



TV Delivery for BBC Worldwide

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Description	Description: This document covers the technical requirements for programmes commissioned in Standard Definition (for delivery on Digital Betacam) and/or High Definition (for delivery on HD CAM SR) which are to be distributed by BBC Worldwide.		
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Technical Delivery Specifications

Version 5.0 July 2009

SCOPE OF DOCUMENT

This document covers the technical requirements for programmes commissioned in **Standard Definition** (for delivery on Digital Betacam) and/or **High Definition** (for delivery on HD CAM SR) which are to be distributed by BBC Worldwide.

BBC Worldwide aims to maintain the highest technical standards. This document sets out the minimum acceptable standards required for programmes delivered to BBC Worldwide for international distribution, in such a way that the programme may reliably be broadcast by BBC Worldwide customers.

It is never the intention to frustrate the producers' ambition to make their programme in the way of their choosing. The purpose of this document, and associated material, is to set out the technical requirements to ensure that material is of a satisfactory standard and is of a format that is acceptable.

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 reality, but please consult your resource provider for advice on specific issues.

TECHNICAL ACCEPTANCE PROCEDURES

All programmes delivered on videotape must be subject to a **Quality Assessment Review (QAR)** prior to delivery. 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. The ITU / CCIR 5 point grading scale is used to assess programmes for quality.

Where masters include a full M&E, these tracks should receive a full QAR, with Final Mix and (where present) 5.1 audio tracks being spot checked.

If a master only includes Final Mix then these tracks should undergo full QAR.

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GUIDELINES FOR QAR (Quality Assessment Review)

All masters to be delivered to BBC Worldwide must undergo and pass a quality assessment review. Your Programme Operations Co-ordinator at BBC Worldwide can advise on approved facility houses.

The review covers both technical quality of each master tape, and that the master tape contains the various content elements required for international distribution.

Overall quality of sound and vision should be separately assessed in controlled monitoring conditions and any impairments noted.

The programme will be judged against the **ITU-R five-point impairments grading scale** as shown 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

Programmes should meet a minimum of Grade 4 for sound and vision quality. Grade 3 is a borderline pass where there are valid reasons for technical exemption, in which case details should be clearly stated on the recording report. Grades 1 and 2 are automatic fails.

Recording Reports

Every tape submitted must be accompanied by a completed recording report. If a tape does not include a Recording Report it will automatically fail QAR.

The report must include full details of the programme supplier and recording facility house and programme title/ subtitle. It must also include technical information including the origination format, timecode of first frame of picture (FFOP), details of the aspect ratio and safe areas used, and must provide clear references to any part of the programme content that may attract low grades (especially below grade 3).

Timecode references should also be included for the start and final frame of the clean background elements.

Checklist

To ensure your masters pass through QAR as quickly and successfully as possible, it is advisable to pay particular attention to the following delivery requirements. These are the most common reasons for QAR failure:

- **Line up Bars and Tone**
- **Ident Clock and Captions fall within Caption Safe Area**
- **Programme has the correct Aspect Ratio**
- **Music and Effects are fully filled (if required)**
- **Clean Elements for Titles and Credits have been included.**
- **Clean Elements have been included for ALL captions within the body of the programme (including clean maps for textless versions)**
- **Film Effect does not cause aliasing or soft picture**

Other common reasons for failing QAR include:

Picture - Time specific trails/redcaps and teases
Lipsync errors
Blanking errors
Luminance peaks
Neg stretches

Grading changes
Discovery Bug Clearance area contains captions (See Discovery Spec).

Audio - Audio Peaks
Distorted audio
M&E has not been recorded
Masters and DA88 are out of sync
Doc M&E for drama sequences.

Flashing Images and Repetitive Patterns

Flickering or intermittent lights and certain types of repetitive visual patterns can cause problems for some viewers who have photosensitive epilepsy. Programmes for UK transmission are required to undergo a Harding test.

However this is not obligatory for BBC Worldwide masters, as responsibility rests with international broadcasters who purchase the programme.

The Independent Television commission (UK)/Ofcom issues guidelines for PSE which can be found on the Ofcom website at:

http://www.ofcom.org.uk/consult/condocs/Broadcasting_code/broadcasting_code/annex8/#co

Definitions Of A Music And Effects Track

Drama:

100 per cent fully filled effects, footsteps and foley to be supplied which includes the atmospheric effects of crunching gravel, background atmos etc.

No speech should be heard at all on m/e.

Documentaries:

We accept Final Mix Minus Commentary, this means:

No commentary, no extra readings or voiceovers should be on the music and effects. The levels should not be dipped.

If a contributor appears speaking to camera, this sync dialogue must continue throughout that piece on the M&E tracks, even if they do not appear in vision throughout.

Any dialogue recorded on location but not used in sync should not appear on the M&E.

Definition Of Clean Title Backgrounds

Sometimes referred to as Textless backgrounds or Neutral backgrounds, they are used for Broadcasters to translate the titles into their own language.

The clean shots should be continuous and from cut point to cut point to enable the clients to drop in the section. Cleans should still include the BBC logo blocks.

Clean backgrounds should be supplied for opening sequences and closing credits on all Worldwide masters.

If this cannot be provided clean due to digitally created titles then some kind of alternative should be supplied and discussions with relevant co-ordinator should take place.

BBC logo:

All masters delivered for WW distribution have to include the logo in opening sequence and within clean backgrounds for opening sequence. Refer to BBC guidelines.

Please note Independent productions are exempt from this rule.

Programme Duration:

Include title sequence and end credits. BBC Worldwide can accept a duration 2mins either side of the agreed duration (i.e. 48'-52' for a 50' programme, and 28'-32' for a 30' programme).

Programme trails/Recaps:

Programme trails are acceptable should the programme air in more than one part, but the commentary should avoid time references such as “next week...”; “tomorrow...” and instead refer to “next” or “Previously”.

GENERAL QUALITY GUIDELINES

Picture Quality

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.

Use of Archive footage or material from domestic or low quality sources

The use of archive footage from sources of variable quality (such as film extracts, home video, DV footage or 4x3 transmission masters etc) should be discussed prior to QAR with Programme Operations for approval. This should reduce the likelihood of subsequent difficulties during the QAR process.

In certain circumstances, for example, shooting actuality material or where a high level of mobility is required, the use of a DV camcorder may be considered acceptable for acquisition, but specific agreement, from Programme Operations, must be sought for using this. Where use of this format is agreed we require particular attention to be given to sound and lighting considerations.

The use of material from all other non-broadcast and domestic videotape formats is not permissible except in exceptional circumstances. Their use must always be fully discussed and agreed in advance with Programme Operations.

Additional information regarding High Definition Delivery:

There are strict guidelines for the percentage of Standard Definition footage used in HD masters. The upper limit for non-HD content in a programme is 25%.

For HD delivery, the use of Standard Definition broadcast and non-broadcast video formats, and certain non-broadcast HD domestic formats is not permissible. Use of up-converted Broadcast Standard Definition and HDV material may be allowed, but such usage must be cleared in advance with Programme Operations.

Programmes must contain a minimum of 75% native high definition material

The following formats are considered to be standard definition:

- All standard definition video formats
- HDV from all manufactures
- Cameras with image sensors under ½”
- Frame based (intra-frame) recording formats below 100Mbs
- Inter-frame based recording formats below 50Mbs (50Mbs Inter-frame compression is acceptable, however it must be kept in its native codec along the Post chain prior to delivery)
- Super16 film whether transferred to tape in high definition or not
- 35mm film transferred to or copied from standard definition tape formats
- Non linear editing codecs with bit rates below 160Mbs (anything over 160Mbs is accepted as lossless)*
- Live contributions links of less than 60Mbs (MPEG2)
- 720 line equipment with the exception of the Panasonic Varicam AJ-HDC27 range and the Panasonic AJ-HDX900 range**

** A maximum of two low pass encodes (anything below 160Mbs) will be deemed acceptable on a HD Transmission master - one of these may be generated at the acquisition stage

*Other 720 line equipment may be acceptable but must be discussed prior to use

35mm Film for high definition acquisition

The following 35mm film types and stock are acceptable for high definition acquisition providing the original negative is clean and transferred directly to a high definition video format;

3 perf - any exposure index although an exposure index of 250 or less is preferred.

2 perf – only if a stock with an exposure index of 250 or less is used

To avoid causing problems with high definition transmission encoding film should be well exposed and not forced more than one stop.

35mm film negative can be transferred to any high definition video format but it is advisable to use formats that have low compression.

Audio Quality

Audio signals 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.

The audio shall be free of spurious signals such as noise, hum and cross-talk. Sibilance, distortion wow and flutter shall not be apparent.

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. Audio compression should be used as little as possible as the effects of compression used for broadcast distribution and transmission can exacerbate impairments.

The relative timing of sound to vision should not exhibit any perceptible error. Sound must not lead or lag vision in excess of 20ms (1 field at 25 frames per second). A sound delay of greater than 20ms can be acceptable where this occurs in context to give a perception of distance.

Electronic Video Processing

Due to international distribution of Worldwide masters and the requirement for standards conversion any use of video processing must be agreed with Programme Operations, this includes the use of film effect and noise reduction.

Standard Definition Standards Conversions

The use of Motion Compensating (sometimes know as Motion Predictive or Motion Vector) Standard Converters is preferred.

High Definition Standards Conversions (AKA Cross-Conversion)

The use of Motion Compensating HD standards converters is preferred. It is also acceptable to use speed change to transfer between High Definition standards as long as the due attention is given to the audio. Currently speed change is the preferred method of changing between 25 and 24 frame HD standards

Down Conversions

It is acceptable to use a broadcast VTR's "on board" down converter to produce standard definition copies of high definition programmes. Programme Operations should be consulted if a standard definition master is to be delivered to Worldwide from a high definition programme.

Up Conversions

Where it's permissible to use standard definition material in a high definition programme, care must be taken to deliver the best possible quality. This is particularly important when material has to be standards converted as well as up converted. Use of standard definition material **must** be cleared with Programme Operations

Film Effect

Currently only film effect processes that attempt to maintain the full resolution of the original are acceptable. Straight field duplication is not acceptable. Where film motion is a requirement the use of progressive capture is the preferred method. Programme Operations must be informed if a film effect process is to be used.

It is **not acceptable** to add film effect to high definition images for high definition delivery. Where film motion is a requirement the use of progressive capture is the preferred method.

TECHNICAL REQUIREMENTS: VIDEO

Videotape recording must be fully compliant with the manufacturer's technical specification, thereby ensuring format compatibility.

Programme signal parameters

Video signals must correspond to the reference line-up levels. These include peak sound, maximum luminance & colour difference (Y Cr Cb) component levels, and black levels. Care must be taken to avoid illegal colours (Y Cr Cb component signals exceeding the gamut limit) which may be generated by caption and graphics systems.

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 must be compatible with the PAL System 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.

Video white levels

White level should not exceed 700mV for component signals, and program black levels should not extend below 0V (DC). Neither the program luminance whites nor blacks should be clipped excessively. For colour difference signals R-Y and B-Y, levels shall not exceed 700 mV or fall below 0 mV when set at a 350 mV offset.

Standard Definition Videotape Format

Programmes should be delivered on Digital Betacam component videotape format and shall replay to the ITU Rec 656 interface standard.

All material shall be of the 625/50 interlaced standard.

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.

Signals will be assessed according to the recommendation CCIR Rec. 601 or ITU-R BT601-5 Part A

High Definition Videotape Format

Programmes should be delivered on either HDCam SR videotape format and shall comply with the SMPTE 274-1998 and SMPTE 295 1997 standards.

Material shall be of either the 1080/50i (interlaced) or 1080/25psf (progressive) standard.

Vertical blanking

V Blanking should fall within SMPTE 274M/295M specifications, as stated in section 14 "Analogue Synch" and section 15 "Analogue Interface" and in ITU-R specification BT.709-4. The vertical blanking interval should equal lines 1-20 and lines 561-563 of the first field and lines 564-583 and lines 1124-1125 in the second field.

Horizontal blanking

H blanking should fall within SMPTE 274M/295M specifications, as stated in section 14 "Analogue Synch" and section 15 "Analogue Interface" and ITU-R specification BT.709-4. Horizontal blanking should be between 280 clock periods and a maximum of 292 clock periods, creating a blanking width of between 3.775 microseconds and 3.935 microseconds when a clock period is equal to 13.48 nanoseconds.

Timecode and control track

On Standard Definition masters, both longitudinal timecode (LTC) and vertical interval timecode (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).

On HD masters, VITC Data and other Metadata is in VANC (vertical ancillary space).

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 have identical times.

If DVITC or ancillary timecode are used then they must be identical to the LTC and VITC. Timecode and control track must have the correct phase relationship with the corresponding video signal.

Recorded signal levels:

The audio reference level of digital recordings must correspond to -18dB with respect to maximum audio coding level, that is the audio reference level (PPM4) corresponds to -18dBFS/0DBU.

Pre-emphasis of the digital signal must not be used.

Programme sound and vision maximum levels must always correspond to the recorded reference tone and colour bar line-up signals according to the following tolerances:

Vision	±3%
Sound	±1dB
Video Chrominance	5%

Colour signals must be legal in PAL and YUV domains meeting the PAL specification.

In line with PAL system I (1984) (section 4 para. 4) the video signal decoded to RGB shall not lie outside the levels corresponding to black level and white level apart from transient overshoots. This corresponds to luminance never lying outside its nominal black 0% and white 100% bounds.

A more reasonable and acceptable working specification can be applied:

Black shall lie no more than 1% (or 2 bits) below nominal black level.

Peak White shall lie no higher than 3% (or 7 bits) above nominal white level.

When decoded to RGB each component signal must not lie above 105% or below -5%.

All measurements can use an IRE filter to remove transient overshoots.

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, episode number, part number and contract number where known.

The clock must provide a clear countdown of at least 20 seconds cutting to black at three seconds prior to the start of the programme.

The clock must appear round when viewed on a screen of the same aspect ratio the programme is intended to be viewed on. E.g. The clock on a 4x3 programme must appear round on a 4x3 display. The clock on a 16x9 programme must appear round on a 16x9 display

Timecode	Picture	Audio 1	Audio 2	Audio 3	Audio 4
09.58.00.00 (or Earlier)	EBU Bars (100/0/75/0) (NTSC converted bars are not acceptable)	Coherent Step tone (100Hz, 900Hz and above 10kHz)		Coherent Step tone (100Hz, 900Hz and above 10kHz)	
09.59.30.00	Ident and Clock				
09.59.57.00	Black	Silence	Silence	Silence	Silence
10.00.00.00	Programme (BBC logo within op sequence).	Master Left (Lt)	Master Right (Rt)	M&E Left (Lt)	M&E Right (Rt)
	BBC Worldwide Branding				
	Minute of black				
	Textless title backgrounds	Clean Backgrounds - Titles and credits (cut points should match). Including BBC logo.			

TECHNICAL REQUIREMENTS: AUDIO

Audio Standards for Standard Definition and non 5.1 High Definition delivery

BBC Worldwide is happy to receive separate audio materials, for both split elements and discrete 5.1 mixes, as **BWAV audio files** delivered on DVD-R or DA88 (or on occasion DA98) tape format.

BWAV files should have file extension .BWF with a sample rate of 48K and bit depth of 16 bits. Programmes shall be delivered in 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.

Audio Levels

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

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.

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 48 kHz is 75 degrees at 10 kHz.

Stereo Audio Delivery

Track Allocation

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

Track 1	Track 2	Track 3	Track 4
Final Programme Mix		International tracks	
Left (A)	Right (B)	Music & Effects (L)	Music & Effects (R)

5.1 Audio Delivery

Programmes delivered with a 5.1 sound track also require a stereo (Lt Rt) mix down on the delivery videotape.

HD programmes delivering with 5.1 audio on HDCAM SR should use the 12 audio tracks as follows:

Channel 1	Stereo Final Mix Left	
Channel 2	Stereo Final Mix Right	
Channel 3	Stereo M&E Left	
Channel 4	Stereo M&E Right	
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Channel 5	Left	
Channel 6	Right	
Channel 7	Centre	
Channel 8	LFE (Low Frequency Effects)	(5.1 M&E layout)
Channel 9	Left Surround	
Channel 10	Right Surround	
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Channel 11	Dialogue	
Channel 12	Commentary	

If a Dolby E 5.1 Main is available this should be on tracks 11-12 (or for programmes with no M&E then Dolby E would be included on tracks 3-4). Dolby E specifications are as per BBC's "HD Channel: Temporary Summary of Delivery Formats" but are not a standard WW deliverable.

5.1 Audio Delivery on separate audio master:

5.1 Audio must be delivered on two DA-88 tapes or BWAV: One for the main audio and the second for the 5.1 international audio (M&E).

The DA-88 or BWAV must be timecode synchronous with the delivered master video tape.

Track layout should conform to the SMPTE 320M-1999 Standard/ITU-R recommendation BR-1384:

Track 1	Left
Track 2	Right
Track 3	Centre
Track 4	LFE (Low Frequency Effects)
Track 5	Left Surround
Track 6	Right Surround
Track 7	Stereo Left total (Lt)
Track 8	Stereo Right total (Rt)

Split Track Dialogue/Music/Effects delivery on HDCAM SR

With prior consent from Programme Operation non 5.1 HD programmes delivered on HDCAM SR can use audio tracks as follows to include split track elements:

- Track 1 Stereo Left Main
- Track 2 Stereo Right Main
- Track 3 Stereo M&E Left
- Track 4 Stereo M&E Right
- Track 5 Left Music
- Track 6 Right Music
- Track 7 Dialogue
- Track 8 Commentary

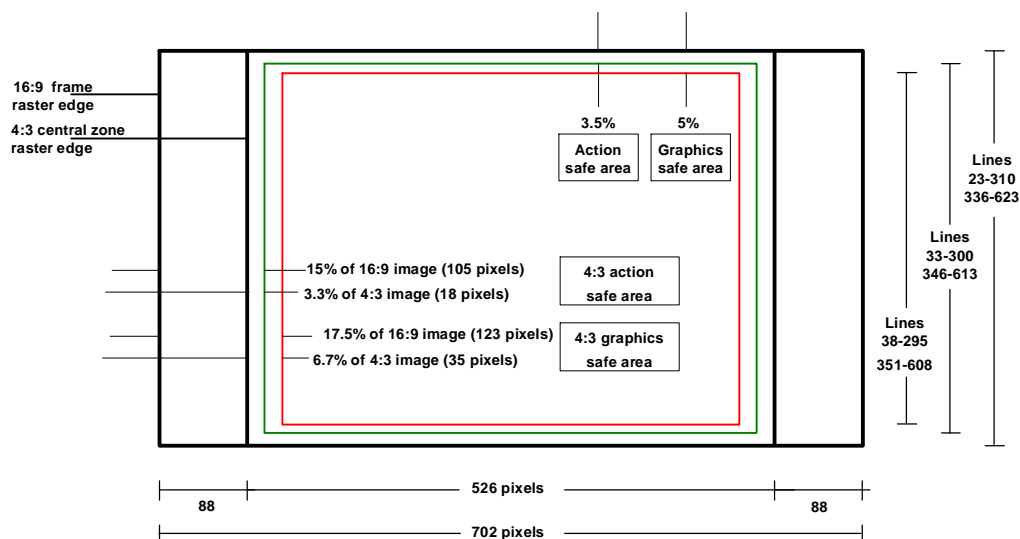
APECT RATIO GUIDELINES: SAFE AREAS

Programmes for international distribution should always conform to the following configuration: 16:9 widescreen shoot to protect 4:3. It is not acceptable for changes from 16:9 display to 4:3 display within a programme. 4x3 titles and captions should be “centre cut out safe”.

These safe areas are as defined and used within the standards documents ITU R BT.1379-1 and EBU R95-2000.

Although High Definition is a fully widescreen standard with 16:9 action and caption safe areas, most HD programmes will be down-converted for distribution in areas that use standard definition protection standards. To allow compatibility, unless otherwise agreed with Programme Operations High Definition masters for BBC Worldwide should conform to the same safe areas criteria as Standard Definition.

BBC WORLDWIDE 16:9 Safe areas	
Action Safe	Caption Safe (centre cut out)
80% of Active Width 93% of Height	65% of Active Width 90% of Height
BBC WORLDWIDE 4:3 Safe Areas	
Action Safe	Caption Safe
80% of Active Width 93% of Height	65% of Active Width 80% of Height



Widescreen shoot to protect the 4:3 central zone