action of noise reduction or low bit rate coding systems.
d) Audio compression should be used as little as possible as the effects of compression used for broadcast distribution and transmission can exacerbate impairments.
e) Dynamic range shall not be excessive. It shall be suitable for the whole range of domestic listening.
f) Care shall be taken when incorporating background music and effects with dialogue, or people with a hearing impairment and poor listening conditions can find the dialogue difficult to hear. Inaudibility is a common complaint from viewers. Reference to “TV Set Style” speakers, preferably in mono, should be made during the sound mixing process.
g) Producers shall follow the Guidelines for a Visually Impaired Audience - Section 8.

6 Specific Requirements for Videotape Delivery (625/50 Digital Betacam and D3).

The video and audio shall also meet all General Technical and General Quality Requirements specified in this document.

6.1 Specific Technical Requirements for Tape Delivery

6.1.1 Technical Acceptance Procedures

Every programme submitted on tape for transmission on BBC Television must pass a Technical Review carried out on BBC equipment to ensure the programme meets the requirements set out in this document. Any programme not meeting the required standard will be returned to the suppler for repair. A subsequent review will then be carried out to check that the work has been done satisfactorily. These reviews are currently chargeable back to the supplier.

6.1.2 Videotape Format

Delivery of new commissions shall be on Digital Betacam for Widescreen 16:9 programming formats. From November 1st 2005, new commissions for 4:3 programming formats shall also be delivered on Digital Betacam and no longer on the legacy D3 format. Archive (repeat) 4:3 programmes which are on D3 can still be delivered in their native format. Special attention should be given to clearly document the aspect ratio, as the delivery format will no longer imply this.

All tapes must be supplied with the record lockout “on” and “double rewound”. This ensures an even tape pack.

Tapes shall be of the highest professional quality, recent manufacture, "first usage", of a type appropriate to the format used and shall be protected by suitable packaging.

During the production process the highest technical standards must be maintained so that the delivered programme achieves the required standards. In all cases the submitted videotape recording must be fully compliant with the manufacturer's technical specification thereby ensuring format compatibility.

Note: For BBC News in London (TVC) and BBC Regional Centres, local arrangements for delivery should be checked, as different tape formats may be acceptable or required.

6.1.3 Audio Track Allocation

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

For domestic transmission:

Track 1	Track 2	Track 3	Track 4
Programme		**For Production use**	
left (A)	**right (B)**	**Left**	**Right**
Final mix on tracks 1 and 2 must be phase coherent		**These tracks may have content but will not be transmitted**	

For Monophonic programmes, tracks 1 and 2 must contain identical audio and be phase coherent so that they can be transmitted through a stereo infrastructure - “Dual Mono” .

Peak sound levels (when measured on a BS 5428 Peak Programme Meter) within the programme must not exceed PPM 6: that is, no greater than +8dB with respect to the reference level of -18dBFS.

The means of delivering related audio description (where required) is yet to be agreed and should be discussed in advance with the Commissioner.

6.1.4 Time-code and control track

Both longitudinal time-code (LTC) and vertical interval time-code (VITC on VBI lines pairs 19 and 21, and 332 and 334) must be recorded throughout the line-up and programme and comply with EBU specification N12-1994 (SMPTE 12M-1995).

Time-code must be contiguous and continuous 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 have identical times.

Time-code and control track must have the correct phase relationship with the corresponding video signal. Assemble edits should not be used between the start of the clock and the end of the programme.

If DVITC or ancillary time-code are used then they must be identical to the LTC and VITC.

Any video indexing data shall indicate a continuous 8 field sequence for the duration of the programme.

Programme start should be at timecode 10:00:00:00. See 6.2.1 for further details

6.2 Specific Operational Requirements for Tape Delivery

6.2.1 Line-up Test Signals, Clock and Leader

The start of programme and any subsequent part should be preceded by a countdown clock indicating programme I.D. number (with the appropriate suffix), programme title, subtitle, episode number, part number and contract number where known. And, if appropriate, pre/post watershed version.

The clock must provide a clear countdown of at least 20 seconds fading to black at three seconds prior to first programme pictures.

The clock must appear round when viewed on a display set to the same format as the programme i.e. for a widescreen programme the clock should be round on a 16x9 display.

Time-code	Picture	Audio 1	Audio 2
09.58.00.00 (or Earlier)	EBU Bars (100/0/75/0) or 100% (100/0/100/0) (NTSC converted bars are not acceptable)	Coherent tone (step tone optional) (100Hz, 900Hz and above 10kHz)	
09.59.30.00	Ident and Clock		
09.59.40.00	Ident and Clock	Stereo (EBU/ITC) Tone or L/U Tone (PPM4)	
09.59.50.00	Ident and Clock	Silence	Silence
09.59.57.00	Black / early vision		
10.00.00.00*	Programme	Audio Left	Audio Right

* If it is not possible to start the programme at 10:00:00:00 then the paperwork should clearly state the start of programme.

Mono derived from Stereo shall be to the M6 practice where the Mono signal is derived according to: “Mono = (L+R) - 6dB”

Please note: At the end of the programme, sound must end naturally or be faded to be out by the end of the programme. There should be a freeze or living hold for 10 seconds.

6.2.2 Recordings spanning more than one tape

If a programme is supplied on more than one tape the following must be observed:

- BBC Broadcast now play programmes from video servers, consequently an overlap between parts should no longer be provided.
- Reel 1 must end at a suitable cut point into Reel 2. This should be at a fade to black or scene change.
- The Last frame / First frame time codes must be clearly documented. The timecodes on Reel 2 must be later than Reel 1 and preferably the first frame will be 13:00:00:00.

6.2.3 Recording Reports

Every tape submitted must be accompanied by a completed recording report. The report must include full details of the programme supplier and recording facility house, programme title / subtitle and BBC Programme I.D. Number with the latest version suffix. It must also include technical information including the origination format, time-code of first frame of picture (FFOP) and details of the aspect ratio and safe areas used.

The recording report must provide clear references to any part of the programme content that may attract low grades (especially below grade 3). The report shall also draw attention to any programme content which may cause photosensitive epilepsy in some viewers as described in section 5.4.

6.2.4 Compilation tapes

Programmes of short duration may be delivered on compilation spools where this has been agreed in advance. However, there must never be more than one ‘take’ of a programme. The following requirements must be observed:

- The tape box and recording report must clearly identify the separate programmes on the spool.

- Each programme must be preceded by a leader clock clearly identifying individual programme details.
- The programmes must be separated by at least one minute of black and silence and start at the “top” of the next timecode minute, i.e. HH:MM:00:00.
- The time-codes of each part should be unique and increment throughout the tape.
- Each programme must be in the same aspect ratio.

6.2.5 Teletext subtitling for the hearing impaired

In excess of 70% of BBC Public Service programmes are transmitted with closed subtitles. These are provided for the hearing impaired and 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 an electronic copy of the script in Microsoft Word word processor format or Scriptwriter delivered on 3.5” floppy disk or by email and a VHS copy of the programme (with VITC and burnt-in time-code to match the programme) should accompany any master tape delivered for transmission. Programme material with burnt-in time-code can also be accepted on type I or type II DVD video disc.

The BBC can accept deliveries of programmes with teletext subtitles recorded on line pair 20 and 333. When this option is chosen details must be clearly stated on the recording report and a copy of the script should also be delivered as described above.

APPENDICES

7 Appendix 1: Widescreen Safe Areas - Shoot to Protect

Clearly the aspect ratios of 16:9 images and 4:3 displays are mutually incompatible. The majority of UK broadcasters have agreed that a 14:9 letterbox image provides the best compromise when viewing a 16:9 widescreen production on a 4:3 display. However, 14:9 letterbox is currently available only for analogue broadcasts. The digital 4:3 viewer has a choice between viewing widescreen programmes in either full-screen 4:3 centre cut-out or 16:9 'deep' letterbox. The majority opts for full-screen 4:3 centre cut-out.

A protection standard for 14:9 (Diagram 2, below) has been adopted by UK broadcasters for general programming and is designed to suit all viewers. But it is found that captions at the limit of 14:9 caption safe can be clipped when viewed on a poorly set-up domestic 4:3 receiver/set-top box combination. If it is essential that no clipping occurs, especially for text, then employ a smaller caption safe area as with widescreen 4:3 protection (Diagram 3).

Commissioning documentation will indicate which protection zones should apply to programmes. The majority of programmes apply 14:9 protection. Sport is normally 16:9 widescreen protected for 4:3. Unprotected 16:9 is agreed in a very few cases only.

Widescreen programmes must never be delivered with letterboxing applied (see section 4.1.5). All should be full-height/anamorphic 16:9.

It should be noted that while there are techniques for incorporating 4:3 material into widescreen programmes, programmes must be in the commissioned format throughout. It is not acceptable for changes from 16:9 display to 4:3 display within a programme or compilation.

Requirements for the protection of BBC Worldwide programmes can vary from BBC Television's requirements and can be found in the BBC Worldwide Technical Standards document at http://www.bbc.co.uk/guidelines/delivering_quality/delivery_tv.shtml

7.1 Standard Protection Zones

Programmes in 16:9 widescreen will normally be commissioned to be shot to one of the three safe area recommendations defined and as agreed by UK analogue terrestrial broadcasters. These are designed to protect:

- the full 16:9 widescreen image
- the 14:9 central zone (assumed unless otherwise specified), or
- the 4:3 central zone

Although some programmes have their own requirements, material for transmission will be assessed against these three standards.

For the following diagrams:

- the line and pixel numbering is more definitive than the percentages. Percentages have been included to allow comparison.
- the line numbering has been calculated on the basis that field 1 is paired with the field 2 line below it. The field 1 line just inside the percentage box is defined as the edge of active picture.
- The numbers in the drawings are the first and last lines or pixels inside the safe area.

7.1.1 Widescreen shoot to protect the 16:9 full image (Diagram 1)

This is most often used for commercially released films which are to be shown in 16:9 'deep' letterbox on the analogue service.

This recommendation 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 1 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.

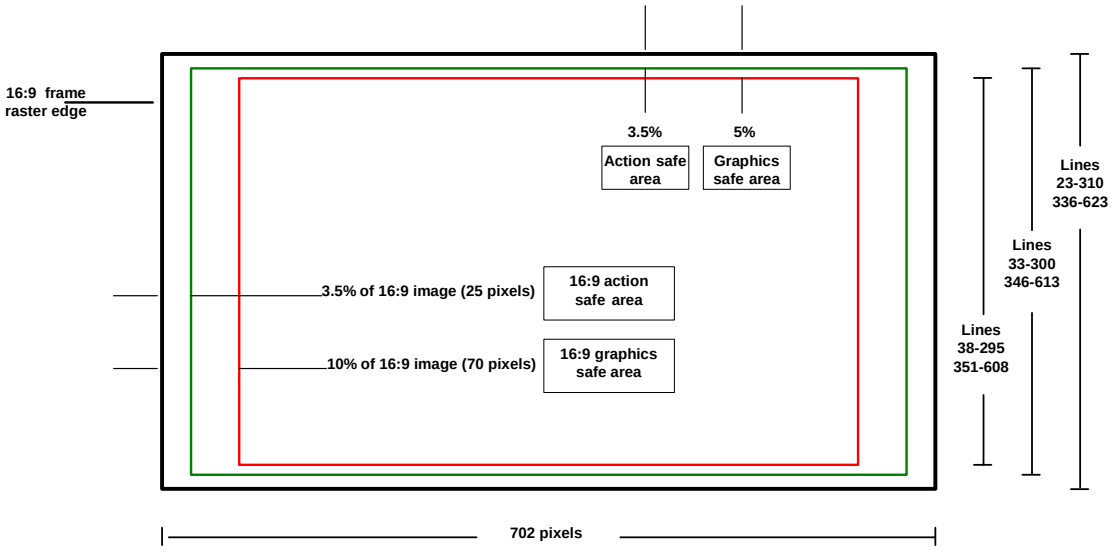

Diagram 1 - Widescreen shoot to protect the 16:9 full image

7.1.2 Widescreen shoot to protect the 14:9 central zone (Diagram 2)

This recommendation is used for the majority of programmes commissioned in widescreen.

It is the most logical option given the need to ensure that graphics and captions within a 16:9 widescreen production are just protected within a central 4:3 zone and can be viewed using the 4:3 centre cut-out option with a 4:3 picture display.

While caption can be clipped in a poorly set-up domestic 4:3 receiver/set-top box combination, this protection is intended to give maximum possible creative freedom within the 16:9 image area. Care should be taken to check for co-producers' differing requirements.

The diagram shows:

- The 14:9 safe action and caption areas 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 and caption areas in the vertical plane by line-number and in percentage terms relative to the first and last lines of active picture.

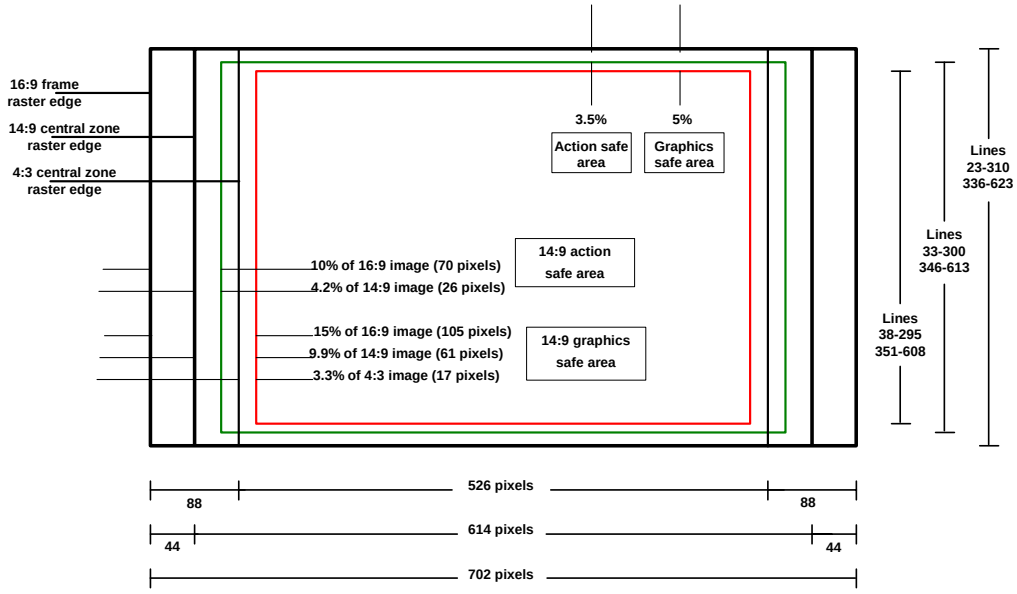

Diagram 2 - Widescreen shoot to protect the 14:9 central zone

7.1.3 Widescreen shoot to protect the 4:3 central zone (Diagram 3)

This recommendation is used where programmes are being made specifically to be directly compatible for 4:3 versioning. Sport generally uses this recommendation.

This recommendation fully protects the 4:3 central zone for action and graphics.

Note that this recommendation does not fully protect the normal 4:3 safe area as some compromise is made between the 4:3 viewer and the 16:9 viewer. This compromise is acceptable for BBC analogue transmissions, but care should be taken to check for co-producers' different requirements.

The diagram 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.

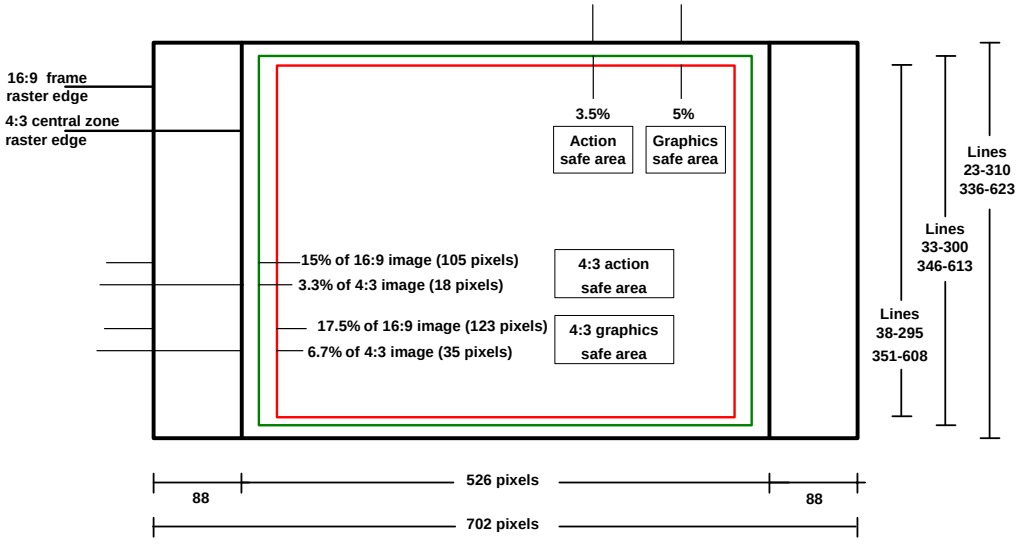

Diagram 3 - Widescreen shoot to protect the 4:3 central zone

8 Appendix 2: Guidelines to take Account of the Visually Impaired Audience

This section reflects existing guidelines, and as such is subject to review.

8.1 Introduction

Significant numbers of viewers have a visual impairment. We have a responsibility to make television entertaining, informative and educational.

There are frequent occasions when it is possible for programme-makers to take greater account of sight-impaired viewers by voicing material as well as showing it, without damaging creativity. This guideline offers advice on what can be achieved. For ease of reference it is split into two areas: Programmes and Graphics.

8.2 Programmes

8.2.1 Factual programmes

Where information is displayed on screen in caption form, consideration should always be given to voicing it also. For example, where telephone numbers and addresses or details of goods and services are shown, they should be voiced as well unless there are demonstrable editorial reasons[1] not to do so.

8.2.2 Entertainment and Drama programmes

Many Entertainment and Drama programmes have a fictional basis and depend for effect on visual impact, thus it is not always possible to explain verbally what is happening. However, there is often scope in factual entertainment to take account of visually impaired viewers. For example, before commissioning quiz shows, consideration should always be given to including verbal descriptions. Similarly, every opportunity should be taken in talk and chart shows to give the factual information verbally as well as with graphics.

8.2.3 Identifying interviewees

Where contributors are identified by name captions, every attempt should be made to name them verbally also. The verbal identification should be included in a way which maintains the smooth flow of the script.

8.3 Graphics

Although visual impairment may make it difficult to some people to read graphics, there are others for whom they would be legible, if composed with care. Programme makers should:

- use large, clear fonts.
- use colours which achieve a good contrast between text and background.
- avoid graphic sequences where they provide information which competes with verbal information being given simultaneously.

[1] Care must be taken to avoid voicing commercial references in a way that could be regarded as promotional. For advice please contact Head of Policy Management

9 Appendix 3: Specific Requirements for Programme Delivery from remote sources, including Outside Broadcasts.

9.2 General technical considerations

For non-news programmes that originate from a source that is remote to the broadcast centre, extra consideration should be given to the means of signal and communications carriage.

In many cases, remote sources will be live from temporary facilities, such as outside broadcasts. Similarly, programmes might originate in studio centres that are remote from the broadcast centre. In any case, the programme might be wholly live, consist of live material plus recorded inserts or be wholly recorded. Similarly, the remote source might be providing a remote contribution into a programme that is “hosted” at a studio or broadcast centre. The key characteristic here is that material is delivered in real-time via circuits from the remote source to the studio or broadcast centre.

The consideration required falls into four areas, seen from the perspective of the broadcast centre:

1. Incoming signal - actual programme material fed from the remote source to the broadcast centre;
2. Cue and Communications circuits and associated signals
3. Contingency against failure
4. Emerging technologies and non-real time systems

It is recognised that there might be several agencies involved in the system. Therefore,

- sufficient monitoring must be in place at all interfaces to ensure continuity of signal quality
- there must be agreement over the share of responsibility for each element in the chain(s).
- all parties must be able to monitor and assess the signals arriving and departing from their domain(s) of responsibility.

9.2 Technical Parameters for the Incoming Signal

It is the BBC’s ideal that the incoming signal can be passed through the play-out and transmission chain without the need for manual intervention.

The remote facility must be able to originate vision and audio line-up signals, including aspect ratio information and identifying the left and right audio channels. Care should be taken to ensure that pre-recorded inserts are in the same aspect ratio as live material. Technical requirements for line-up signals are given in sections 4.1.3, 4.2.3 and 6.2.1 of this document.

Required checks will include representative moving pictures and synchronous sound.

Line-up signals must be available at least 30 minutes prior to the programme start time, and a technically competent contact must be designated to liaise with BBC engineering staff.

The video and audio signals must be continuous and stable in all respects throughout the broadcast period. Remote sources to the facility must be fed in such a way to ensure stable synchronous signals are present on the transmission output at all times.

The digital signal characteristics must meet with EBU/SMPTE Recommendation 601. See section 4.1 for more details.

9.3 Cue and Communications

9.3.1 Cue Path

Return audio and/or audio/video circuits may be necessary for programmes which require two way communication between centres. It is necessary to consider the latency and reliability of the cue path. This is especially important during live interviews. It is preferable to arrange dedicated audio or video return or cue paths to sources. The use of “off-air” cueing should be considered a last resort for contingency purposes. Similarly, care should be given to the choice of communications circuits and their use.

9.3.2 Communications

Before transmission, the minimum requirement is that a dedicated telephone number is provided for contact with the source engineer. It is important that the number of any pertinent telephone is communicated to the destination and to Network Bookings well in advance of the booking. During line-up, mobile telephones are suitable. During transmission, however, mobile telephones *may* be suitable but should not be relied on as the only means of communication.

For direct contributions into network transmissions, a feed of the source production talk-back will be required. A dedicated “4-wire” circuit offers flexibility and should be considered to be a minimum requirement.

9.3.3 Circuit Bookings

The production company producing or commissioning the material shall be responsible for the costs of all necessary communications and for ensuring that all the necessary circuits are booked from the source to the point of recording or transmission. Where multiple agencies are involved, a collaborative approach is essential.

The London TV Centre end of circuit bookings should be made through the BBC Technology Telecoms Network Bookings Agency who should also be informed of the full route at least one week before the programme production date. This is especially important if any of the route is provided by non-BBC suppliers. The point of delivery is normally CCA unless specifically stated otherwise.

A technical contact will be required to be available prior to the event to confirm technical planning and for dealing with any queries. Similarly a technical contact must be available at the source throughout the line-up period and during the feeding of material.

9.4 Resilience

Paths between source and destination can be difficult to guarantee, so producers and commissioners should be aware of the options open to them for reducing the risk of signal failure, especially during live transmissions with particular attention paid to single points of failure.. Certain broadcasts may be considered sufficiently important for some additional facilities to be deployed as backup. In some cases a second, independent transmission path may need to be established. This should take a different route to the main transmission path. The decision about the amount of redundancy built into the link, and therefore the additional expenditure should be taken in conjunction with the Producer and/or the programme commissioner. For example, if there is likely to be two-way interview during the transmission, dedicated communication circuits are recommended.

The live transmission of scheduled BBC programmes from within the UK normally requires the provision of reserve sound and vision circuits to safeguard against failure.

Facilities for down-linking satellite circuits to Television Centre in London are available at commercial rates. The BBC also has permanent circuits to the BT tower and all other major broadcasters.

9.4.1 Point of Contact

The Presentation Engineering Co-ordinators (PECs) are the main round-the-clock operational point of contact working closely with the BBC Broadcast Editor. The point of contact for technical enquiries affecting immediate delivery matters should be made to them.

- Presentation Engineering Co-ordinators, tel: +44(0) 20 857 **60090**

9.5 Emerging Technologies

At time of writing, a number of options for asynchronous streaming are available, such as the internet, stored and forward systems and file formats such as MXF. These include streaming via IP, including the use of interim storage or caching. This document does not prohibit the use of these technologies, but they must be considered as special cases requiring particular attention and planning.

Document Versions

Version	Date	Comment	Author
0.1	October 2001	Merged draft of Digital and Analogue standards	R Preston Bell
0.2	Feb 2002	More work on Merged doc and removal of WW as they now have own web site document	M Taylor
0.3	Feb 2002	Table of contents and other formatting	R Preston Bell
0.4	13 Feb 2002	Minor amends	M Taylor
0.5	22 Feb 2002	Reordering of sections Rewording of scope and introduction Simplification of contact details Tightening of wording in quality sections Deletion of note about mono/stereo compatibility Other minor typographical amends	TV Standards Workgroup
0.6	22 Feb 2002	Alternative reordering of sections	TV Workgroup
0.7	18 March 2002	Rebuilding by	R Preston Bell
0.8	19 March 2002	Rebuilding Includes redraft of Programmes spanning more than one tape, and Subtitling sections	B Bulford, TV Standards Workgroup
0.9	25 March 2002	Further revisions, including changes to Widescreen, responsibilities, technical quality and HD sections	TV Workgroup
0.10	29 April 2002	Revisions following Change Control circulation of draft	TV Workgroup
0.11	2nd May 2002	Reconciliation of differing views from respondents	Wes Curtis
1.0	10th May 2002	Minor adjustments to wording	TV Workgroup, Wes Curtis
1.1	13th May 2002	Re-introduction of PSE guidance summary	TV Workgroup, Wes Curtis
1.2	27th May 2002	Correction so PSE guidance consistent with ITC guidelines	R Preston Bell
1.3	5th Dec 2002	Update to 6.2.2 requirements for programmes spanning more than one tape Removal of out-of-date contact details in section 10	Mike Taylor R Preston Bell
1.4	12th Feb 2003	"BBC Choice" replaced with "BBC Three" in title. Minor clarification of table format in section 6.2.1	Wes Curtis
1.5	26th June 2003	Replacement of sections 9 and 10 with new appendix on outside broadcast procedures	OB Workgroup, Wes Curtis
1.6	12th November 2004	Minor updates including correction in table showing line-up test signals, clock and leader (section 6.2.1) Addition of guidance on use of floating images (section 4.1.5)	Korinna Dunton, Wes Curtis
1.7	10th March 2005	Replacement of ITC with Ofcom and other minor changes	R Preston Bell
1.8	15th April 2005	Update to D3 clauses in Section 6 to reduce dependency on legacy tape formats.	Wes Curtis
1.9	2nd Sept 2005	Minor change to Section 6 introduction, clarifying delivery of 4:3 programmes on Digibeta.	R Preston Bell

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Special thanks also due to Jeff Booth for significant contributions throughout the life of this document	

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