

TECHNICAL STANDARDS FOR DELIVERY OF TELEVISION PROGRAMMES TO



This document is a complete guide to the common technical standards agreed by the BBC, BSkyB, Channel 4, Channel 5, ITV and S4C.

The Standards include:

- Technical Specifications, i.e. the technical production methods which must be used, and the parameters which all material must meet to be acceptable by the broadcasters.
- Picture and Sound Quality requirements, which also form a binding obligation on producers of material. Assessment of quality is by nature subjective, and is highly dependent on the nature of the programme. Some of the Quality Requirements are expressed in relative terms ("reasonable", "not excessive" etc.), and it will be necessary to make a judgement as to whether the quality expectations of the intended audience will be fulfilled, and whether the broadcaster will feel that value for money has been achieved.
- Delivery Requirements, which specify the form and layout of the programme material.

Every programme submitted for transmission must satisfy a Quality Control process specified by the broadcaster. Any programme failing the QC process on tape or file may be rejected and returned to the supplier for repair.

Technical Responsibility and Contacts:

General Responsibility

The BBC's Delivering Quality (DQ) group 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 (<mailto:dqm@bbc.co.uk>).

This document does not cover any specific requirements for delivery of programmes to BBC Worldwide or other co-producers.

Technical Liaison

The Duty Engineering Managers (DEMS) in Red Bee Media are the main round-the-clock point of contact for technical enquiries affecting immediate (defined as "on the day") delivery.

Duty Engineering Managers (DEMS) +44 (0) 20 8495 5400

For all other enquiries please contact your commissioner or the DQ web site:

http://www.bbc.co.uk/guidelines/delivering_quality/consultation.shtml

File Naming Requirements

Programme files delivered to the BBC must be named as below. NB Filenames must be in upper case, with filename extensions in lowercase:

Contact the BBC for programme specific identifier information

Requested Programme File Name Format	Example Filename	Notes
	CTL02152_82.T01.XML CTL02152_82.T01.MXF	

Live Programme Delivery

Circuit Bookings

The BBC point of delivery is currently CCA in Television Centre. However as new buildings come on-line programmes may be required to deliver to other locations. Unless otherwise agreed, it should be assumed CCA is the required point of delivery.

The production company is responsible for the costs of all communications and for ensuring all circuits are booked from the source to the point of delivery.

The London Television Centre (TVC) end of circuit bookings should be made through the ATOS Network Bookings Agency who should also be informed of the full route at least one week before the programme production date.

ATOS Network Booking Agency +44 1386 420040

Hours: 09:00 - 22:00 Monday to Friday

09:00 – 19:30 Saturday, Sunday and Public Holidays

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.

Play-out Point of Contact

The Duty Engineering Managers (DEMS) in Red Bee Media, the BBC's playout provider, are the main round-the-clock operational point of contact working closely with the playout editors. Technical enquiries affecting immediate delivery should be made to them.

Duty Engineering Managers (DEMS) +44 (0) 20 8495 5400

BBC Resilience Levels:

Resilience levels will be discussed with each live programme during the commissioning stage however as a guide programmes will need to meet the following:

OPTION A: Programmes with a major UK and International public interest

Main and Backup links are geographically and electrically separate as far as possible. Where satellite is used, there are two separately located uplink trucks, powered differently from each other. The source should be able to continue in some form, during a break down or power loss affecting some facilities. The programme producers must discuss the contingencies for alternate content should all facilities be affected.

OPTION B: Live Primetime Programmes (e.g. Saturday early evening)

Main and Backup links and power supplies have some commonality, which creates an accepted single-point-of-failure risk. Reserve links could be lower quality or even SD. A reserve power supply should be available however it only need be capable of supplying the minimum infrastructure to keep some of the programme on air. The programme producers should discuss alternate content should all facilities be affected

OPTION C: All other programmes including live links into studio programmes

A single link, with no backup is acceptable. There only need be minimal alternate power supply and mobile phones can be used as alternate comms. The BBC may provide alternate content in the event of programme failure. The Production is responsible for filling any loss of link into a live studio programme to meet the scheduled duration.

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1 General Quality Requirements

1.1 Picture Quality

The picture must be well lit and reasonably but not artificially sharp.

The picture must be free of excessive noise, grain and digital compression artefacts.

The picture must be free of excessive flare, reflections, lens dirt, markings and obstructions (e.g. lens hood), and lens aberrations.

Movement must appear reasonably smooth and continuous, and must not give rise to distortions or break-up to moving objects, or cause large changes in resolution.

The picture must be free of excessive black crushing and highlight compression. Hard clipping of highlights (e.g. by legalisers) must not cause visible artefacts on screen.

There must be no noticeable horizontal or vertical aliasing, i.e. jagged lines, field or frame rate fluctuations in fine detail.

Colour rendition, especially skin tones, must be consistent throughout, and a realistic representation of the scene portrayed unless it is altered as an editorially essential visual effect.

The picture must be stable and continuous - i.e. no jumps, movements, shifts in level or position.

There must be no visible contouring / artefacts caused by digital processing. Quantisation noise must not be apparent.

There must be no noticeable spurious signals or artefacts e.g. streaking, ringing, smear, echoes, overshoots moiré, hum, cross-talk etc.

Note: EBU R118 is used to assess the suitability of cameras for HD use.

1.2 Sound Quality

Sound must be recorded with appropriately placed microphones, giving minimum background noise and without peak distortion.

The audio must be free of spurious signals such as clicks, noise, hum and any analogue distortion.

The audio must be reasonably continuous and smoothly mixed and edited.

Audio levels must be appropriate to the scene portrayed and dynamic range must not be excessive. They must be suitable for the whole range of domestic listening situations.

Stereo audio must be appropriately balanced and free from phase differences which cause audible cancellation in mono.

The audio must not show dynamic and/or frequency response artefacts as a result of the action of noise reduction or low bit rate coding systems.

1.3 Access for People with Disabilities

The Equalities Act 2010 (formerly the Disability Discrimination Act) requires service providers to take positive steps to make their services accessible to people with disabilities. It states that where a service provider offers or provides services to members of the public, the provider will have to take such steps as is reasonable to make it easier for disabled people to make use of the service. Broadcasters are service providers and this therefore applies to them. (DCMS Guidance 2006)

Programme suppliers are therefore required to consider the needs of people with hearing or visual impairments while generating captions, subtitles and graphics, using voiceovers, and while mixing sound.

The Communications Act 2003 sets targets for broadcasters (monitored by Ofcom) to provide subtitling, sign language and audio description services, so suppliers may be asked to provide appropriate additional material.

For further information, please refer to the appropriate technical contact on the front page of this document.

2 Technical Requirements - Video

NOTE - This section is applicable to both file and tape deliveries. Specific requirements which are different for file and for tape are covered in separate sections 4 and 5.

2.1 High Definition Format

All material delivered for UK HD TV transmission must be:

- **1920 x 1080 pixels in an aspect ratio of 16:9**
- **25 frames per second (50 fields) interlaced - now known as 1080i/25.**
- **colour sub-sampled at a ratio of 4:2:2**

The HD format is fully specified in ITU-R BT.709-5 Part 2.

2.1.1 Origination

Material may be originated with either interlaced or progressive scan.

Interlaced and progressive scan material may be mixed within a programme if it is required for editorial reasons or the nature of the programme requires material from varied sources.

2.1.2 Post-production

Electronically generated moving graphics and effects (such as rollers, DVE moves, wipes, fades and dissolves) must be generated and added as interlaced to prevent unacceptable judder.

2.1.3 Film motion or 'film effect'

It is not acceptable to shoot in **1080i/25** and add a film motion effect in post-production. Most High Definition cameras can capture in either **1080i/25** or **1080p/25**. Where film motion is a requirement, progressive capture is the only acceptable method.

2.1.4 Field dominance

Cuts in material must happen on frame boundaries (i.e. between field 2 and field 1). Motion on **psf** material must always occur between field 2 and field 1 (i.e. field 1 dominance).

Note - It is possible to shoot material at **1080p/50**. If this is done, the correct 2-frame marker phasing must be maintained when down-converting to **1080i/25** or **1080psf/25**.

2.2 Video Line-Up

Programme video levels must be accurately related to their associated line-up signals. Video line-up must be colour bars of the type known as EBU 100% or 75% (100/0/100/0) or (100/0/75/0) and filling the 16:9 raster. SMPTE pattern bars are not acceptable. For required durations, see Delivery Requirements below for Tape or File as appropriate.

2.3 Video Levels and Gamut (illegal signals)

High Definition digital signals will be assessed according to the recommendation **ITU-R BT709-5 Part 2**.

Video levels must be received within the specified limits so that the programme material can be used without adjustment. Any signal outside the specified limits is described as a gamut error.

2.3.1 Measuring signal levels

Digital video levels are usually measured with a device which displays a trace like a traditional waveform monitor. This gives readings in mV (emulating an analogue signal), or as a percentage of the allowable levels.

The limits of signal levels are defined by reference to a nominal black level and a nominal white level. Black level comprises R, G and B all at zero (or 0% or 0mV) and white level is all three components at 100 % or 700mV.

In a picture signal, each component is allowed to range between 0 and 100% (or 0mV and 700mV). This equates to digital sample levels 16 and 235 (8-bit systems) or 64 and 940 (10 bit systems).

2.3.2 Tolerance of out of gamut signals

In practice it is difficult to avoid generating signals slightly outside this range, and it is considered reasonable to allow a small tolerance, which has been defined as follows under **EBU Rec103**:

- **RGB components must be between -5 % and 105% (-35 and 735mV)**

and

- **Luminance (Y) must be between -1% and 103% (-7mV and 721mV)**

Slight transient overshoots and undershoots may be filtered out before measuring, and an error will only be registered where the out of gamut signals total at least 1% of picture area. Many monitoring devices are designed to detect errors to this specification.

2.4 'Blanking'

HD images must fill the active picture area (1920 x 1080 pixels). No 'blanking errors' are permitted on new, up-converted, or archive material.

However a two pixel tolerance will be permitted during CG or complex overlay sequences where key signals, graphic overlays or other effects do not fully cover the background image. Where animated key signals or overlays cause moving highlights at the edge of the active image it is preferable to blank these pixels completely. A note of the timecodes and reasons for these errors should accompany the delivered programme.

2.5 Aspect Ratio

All high definition programmes (except as below) must be delivered in 16:9 Widescreen. This means that the active picture must fill a 16:9 screens vertically and horizontally without geometric distortion.

2.5.1 'Cinemascope ratio' letterbox

For delivery to dedicated movie channels or at the discretion of the broadcaster, programmes may be delivered with an active picture in the cinema ratios of 2.35:1 (21:9) or 1.85:1, centred vertically between black bars in a 16:9 frame, filling the width of the frame, and with no geometric distortion.

2.5.2 Floating images

Short sequences of images surrounded by black borders, (floating images), may be used for 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 letterbox, so are likely to enlarge the picture. The resulting unpredictable zooming can be annoying for the viewer and undermine the artistic intent. If used, the black space around floating images must be consistent across sequences of images.

2.5.3 'Pillarboxed' HD material

Some 'pillar-boxed' material is acceptable at the discretion of the broadcaster where it has been acquired on a medium that has the capability to be transferred to a legitimate HD resolution, for example, 35mm film shot using 4 perf at an aspect ratio narrower than 16:9. The pictures must be centrally framed in a 16:9 raster with no geometrical distortion.

2.6 Archive Material

Archive material must meet all the requirements in this document, including those for up-converted SD video where relevant, except for the following:

2.6.1 General quality - archive

Archive material must be taken from the best available source, and any improvement or restoration work which could reasonably be expected must be done (for example grading, dropout repair or audio equalisation.)

2.6.2 Aspect ratio - archive

Archive material should be zoomed to fill the 16:9 raster where possible without compromising the image quality or composition, otherwise it may be presented in a pillar-box format, which:

- may be of an intermediate ratio between 4:3 and 16:9, but must be of consistent width across sequences,
- must be centrally framed in the 16:9 raster,
- must show no geometrical distortion,
- must have clean and sharp pillar-box edges (i.e. any video or film edge artefacts may need to be blanked.)
- must be black outside the active picture, unless otherwise specified by the broadcaster.

Note however, that consumer TV sets operating in Auto Zoom / Auto mode may enlarge the picture to fill the screen horizontally. The resulting unpredictable zooming can be annoying for the viewer and undermine the artistic intent.

2.6.3 Safe areas - archive

Any captions or text already in the archive material should be kept within the caption safe area if possible, but if not, should be noted in the accompanying documents.

2.7 Use of Non-HD material

Some high definition programmes will contain some material from standard definition originals, and sources which are not considered to meet HD broadcast standards, such as domestic camcorders. This material is all called 'non-HD' in this document.

To maintain a high standard and meet audience expectations the amount of non-HD material is limited to **25%** of the programme's total duration. Non-HD material must not be used for large uninterrupted sections of the programme, unless agreed by the broadcaster. This includes archive material.

2.7.1 Non-HD material

Material acquired using the following methods or formats is considered to be below the high definition standard and will therefore be treated as non-HD:

- HDV from all manufactures
- Most cameras with image sensors under 1/2"
- Frame based (intra-frame) recording formats below 100Mb/s
- Inter-frame based recording formats below 50Mb/s
- Material generated or processed on 720 line equipment
- Film not meeting the requirement for HD in section **2.8** below

2.7.2 Up-converted SD video material

Particular care must be taken to deliver the best possible quality of up-converted material. In general standard definition pictures must look no worse than the original after being up converted, post processed and down converted. Only high quality up-conversion processes will achieve this.

Standard definition video contains a half-line at top and bottom on alternate fields. This must be removed on up-conversion to HD, or it will be visible flickering at top and bottom of the HD frame.

Any VITC or switching signals visible at the top of SD material must be removed.

Any line blanking from SD signals must not appear in the HD conversion.

For these reasons it is necessary that all SD material is zoomed in by a small amount on up-conversion.

2.8 Film for High Definition Acquisition

Super16 film is *not* considered to be high definition no matter what processing or transfer systems are used.

The following **35mm** film types and stock are acceptable for high definition acquisition;

- 3 perf - any exposure index although an exposure index of 250 or less is preferred.
- 2 perf – only if daylight 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.

2.9 Photosensitive Epilepsy (PSE)

Flickering or intermittent lights and certain types of repetitive visual patterns can cause serious problems for viewers who are prone to photosensitive epilepsy. Children & teenagers are particularly vulnerable.

All UK Television channels are subject to the **Ofcom BROADCASTING CODE 2009** which states:

Section 2: Harm and Offence:

2.12 Television broadcasters must take precautions to maintain a low level of risk to viewers who have photosensitive epilepsy. Where it is not reasonably practicable to follow the Ofcom guidance (see the Ofcom website), and where broadcasters can demonstrate that the broadcasting of flashing lights and/or patterns is editorially justified, viewers should be given an adequate verbal and also, if appropriate, text warning at the start of the programme or programme item.

The Ofcom guidance is at: <http://stakeholders.ofcom.org.uk/binaries/broadcast/guidance/813060/section22009.pdf>

2.9.1 Testing for flashes and patterning

All programmes for tape delivery must be tested using the Harding Flash Pattern Analyser Algorithm v2.5 on an SD down-converted SDI feed.

All programmes for file delivery must be tested using the Harding Flash Pattern Analyser Algorithm v3.4 or later.

Any failure whatsoever will result in rejection of the programme, and any affected sections must be repaired and re-tested before acceptance.

Broadcasters will, at their discretion, either test the programme during the Quality Control process, or will require a relevant Harding FPA pass certificate to be delivered with the tape.

2.9.2 PSE-broadcast warnings

Verbal or on-screen text warnings at start of programme may only be used in exceptional circumstances when:

The relevant content is completely integral and necessary to the context of the programme and,

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

Advance notification and planning requirements will vary by broadcaster.

2.10 Safe Areas for Captions

Captions and credits must be clear and legible and must be within the safe areas specified.

All font sizes must be legible as HD and also after down conversion for the SD viewer.

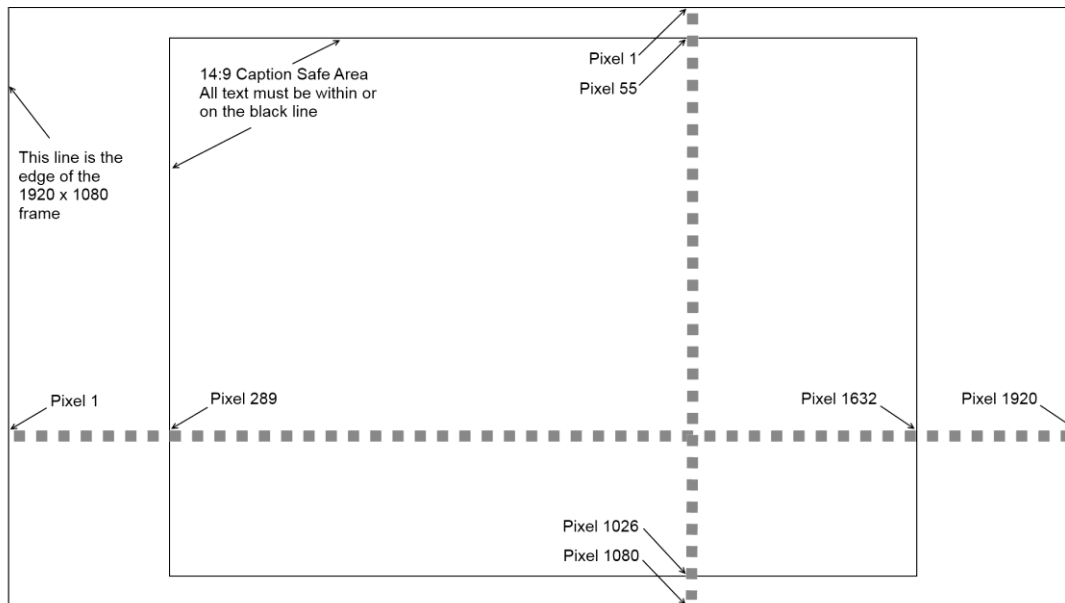
There are two primary caption safe areas defined for 16:9 material for UK transmission:

- **14:9** **used for the majority of UK programmes/broadcasters.**
- **4:3** **required for certain programmes/broadcasters or for programmes distributed internationally.**

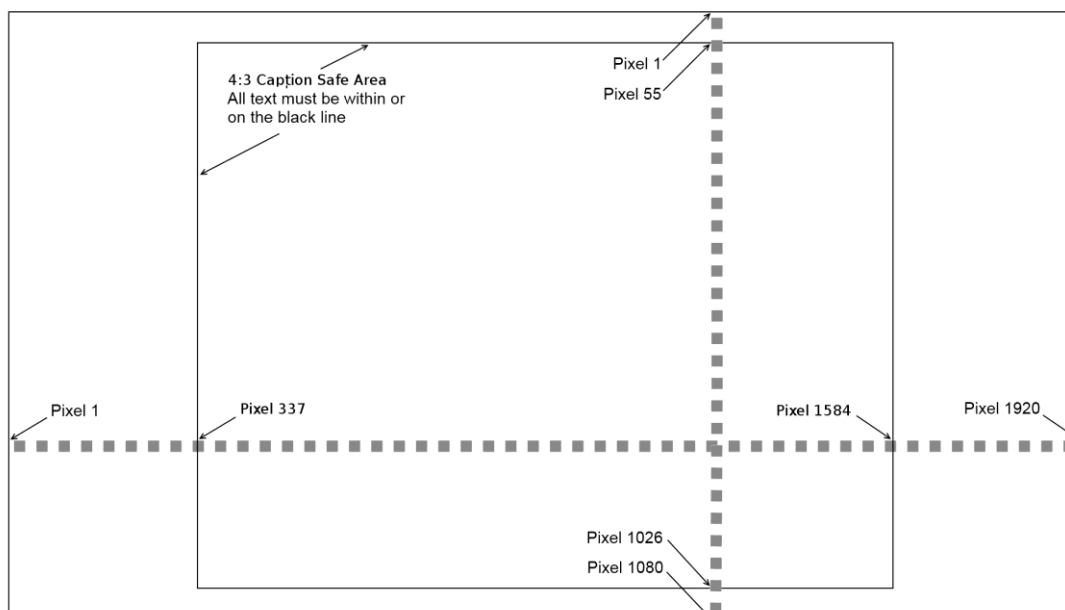
Caption Safe Area	Defined as (%)	HD pixels (inclusive) first pixel numbered 1	TV line numbers (inclusive) numbering as per "Rec709"
14:9 Caption safe	70% of Active Width 90% of Active Height	289 – 1632 55 – 1026	48 to 532 (F1) and 611 to 1095 (F2)
4:3 Caption safe	65% of Active Width 90% of Active Height	337 – 1584 55 – 1026	48 to 532 (F1) and 611 to 1095 (F2)

At the discretion of the broadcaster, programmes such as feature films and some acquisitions may be excluded from this requirement.

2.10.1 14:9 Caption Safe Area (BBC, C4, C5, ITV & S4C)



2.10.2 4:3 Caption Safe Area (BSkyB)



2.11 Standards Conversion

When standards converted material is included in a programme, Motion Compensation (sometimes known as Motion Predictive or Motion Vector) standards conversion is required.

Currently speed change is the preferred method of changing between 24fps (including 23.98) and 25fps standards. Due attention must be given to the audio.

Use of non-linear editing platform hardware or software standards conversion is not permitted for whole programmes but may be used for short inserts at the discretion of the broadcaster.

3 Technical Requirements – Audio

NOTE - This section is applicable to both file and tape deliveries. Requirements which are different for file and for tape are covered in separate sections 4 and 5.

Programmes delivering surround sound must also carry a stereo mix meeting all requirements for stereo. This may be a mix-down from the surround channels. 5.1 and stereo must be synchronous.

Stereo viewers will receive either the stereo mix, or a mix-down from the surround channels generated in the playout chain or at their receiver.

For track layout and allocations, see the relevant Delivery Requirements for File (Section 4.4.1) or Tape (Section 5.4.).

3.1 Stereo Audio Requirements

Stereo tracks must carry sound in the A/B (Left/Right) form.

If mono originated sound is used, it must be recorded as dual mono, so that it may be handled exactly as stereo. It must meet all the stereo standards regarding levels, balance and phase.

3.1.1 Stereo line-up tones

All stereo tracks must use EBU 1kHz tone (left ident). All tones must be sinusoidal, free of distortion and phase coherent between channels.

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

3.1.2 Stereo audio levels and measurement (loudness or volume)

Stereo programme audio levels are currently measured by Peak Programme Meters (PPM). The Maximum or Peak Programme Level must never exceed 8dBs above the programme's reference level.

The following levels, as measured on a PPM meter to BS6840: Part 10 with reference level set at PPM 4, are indicative of typical levels suitable for television, and are given as guidance only.

MATERIAL	NORMAL	PEAKS FULL RANGE
	PPM	PPM
Dialogue	3 - 5	3 - 6
Uncompressed Music	5	2 - 6
Compressed Music (depending on degree of compression)	4	2 - 4
Heavy M & E (gunshots, warfare, aircraft, loud traffic, etc.)	5 - 6	
Background M & E (office/street noise, light mood music etc.)	1 - 3	

Shortly, all programmes must be compliant with EBU recommendation on Loudness EBU R128.

3.1.3 Stereo phase

Stereo programme audio must be capable of mixing down to mono without causing any noticeable phase cancellation.

3.2 Surround Sound Requirements

Surround sound is transmitted as 5.1 format, and will be delivered as discrete tracks, except by agreement with the broadcaster.

3.2.1 Surround line-up tones

All surround tracks must carry BLITS tone, as described in **EBU Technical Paper 3304**. An audio file of BLITS tone may be downloaded from broadcasters' websites.

3.2.2 Surround audio levels and measurement (loudness or volume)

All programmes must also be compliant with EBU recommendation on Loudness EBU R128.

3.3 Sound to Vision Synchronisation

The relative timing of sound to vision should not exhibit any perceptible error. Sound must not lead or lag the vision by more than 5 ms.

3.3.1 Audio / Video sync markers

To assist in maintaining A/V sync through the post-production process, a 'sync plop' may be used. If the delivered programme leader contains one it must meet the following conditions:

- The sync plop must be between timecode 09:59:57:06 and 09:59:57:08
- The audio plop must be 1kHz tone on all tracks at -18dB (standard zero level)
- The duration of the vision flash must be 2 frames to allow it to pass through standards conversion successfully
- The audio plop must be synchronous across all audio PCM audio tracks and with the video flash (within +/- 5 ms)
- If an end sync plop is used it must be no closer than 10 seconds to the end of the programme and comply with the points above.

4 File Delivery Requirements

*The BBC does not yet accept programme delivery by file. Trials are currently underway and there will be further announcements later in 2012. This section is included **FOR INFORMATION ONLY**. If more information is required please email The Delivering Quality Manager, (mailto:dqm@bbc.co.uk) using "File Delivery" in the subject line.*

All programmes delivered as files must comply with all the relevant video and audio requirements above. The files must conform to AMWA Specification AS-11 v1.0 constrained to the UK DPP AS-11 shim.

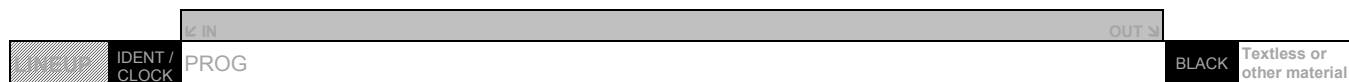
This document covers the requirements for transmission-ready files. There may be additional requirements for programmes intended for further editing, re-versioning or archiving.

The method of delivery to the broadcaster of programme files is to be agreed with the relevant broadcaster. Information on the options is available on the DPP website, <http://www.digitalproductionpartnership.co.uk/>

Each programme should be delivered as a single principal MXF file containing the audio and video, plus a single XML file (see 4.11 Metadata below.) There must be only one programme in each file, although a programme may be either soft or hard-parted within that file, as specified by the broadcaster, according to the diagrams below. Only when agreed in advance with the relevant broadcaster, programmes in several parts may be delivered in more than one file, as shown in the third diagram below.

Single part or soft parted programme

A single part programme will always be played out from start point to end point without interruption. Soft parting is where a programme is provided as a single continuous programme, but the broadcaster may break the transmission of the programme at several points to insert commercials or for other reasons. IN and OUT points for continuous playback only must be included with the delivery metadata; suggested timecodes for breaks should not be included.



Hard - parted programme

A hard-parted programme is billed and scheduled for transmission as a single entity, but is delivered as a single file containing clearly separated parts between which adverts, trails etc will be inserted.



Multi - part programme delivered on multiple files

Where a programme's delivery must be split over more than one file, e.g. due to editing up to transmission.

FILE 1



FILE 2



4.1 **File format**

Each high definition programme must be delivered as a single MXF OP1a file which conforms to the AMWA specification AS-11 v1.0. The AS-11 file must use the 'UK DPP HD shim specification' that describes exactly how the file must be constructed to meet DPP requirements.

The AS-11 file must contain the metadata described in section 4.11 below

Note: AS-11 is an Application Specification published by the Advanced Media Workflow Association (www.amwa.tv) and applies to MXF OP1a files that are intended for delivery of finished programming. MXF provides an extensive 'toolkit' and this specification describes how it must be used to ensure that finished programmes are interoperable when exchanged between production companies, post houses, broadcasters and other organisations in the programme delivery workflow.

Although AS-11 restricts how the MXF file is constructed it does permit some variation to suit location or other specific requirements (differing frame rates between Europe and the USA, for example). The specification therefore includes the concept of a 'shim' that further refines (or constrains) the possible options to a single, carefully controlled set that meets an individual requirement. DPP has defined two AS-11 shims, one for SD and one for HD file delivery in the UK.

A copy of the AS-11 specification is provided at the end of this document. Consult your systems suppliers to ensure they can provide AS-11 compliant files.

4.2 **Video codec**

As described by the AS-11 specification (and the UK DPP HD shim), the video essence in the file must be encoded at a nominal bitrate of 100Mbit/s using the 'AVC Intra' codec. It must use the High 4:2:2 Intra profile@level 4.1. AS-11 gives full technical details of how the file should be constructed.

4.3 **Image format**

HD video must be recorded with an active picture area of 1920 x 1080 pixels.

This must normally be structured as interlaced at 50 fields per second, described as System 2 in EBU-TECH 3299. Material may be originated as progressive scan, but should be delivered as interlaced. Also note the requirement in 2.1.1 above that moving graphics and effects, such as credit rollers, DVE moves etc, are always interlaced.

In some cases, only where specifically required by the broadcaster, material which has been originated entirely progressively, described as System 3 in EBU-TECH 3299, must be delivered as a progressive structured file.

4.4 Audio

The audio must be frame interleaved with the video as described by AS-11. All audio tracks must be encoded as PCM with a sample rate of 48kHz at a depth of 24bits/sample.

4.4.1 Track allocations

HD files must contain a group of either 4 or 16 tracks, with track allocations as on the table below. The EBU R48 or R123 code must be included in the metadata (see 4.11 below) to identify the track allocations.

EBU Reference code	Prog Type	Audio track numbers															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
R48: 2a	Stereo	St. Final Mix L	St. Final Mix R	Silence	Silence												
R123:4b	Stereo with M&E	St. Final Mix L	St. Final Mix R	St. M&E L	St. M&E R												
R123:4c	Stereo with Audio Description	St. Final Mix L	St. Final Mix R	St. Aud Desc L	St. Aud Desc R												
R123:16c Option 1	Stereo, 5.1 and M&E	St. Final Mix L	St. Final Mix R	St. M&E L	St. M&E R	5.1 Final Mix L	5.1 Final Mix R	5.1 Final Mix C	5.1 Final Mix LFE	5.1 Final Mix Ls	5.1 Final Mix Rs	5.1 M&E L	5.1 M&E R	5.1 M&E C	5.1 M&E LFE	5.1 M&E Ls	5.1 M&E Rs
R123:16c Option 2	Stereo, 5.1 and Audio Description	St. L Mix	St. R Mix	St. Aud Desc L	St. Aud Desc R	5.1 Final Mix L	5.1 Final Mix R	5.1 Final Mix C	5.1 Final Mix LFE	5.1 Final Mix Ls	5.1 Final Mix Rs	5.1 M&E L	5.1 M&E R	5.1 M&E C	5.1 M&E LFE	5.1 M&E Ls	5.1 M&E Rs
R123:16d	5.1 Two languages	5.1 Lang 1 L	5.1 Lang 1 R	5.1 Lang 1 C	5.1 Lang 1 LFE	5.1 Lang 1 Ls	5.1 Lang 1 Rs	Other	Other	5.1 Lang 2 L	5.1 Lang 2 R	5.1 Lang 2 C	5.1 Lang 2 LFE	5.1 Lang 2 Ls	5.1 Lang 2 Rs	Other	Other
R123:16f	Three Languages	St. Lang 1 L	St. Lang 1 R	Not Used	Not Used	St. Lang 2 L	St. Lang 2 R	Not Used	Not Used	St. Lang 3 L	St. Lang 3 R	Not Used	Not Used	Other	Other	Other	Other

Note:

- R48:2a, R48:4b, R123:4b, R123:4c, R123:16c must only be used for programmes with single language soundtracks
- R123:16d must only be used for programmes with dual language soundtracks
- R123:16f must only be used for programmes with 3 different language soundtracks

Any unused audio tracks in the 16 track groups above must contain digital silence and encoded as PCM audio.

For compatibility with stereo systems, any audio generated as mono must be presented on two phase-coherent tracks, and flagged as stereo.

Any additional audio tracks required by the broadcaster must be delivered separately as 'B-WAV' files. (See 4.9 below)

The naming conventions used in all related documentation and metadata (see 4.11 below) must match those specified above.

4.5 Programme Layout / Format

All programmes delivered on file or tape must be laid out with elements in the following pattern relative to timecode:

Time-code	Duration	Picture	Sound
09.58.00.00	90"	EBU Bars (100/0/75/0 or 100/0/100/0)	Line-up tone
09.59.30.00	between 27" 00fr and 27" 05fr	Ident Clock or Slate	Silence
09.59.57.06 (optional)	2fr	2 Frames peak white	1 Frame tone (on first video white frame)
09.59.57.06	2" 19fr	Black	Silence
10.00.00.00		Programme	Programme
end of part (multipart programmes)	5"	freeze or 'living hold' after end of part	fade or cut to silence by end of part
end of prog	10"	freeze or 'living hold'	fade or cut to silence
end of prog + 10" (optional)	2fr	2 Frames peak white	1 Frame tone (on first video white frame)

4.5.1 Start and end

Note that it is usual for sound and vision to be automatically cut to air on transmission, so early vision or sound is not normally required. Vision may fade up from black starting at 10.00.00.00 if desired.

All programmes must end with a fade or cut to silence **before** the intended end point. Any fade out or reverb must be allowed for within the programme duration.

Vision freeze or 'living hold' must be held for a further 10" after the end point.

Any other programme elements after the end of the programme should not start less than 1min after end of programme.

4.5.2 The Ident Clock or Slate

A countdown clock or slate clearly displaying the following information must precede the start of programme and any subsequent part:

- Programme I.D. number
- Programme title (and series number if applicable)
- Episode number (if applicable)
- Episode subtitle (if applicable)
- Version (Pre/post watershed etc. if necessary)
- Part number (if applicable)

No technical information may be included. The clock or slate may display telephone contact numbers for the post-production facility and production company, and may display company branding.

Where a moving clock is used, it must provide a clear countdown of at least 20 seconds, including a hand moving in 1 sec steps (i.e. **not** smooth motion) around a circular clock face. Clocks with only digital countdown are not acceptable.

There must be no audio tone or ident over the clock.

4.6 3D Delivery

Programmes delivered for 3D transmission will be subject to additional requirements and agreement with the broadcaster. The appropriate metadata flags should be set as specified in 4.11 below.

4.7 Closed captions (Subtitles)

Closed captions or subtitles must be delivered as a separate file as required by each broadcaster. The separate file must be named identically to the principal MXF file, apart from the filename extension.

4.8 Timecode

Timecode must be as specified in the AMWA AS-11 specification (para 6.3.6). To ensure compatibility with downstream systems it is very important that timecode is inserted in the file exactly as specified.

4.9 Audio only files

Additional audio only files related to a programme, such as Audio Description files, must be supplied as BWF (sometimes called 'B-WAV') files, conforming to the specification in EBU-Tech 3285. File duration and timecode must exactly match the principal MXF file.

4.10 SD Files (Legacy programmes only)

Delivery of standard definition legacy programme files must be by agreement with the broadcaster. Those files must meet the following requirements:

4.10.1 File format

Each standard definition programme must be delivered as a single MXF OP1a file which conforms to the AS-11 specification v1.0 published by AMWA. The AS-11 file must use the 'UK DPP SD shim specification' that describes exactly how the file must be constructed to meet DPP requirements.

The AS-11 file must contain the metadata described in section 4.11 below

4.10.2 Video codec

As described by the AS-11 specification (and the UK DPP SD shim), the video essence in the file must be encoded at a nominal bitrate of 50Mbit/s using the SMPTE ST 0356:2001 D-10 stream specification. This is a constrained version of MPEG-2 4:2:2 P@ML. AS-11 gives full technical details of how the file should be constructed.

4.10.3 Image format

SD video files must be recorded with a picture area of 702 x 576 pixels, where the 702 pixel wide picture must be centred in the active 720 pixel wide line. The picture information may extend the full width of the 720 pixel wide line, providing the image shape is not distorted. In either case there must be an additional 32 lines corresponding to a Vertical Blanking Interval (VBI) making a total of 720 x 608. The VBI must not contain any data or image.

4.10.4 Audio essence

The audio must be frame interleaved with the video as described by AS-11. All audio tracks must be encoded as PCM in an AES stream with a sample rate of 48kHz at a depth of 24bits/sample.

4.11 Metadata

Metadata is the name for all the information which is not the audio or video essence, but which is required to ensure that contents of the file can be identified correctly, and can be played back or converted in various systems. The metadata required is specified below, and must be delivered both within the principal file, and in an additional XML file (a type of text file which organises data so that it can be read in a standard way by computer systems, and which can be considered equivalent to a paper VTRR delivered with a tape.) For developers, the metadata XML schema will be made available.

Metadata can usefully be divided into two categories:

Structural

Describes the technical format of the file itself, the audio and video essences, and the other metadata included with the file. Structural metadata is usually added automatically by systems which construct the file, and are relied on by systems which decode the file. It will include information about the compression codecs used and which audio tracks are present.

Descriptive

Descriptive metadata is usually added manually by the producer of the file. This includes information which will be read by the users of the file in order to identify the material and use the appropriate parts for further operations. It will include the titles and ID numbers for the programme, and the allocations of the audio tracks present.

4.11.1 Filenames

Filenames for the MXF and XML files must be supplied as specified by each broadcaster, and should contain the relevant programme identifier information. Filenames must be in upper case, with filename extensions in lowercase. Allowable characters are 'A-Z', '0-9', '-' & '_'.

The Broadcaster specific naming convention is shown on page 1.

4.11.2 UK DPP Metadata application

Metadata should initially be generated by the programme supplier using the **UK DPP Metadata application**, which will be available for download from the DPP website. This is an application which will allow entry and insertion of the metadata into the MXF programme file. It will also generate the required XML file, and a checksum which is used to verify delivery to the broadcaster.

These must be done after all post-production is complete and the file is ready for delivery to the broadcaster, as any changes whatsoever to the file will invalidate the metadata and cause the file to be rejected.

The XML file must be named identically, apart from the filename extension, to the principal MXF file.

4.11.3 Delivery Requirements in MXF

Metadata within the principal MXF file must be as described by the AMWA AS-11 specification with DPP shims, and must correctly reflect the material contained in the file.

Descriptive metadata must be included in the relevant metadata tracks within the file, and must be identical to that in the XML file.

4.11.4 Delivery requirements in XML

The XML file must be delivered with the MXF file according to the delivery method required by each broadcaster.

The metadata included in the MXF and XML files will be identical except that the XML contains the following additional fields, which are generated and filled by the UK DPP Metadata application:

Associated Media Filename

Media Checksum Type

Media Checksum Value

Part SOM

Part Duration

4.11.5 Required Metadata

The metadata required is detailed in the table below. The mandatory column indicates which fields must be entered before delivery of the file. The entries highlighted as **Yes** and bold in the Mandatory column should be entered by a production or technical representative. The remaining mandatory fields which are not highlighted will be derived by the DPP Metadata application from the MXF file structure.

More comprehensive details on these fields and allowable values can be found in the associated DPP Metadata spread sheet v10.

Field Name	Definition and usage	Mandatory	Typical Values
------------	----------------------	-----------	----------------

Editorial			
Series Title	The final title of a grouping of publishable assets with shared identification and branding linked by common characters, subject matter, style or story. <ul style="list-style-type: none"> This could be a series, serial or themed grouping. May include a series or season number, or a year. One off programme titles must also be entered in this field 	Yes	Coronation Street- Series 52 (2011)
Programme Title	The final title of a unique asset. <ul style="list-style-type: none"> One off programmes must repeat the title used as the Series Title. 	Yes	7507
Episode Title / Episode No	The final episode title used to identify an individual episode or an editorially distinct version, and / or a number representing its transmission order within the series.	Yes	7507 International Version
Production Number	A unique number used to identify an individual Programme Version. <ul style="list-style-type: none"> Also known as Clock Number, Programme number or Material ID. The commissioning broadcaster will inform you of their required number. 	Yes	DRIB111P/01
Synopsis	A brief descriptive summary of the content	No	
Originator	Company responsible for creating the programme. <ul style="list-style-type: none"> Programmes may also be delivered via a distributor - see below. 	Yes	Angst Productions
Copyright Year	Year in which the production was completed	Yes	2011
Other Identifier	Usually a programme-specific code used by broadcasters for rights management or re-broadcast purposes, e.g. ISAN number, contract number, costing number or UMID.	No	
Other Identifier Type	Description of Other Identifier, e.g. ISAN number, costing number or contract number	No	ISAN number
Genre	A genre categorising the whole asset.	No	Comedy
Distributor	The name of the person or company providing the content, if this is not the originator.	No	Sony Pictures

Technical			
Shim name	The name of the AS-11 shim specification to which the associated MXF file conforms.	Yes	UK DPP HD Rev.1.0 UK DPP SD Rev 1.0

Video			
Video Bit Rate	Nominal video bit rate in bits per second	Yes	100000000
Video Codec	Name of the video codec	Yes	AVC-Intra 100 D10 50
Video Codec Parameters	The detailed codec profile and level information used to create the file	Yes	
Picture Format	This describes the picture structure, using pre-defined codes.	Yes	576i 50 4:3 1080i 50 16:9
AFD	This will be used in conjunction with the picture ratio field to determine the complete aspect ratio of the asset.	Yes	9 / 10 / 14
Picture ratio	Used in addition to the AFD field to further determine the complete aspect ratio of the asset, e.g. where the image is letterboxed or pillarboxed.	Yes	2.35:1 1.85:1 1.78:1 1.56:1 1.33:1
3D	Whether the programme is made for 3D transmission.	Yes	Yes / No
3D type	This describes the type of 3D being delivered. A formal system of 3D type codes is being developed.	No	Left/Right Side by side
Product Placement	To be set if the content contains product placement.	No	Yes / No
FPA Pass	Status of any flashing and pattern analyser test carried out on the material for PSE.	Yes	Yes No Not tested
FPA Manufacturer	Product used to carry out the PSE analysis.	No	Harding FPA BPR Gordon
FPA Version	Version of algorithm used to carry out the PSE analysis.	No	FPA V2.5 FPA V3.4 Gordon V1.0.0
Video Comments	The comments which illustrate the subjective quality and any known artefacts or defects (inc. intentional) within the video content discovered during production / post production / or any subsequent technical QC/Review process.	No	

Audio			
Audio Sampling Frequency	The sampling frequency used in kHz (must be the same for all audio tracks)	Yes	48.000
Audio bit depth	No. of quantisation bits in the audio signal. (must be the same for all audio tracks)	Yes	24
Audio Codec parameters	The audio codec employed for the creation of the file.	Yes	PCM
Audio Track Layout	Code in accordance with EBU R123 and R48 <ul style="list-style-type: none"> The requirement is to always have 16 tracks (4 for SD) and digital silence must be encoded on tracks not used for audio 	Yes	4a, 4b, 4c, 16d, 16f
Primary Audio Language	Main language used on primary audio tracks <ul style="list-style-type: none"> Use ISO 639.2 values - three letter codes 	Yes	none, eng, ita, wel etc.
Secondary Audio Language	Main language used on secondary audio tracks <ul style="list-style-type: none"> Use ISO 639.2 values - three letter codes 	Yes	none, eng, ita, wel etc.
Tertiary Audio Language	Main language used on tertiary audio tracks <ul style="list-style-type: none"> Use ISO 639.2 values - three letter codes 	Yes	none, eng, ita, wel etc.
Compliant Audio Standard	States the audio standard which defines the audio track layout	Yes	R48 R123
Audio Comments	QC comments to illustrate subjective quality and any known artefacts or defects	No	Wide dynamic range in places

Timecodes			
Line up start	Timecode for start of line up test signals.	Yes	09:58:00:00
Ident Clock Start	Timecode for start of countdown clock or static slate.	Yes	09:59:30:00
<i>Repeating Group: Timecode</i>			
Part Number	Identifier for the part no.	Yes	1/1, 1/3, 2/3, 3/3

Part Total	The total number of parts in the programme. (May be across more than one file)	Yes	1, 3, 6
Part SOM	SMPTE timecode for first frame of the part number. To be included in XML file only.	Yes	10:00:00:00
Part Duration	SMPTE timecode for the duration of the part number. To be included in XML file only.	Yes	00:08:22:00
<i>End of repeating group: Timecode</i>			
Total Number of Parts	The total no. of 'hard' parts contained within the file. (May not be the total for the programme, if on more than one file)	Yes	1,3
Total Programme duration	Total of all part durations	Yes	00:57:22:00

Access Services

Audio Description Present	Whether the programme contains an Audio Description soundtrack	Yes	Yes / No
Audio Description Type	Type of Audio Description soundtrack	Yes	Control Track and Data AD Mix
Closed Captions	Whether the programme contains closed captions.	Yes	Yes / No
Closed Captions Type	Type of closed captions used	No	Hard of Hearing, Translation
Closed Captions Language	Language used in closed captions • Use ISO 639.2 values - three letter codes	No	eng, ita, wel etc.
Open Captions	Whether open captions are present	Yes	Yes / No
Open Captions Type	Type of open captions	Yes	Hard of Hearing, Translation
Open Captions Language	Language used in open captions • Use ISO 639.2 values - three letter codes	No	eng, ita, wel etc.
Signing Present	Whether sign language interpreter is in vision	Yes	Yes / No / Signer only
Sign Language	The language used by a sign language interpreter e.g. BSL (British Sign Language) / Makaton	No	BSL / Makaton

Additional

Completion Date	Date of completion of the edit before delivery of the programme	Yes	15/12/2010
Textless Elements Exist	Whether clean text less elements are present after the main programme	No	Yes / No
Programme Has Text	Used to identify if the main programme is free of any text.	No	Yes / No
Programme text language	Use ISO 639.2 values	No	eng, ita, wel etc.
Associated media filename	To be included in XML file only	Yes	12345_001_001_V1.mxf
Media Checksum type	To be included in XML file only	Yes	MD5 / SHA-1
Media Checksum value	To be included in XML file only.	Yes	2fd4e1c6 7a2d28fc ed849ee1 bb76e739 1b93eb12

Contact Information

Contact Email	The contact details for the person in the company responsible for delivering the completed commission.	Yes	
Contact telephone no.	The contact telephone number for the person in the company responsible for delivering the completed commission.	Yes	

5 Tape Delivery Requirements

Note that programmes delivered on tape must comply with all the requirements of this document other than those for file or live delivery.

5.1 Videotape recording

5.1.1 Tape format

HDCam SR is the only format acceptable for HD tape delivery. The recording must be fully compliant with the manufacturer's technical specification thereby ensuring format compatibility.

Tapes must be clean, new stock, in the manufacturer's case, protected by suitable packaging and clearly labelled. Note that flock filled padded envelopes are not suitable since a failure in the packaging can lead to contamination of the tape. All tapes must be supplied with the record lockout "on" and fully rewind. It is recommended to "double rewind" before shipping to ensure an even tape pack. Labels must be fixed to both the cassette case and cassette and must not obscure the spools or obstruct the flap mechanism.

5.1.2 'i' and 'psf' Flags

All programmes must be delivered with flags set to 'i' throughout the programme, even if the bulk of the programme has been originated progressively. This is because some equipment introduces processing to 'psf' flagged material which degrades some material. Broadcasters may accept certain material with 'psf' flags entirely at their discretion.

5.1.3 Time-code

LTC and ancillary timecode (referred to as VITC on HDCam SR VTRs) must be identical, contiguous and continuous throughout the recording.

It is recommended that assemble edits should not be used between the start of the clock and the end of the programme, as they may introduce LTC discontinuities.

5.2 Programme Layout / Format

All programmes delivered on file or tape must be laid out with elements in the following pattern relative to timecode:

Time-code	Duration	Picture	Sound
09.58.00.00	90"	EBU Bars (100/0/75/0 or 100/0/100/0)	Line-up tone
09.59.30.00	between 27" 00fr and 27" 05fr	Ident Clock	Silence
09.59.57.06 (optional)	2fr	2 Frames peak white	1 Frame tone (on first video white frame)
09.59.57.06	2" 19fr	Black	Silence
10.00.00.00		Programme	Programme
end of part (multipart programmes)	5"	freeze or 'living hold' after end of part	fade or cut to silence by end of part
end of prog	10"	freeze or 'living hold'	fade or cut to silence
end of prog + 10" (optional)	2fr	2 Frames peak white	1 Frame tone (on first video white frame)

5.2.1 Start and end

Note that it is usual for sound and vision to be automatically cut to air on transmission, so early vision or sound is not normally required. Vision may fade up from black starting at 10.00.00.00 if desired.

All programmes must end with a fade or cut to silence **before** the intended end point. Any fade out or reverb must be allowed for within the programme duration.

Vision freeze or 'living hold' must be held for a further 10" after the end point.

Any other programme elements after the end of the programme should not start less than 1min after end of programme.

5.2.2 Programmes longer than a single tape

If a programme must be delivered on two or more tapes because it is longer than the capacity of a single HDCam SR tape, the second part must begin at the next whole hour timecode after the end of the first part - e.g. 12:00:00:00 or 13:00:00:00 with appropriate continuous timecode throughout the line-up and clock sequence above.

5.2.3 Compilation tapes

Where a broadcaster has agreed to accept short programmes on a compilation tape, there must be at least 15" of black and silence between the end of one programme and the start of the clock for the following programme. (i.e. after the 10" hold)

Each programme must be recorded to begin at a 'full minute' - i.e. Timecode HH:MM:00:00

5.2.4 Ad breaks

For hard-parted programmes, each part must be preceded by a countdown clock as below.

There must be at least 15" of black and silence between the end of one part and the start of the clock for the following part. (i.e. after the 10" freeze)

Each part must be recorded to begin at a 'full minute' - i.e. Timecode HH:MM:00:00

5.2.5 The Ident Clock

A countdown clock clearly displaying the following information must precede the start of programme and any subsequent part:

- Programme I.D. number
- Programme title (and series number if applicable)
- Episode number (if applicable)
- Episode subtitle (if applicable)
- Version (Pre/post watershed etc. if necessary)
- Part number (if applicable)

No technical information may be included. This means HD format, tape format, aspect ratio, audio track allocations, safe area etc. Duration should not be included. The clock may display telephone contact numbers for the post-production facility and production company, and may display company branding.

The clock must provide a clear countdown of at least 20 seconds, including a hand moving in 1 sec steps (i.e. **not** smooth motion) around a circular clock face. Clocks with only digital countdown are not acceptable.

There must be no audio tone or ident over the clock.

5.3 Paperwork

Each tape must have the following information on its box and cassette labels and on a VTRR (videotape Recording Report) included in its box:

- Programme I.D. number
- Programme title (and series number if applicable)
- Episode number (if applicable)
- Episode subtitle (if applicable)
- Version (Pre/post watershed etc. if necessary)
-

In addition, the VTRR must include further information as specified by the broadcaster, which will include:

- Log of tape contents by timecode
- Editor's technical comments
- Audio track allocation
- Confirmation of PSE test pass

5.4 Audio Track layout

Audio must be delivered with track layouts as specified by the broadcaster, and will be one of the options available on the following table.

Channel 4 has a modification to this track layout for **tape** delivered HD programmes with surround sound. This is to maintain compatibility with archive programmes

AES	Track	Format	Content Options		
1	1	Digi/SR/SDI	Main Stereo L		
	2	Digi/SR/SDI	Main Stereo R		
2	3	Digi/SR/SDI	M&E Stereo L	2 nd Language L (Digi)	Main Dolby E*
	4	Digi/SR/SDI	M&E Stereo R	2 nd Language R (Digi)	
3	5	SR/SDI	Main Front L	M&E Dolby E*	
	6	SR/SDI	Main Front R		
4	7	SR/SDI	Main Centre		
	8	SR/SDI	Main LFE		
5	9	SR/SDI	Main Surround L		
	10	SR/SDI	Main Surround R		
6	11	SR/SDI	M&E Front L	2 nd Language L (SR)	AD L (SR Only)
	12	SR/SDI	M&E Front R	2 nd Language R (SR)	AD R (SR Only)
7	13	SDI	M&E Centre		
	14	SDI	M&E LFE		
8	15	SDI	M&E Surround L		
	16	SDI	M&E Surround R		

Channel 4 Tape Delivery – HD programmes with Surround Sound

AES	Track	Format	Content Options		
1	1	SR	Main Stereo L		
	2	SR	Main Stereo R		
2	3	SR	Main Front L		
	4	SR	Main Front R		
3	5	SR	Main Centre		
	6	SR	Main LFE		
4	7	SR	Main Surround L		
	8	SR	Main Surround R		
5	9	SR	Main Dolby E*	If Required	
	10	SR		If Required	
6	11	SR	AD L	M&E Stereo L	If Required
	12	SR	AD R	M&E Stereo R	If Required

* Due to legacy issues there will be some variation between broadcasters for tape delivered programmes especially the position of Dolby E (if it is required). Dolby E will be at the request of the broadcaster.

6 Live Delivery

6.1 Responsibilities of the Production

The production should have a technical contact available as far as is possible in advance of the programme, to allow the broadcaster to confirm technical planning, and for dealing with any queries.

There must be a technical contact available at the source during the programme itself and throughout the line-up period.

The technical contact for the programme is responsible for making sure;

- The programme meets the general overall Technical Standards outlined in Sections 2 and 3 of this document.
- The cue and communications circuits are adequate and fully operational.
- The video and audio signals are continuous and stable throughout the broadcast period.
- That resilience levels meet the broadcaster's requirements.
- That the signal leaving their site and incoming to the broadcaster can be passed through the playout and transmission chain without the need for further technical intervention unless previously agreed & using pre-booked facilities (excludes any synchronisation required at the broadcaster's point of delivery).
- That there is sufficient monitoring in place to confirm the signal quality from the location to the point of delivery.
- That any and all sources are stable and synchronous at all times.
- That pre-recorded inserts are the same aspect ratio, resolution and match the quality of the live material.
- Line-up signals are available at least 30 minutes prior to the programme start time although it is strongly recommended that contact on the day is made well in advance of line-up and all possible links are tested as soon as technically possible.

6.2 Definitions

A **Live programme** is any programme that is not delivered by tape or by file, and requires some form of communications link for delivery.

These programmes will fall under the following sub-categories:

- **Live** – The programme output from the remote location goes straight to air via the broadcaster's play-out facility.
- **Compliance Live** - As Live but a short delay exists in the signal path to allow for intervention by the broadcaster for compliance or legal reasons.
- **As Live** – The programme is produced on-site as if it were live, but the output recorded and played-out at a delayed time (or date) in the schedule. Recording and Payout may occur at the production site, or the broadcaster's play-out facility.
- **Late Delivery** – The programme is produced and edited very close to its scheduled time, and as such, tape or file delivery to the broadcaster's play-out facility is not practical. Delivery is via a link or permanent line from another facility.

Point of delivery is the location or building to which the live programme is commissioned to deliver, usually the broadcaster's play-out or central routing facility.

Permanent Link is any dedicated path from the location to the point of delivery that uses land-based circuits that are permanently assigned for use by the broadcaster.

Contribution Link is any path from the location to the point of delivery that is not a dedicated or permanent link, such as a bookable circuit, a satellite feed, or microwave link.

Resilience Level is the level of resilience (back-up) that a live programme is required to have. The level of resilience is a requirement of the individual Broadcaster, and may vary depending upon the production.

6.3 Link Specifications

The quality of the link from the remote location to the broadcaster's point of delivery has a major effect on the quality of the programme seen by the audience. The content, genre and workflow requirements of the programme are the primary factors that determine the bandwidth of the link.

For instance, programmes that feed into post production via the link will usually require a higher link specification than programmes that are completed on site, where the link is only used for transmission. The same can apply to programmes that are archived **via a link**.

Link specifications are always a trade-off between quality, cost and available bandwidth. However the link should never be considered in isolation. So in addition to the type and settings of the link encoder, the use of location radio cameras, and the transmission compression used by the broadcaster all have to be considered. Where there is any doubt, programme production companies should ask their link provider to speak to the broadcaster's technical contacts.

In all instances, the delivered picture format shall be:

1920 pixels wide x 1080 pixels high

16:9 Aspect ratio

25 frames per second, delivered as 50 interlaced fields per second.*

*Programmes may use cameras and inserts using the 25 frame progressive option (1080p/25) delivered in psf mode - see section 2.1.3.

Any external reference source at a remote site should be locked to GPS.

The **types** of links used for any Live HD programmes shall fall into the following categories:

6.3.1 Uncompressed via Optical Fibre:

1.485 Gb/s HD-SDI connection, SMPTE 292M, [often known as 1.5Gbs HD-SDI]. This remains uncompressed along its route to the point of delivery.

Wherever possible, practical, or cost-effective, programmes should use an uncompressed 1.485Gbs HD-SDI connection.

In all instances where the signal can be carried uncompressed, stereo audio for the programme should be carried as discrete linear PCM (unless Dolby E is requested by the broadcaster).

6.3.2 Compressed via Optical Fibre:

Links that provide a 1.5Gbs HD-SDI connection at the point of delivery, but which use compression/decompression along their route:

Locations with access to already-established SD-SDI fibre connections (such as STM-1 SDH fibres) should use compression codecs that allow HD-SDI to be transferred via SD-SDI (e.g. JPEG2000, Dirac, etc.). This is a well-established method in the UK.

Locations with access to other single hop fibre connections should use compression codecs that use nominal video bitrates of:

- **JPEG2000 - 140 Mbps.**
- **MPEG4, H.264, Long GOP 4:2:2 – 45 Mbps.**
- **MPEG2, Long GOP, 4:2:2 – 60 Mbps.**

6.3.3 Compressed via Satellite Link:

Where fibre is not available, links via satellite may be used. The following are permissible and achievable largely by using DVB-S2 modulation schemes. Modulation schemes should be carefully chosen so that the increase in transponder capacity (in MHz) required to deliver the optimal video bitrate (in Mbps) does not come at the cost of a decreased robustness of signal.

Single-hop satellite links should have a nominal video bitrate of:

- **45Mbps MPEG4 H.264, Long GOP 4:2:2 or**
- **60Mbps MPEG2, Long GOP 4:2:2**

Codec requirements are listed in Appendix 1

Where the link directly feeds a second compressed link, the signal should not be decoded back to baseband but passed to the second link as a transport stream.

Stereo audio should be carried as MPEG1 Layer II (stereo) at 384kbs. Multi-channel audio may have to be carried as Dolby E. (see Audio Track Layout Appendix 2)

6.3.4 Compressed via Microwave Point-to-Point Link:

In some locations a point-to-point microwave link may be used as an alternative to satellite links. Microwave links can be used for short hops from the location to a fixed fibre link point or where a satellite up-link has to be remote from the production location. Where microwave links are used to feed a second compressed link, the signal should not be decoded back to baseband but passed to the second link as a transport stream.

The payload on the link should have a nominal video bitrate of:

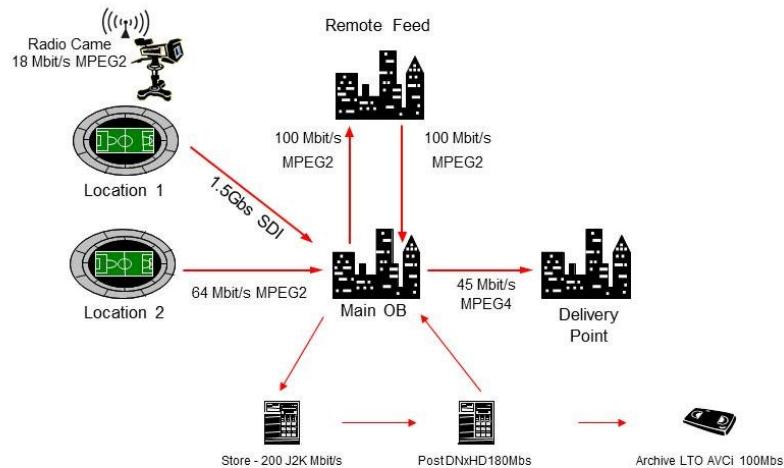
- **45Mbps MPEG4, H.264, Long GOP 4:2:2, or**
- **60Mbps MPEG2, Long GOP 4:2:2**

Please speak to the broadcaster about multi-hop microwave links or combination microwave/satellite links

Stereo audio should be carried as MPEG1 Layer II (stereo) at 384kbs. Multi-channel audio may have to be carried as Dolby-E. (see Audio Track Layout Appendix 2)

6.4 Picture Quality & Bit Rates (concatenation issues)

Different devices and contribution links use different compression codecs. A “codec map” must be produced for the broadcaster listing all codecs (including the bit rates) through which a programme signal passes before arriving at the point of delivery.



Example of a codec map

This means you must produce a list of all the compression rates used along the route of the signal's delivery, even if only one coder/decoder pair is used.

Pictures viewed at the point of delivery should be free from visible compression artefacts when viewed on a broadcast style flat screen 40-inch display at normal viewing distance (3H, where H is the height of the visible screen-size).

To allow further processing (recording, editing etc.) especially if the signal is comprised of any additional contribution links, the highest bit rate possible must be used.

Maintaining as high a bit rate as possible throughout the production and playout process is especially pertinent when considering that the signal has to then undergo further compression and decompression in the transmission chain delivering the final product to the viewer.

6.5 Standards Conversion

Only very high quality motion compensation (sometimes known as Motion Predictive or Motion Vector) standards converters can be used. Where a programme requiring frame-rate & standards conversion is supplied via a contribution link of less than 100Mbps, the standards conversion must be done before the contribution link.

6.6 Standard Definition

In some instances, some contributions may have to be delivered in Standard Definition by exception.

Where Compressed Standard Definition contribution is used, it should have a video bit rate of at least 25Mbps MPEG2 Long GOP. The GOP structure and encoder setup is the same as the HD requirements in Appendix 1.

Standard Definition video is 702 x 576 pixels, and the 702 pixel-wide picture must be centred in the active 720 pixel-wide line. This leaves 9 pixels to the left and 9 pixels to the right unused. (This is a result of a legacy inherited from PAL analogue TV signals).

The picture information may extend the full width of the 720 pixel wide line, providing the image shape is not distorted.

6.7 Audio

6.7.1 Stereo Audio

In all instances where the signal can be carried uncompressed, stereo audio for the programme should be carried as discrete linear PCM. If the signal must be carried in a compressed format, Stereo audio should be carried as MPEG1 Layer II (stereo) at 384kbs.

6.7.2 Multi-channel Audio (when required):

Multichannel (surround sound) should normally be discrete PCM where there is sufficient bandwidth available in the link to the point of delivery.

Dolby E should be used for multi-channel audio when bandwidth is limited or at the request of the broadcaster. Settings for Dolby E encoding are in Appendix 3

Use of the Low Frequency Effect Channel (LFE) channel is optional. Use of the LFE channel should comply with Recommendation ITU-R BS.775.

There should be no sample timing differences between the individual channels of a surround signal.

Each stereo pair or multi-channel group (the 6 audio tracks of a surround sound signal) must be transported in a single SMPTE ST.302 PES in order to maintain the phase relationship between channels.

6.7.3 Audio Track Allocation

It is difficult to prescribe the exact audio track layout for all live programmes. International, host broadcaster, local requirements and link bandwidth may vary the audio layout requirements.

All broadcasters are working towards the standard audio layout below however in many situations this layout is not yet implemented due to legacy requirements. **Please see Appendix 2 for the current requirements of each broadcaster.**

AES	Track	PROPOSED Standard
1	1	Main Stereo L
	2	Main Stereo R
2	3	M&E Stereo L
	4	M&E Stereo R
3	5	Main Front L
	6	Main Front R
4	7	Main Centre
	8	Main LFE
5	9	Main Surround L
	10	Main Surround R
6	11	M&E Front L
	12	M&E Front R
7	13	M&E Centre
	14	M&E LFE
8	15	M&E Surround L
	16	M&E Surround R

6.7.4 AV Synchronisation

AV sync should be checked via the audio desk (not just the links truck in the case of OBs) at least once a day.

Any professional AV sync equipment is acceptable but systems that can be used across all audio tracks (up to 16) simultaneously are preferred.

AV sync timing through the audio desk to the point of delivery should be $\pm 5\text{ms}$.

AV sync timing should also be within $\pm 5\text{ms}$ from any remote sources into a studio or an OB including non-live inserts from tape or file.

Any external reference source at a remote site should be locked to GPS.

6.7.5 AV Synchronisation - Radio Link Cameras

Radio link cameras are always a compromise between delay and image quality. Image quality should always be the overriding consideration. Where radio and cabled cameras are mixed covering a location with lip-sync, and it is not possible to delay the audio, the radio camera should not have a delay greater than 40ms compared to the cable cameras. The director is responsible for making sure any visible lip-sync issues are kept to a minimum.

Where all cameras use radio links, the audio must be delayed to match the video. To minimise the issues caused by open talkback and presenter switched talkback the AV sync can be $\pm 20\text{ms}$

6.8 TOD timecode

Programmes should use local time of day timecode pertinent to the venue and this should be carried in the VANC unless specifically requested by the broadcaster.

6.9 Cue and Communication

A dedicated, stand-alone technical telephone number must be provided and distributed well in advance of the transmission. This should be a fixed landline telephone.

For direct contributions into network transmissions, a feed of the source production talk-back will be required at the playout facility. A dedicated, land-based, "4-wire" circuit offers flexibility and should be considered the minimum requirement.

Talk-back (open or keyed, depending on the broadcaster's choice) must be offered to playout for the duration of the programme and should be available from thirty minutes before the start of transmission.

It is preferable to arrange instantaneous or low-latency video/audio return or cue paths to sources. Return audio or video cue circuits of the programme may be necessary for programmes that require two-way communication between centres. It is important to consider the latency and reliability of the cue path especially when the programme has live interviews.

Due to the latency of a Digital Terrestrial or Digital Satellite off-air signal (up to 6 seconds), off-air cueing should be considered as a last resort and for contingency purposes only.

It is acceptable to use mobile telephones for communication during the line-up period but during transmission use of mobile phones should be agreed in advance and they should not be relied on as the only means of communication.

6.10 Photosensitive Epilepsy (PSE) and Live Programmes

Live programmes must meet the Ofcom PSE requirements (see section 2.9 of this document).

Programmes must be checked during rehearsals and every effort made to meet the requirements before transmission.

If the situation is not under the control of production or there is any chance a programme might breach the requirements, it is the responsibility of the programme's producer to arrange for a warning announcement or caption to be used before the transmission begins.

(Note – the Producer of the programme as well as the Broadcaster may be liable for any action taken by Ofcom or a member of the public, for a breach of these requirements).

6.11 Ancillary Data (VANC)

Where required the following lines must be used for ancillary data

Line	Data	Comments
9	SMPTE ST 2020	Main use: Surround sound metadata
11	SMPTE ST2016	Main use: AFD
12	OP47	Subtitles if required

These lines should not be used for other data unless agreed by the broadcaster for a specific event or programme.

6.12 UPS & Generator Provision

Unless otherwise agreed, Production companies should ensure OB suppliers, or remote locations, have UPS/Generator provision so the live programme transmission can be maintained in the event of any loss of power at the remote location. Critical systems should always be protected by UPS and if generator power is used it should be a dual system which allows synchronous changeover. This provision should be fully tested prior to transmission to ensure the functionality is fit for purpose.

7 3D (Interim for Live and Tape only)

7.1 3D General

The BBC is currently undertaking limited trials of 3D. These guidelines are available to give general guidance to any programme taking part in trials but they will be subject to change as experience and knowledge grows.

All 3D programmes must comply with the technical specifications in the joint broadcaster high Definition delivery document attached (sections 1 to 4.2).

All 3D programmes will be delivered on HDCam SR “dual stream” tape as two full resolution images at 440Mbs Left and 440Mbs Right eye images *AND* a Side by Side transmission master on HDCam SR tape.

3D programmes *must* be supplied with surround sound audio as well as stereo

The Master tapes must follow the audio track layout in section 3

Images should have no vertical displacement relative to each other and must be timed to within 10ms of each other.

There should be no horizontal timing shift between the Left and Right signal streams.

7.2 3D Live

In addition to the requirements of section 4.5 (Live Delivery)

Programmes should be delivered by two synchronous (MPEG-2) links where each signal meets the standards recommended in EBU R132. Each link video should be at least 60 Mbit/s for a single hop, and 85 Mbit/s for multiple hops. Quality loss should always be less than 6% with the most critical content ('high entropy content').

It is acceptable where no further processing is required, that a 3DTV programme may be pre-processed into the emission standard e.g. Side by Side before the contribution link. This is advisable only if it is not clear that the contribution path can maintain the timing and quality of two independent links. It is assumed all post production processing and archive recordings will at the source.

In this case Side by Side processing should be via a linear sub-sampling of the YCrCb alternate horizontal pixels (e.g. 0,2,4,6...1918).

7.3 3D Video Requirements

3D programmes must contain at least 75% 3D content that meets the HD full specifications.

Any material that has been “dimension converted” to simulate 3D will be treated as part of the 25% 2D allowance.

Each eye (signal) must be acquired at full resolution (1920 x 1080) at either 25 progressive frames per second or 25 interlace frames per second (1080p/25 or 1080i/25)

Compressed recording formats must be 1920 x 1080 4:2:2 10bit

Recommended studio or OB recording formats

- HDCamSR tape running in dual 440Mbs mode
- Twin AVC-I 100Mbs (synchronous timecode)
- Twin DNxHD 185 (synchronous timecode)

Note: This requirement will change when 3D or 3G (1080p/50) codecs such as AVC Ultra, SR-Lite DNxHD at 360Mbs, etc. become viable.

Recommended PSC recording formats must meet the standards in the HD delivery document i.e.

- 2 x 50Mbs intra-frame 4:2:2
- 2 x 100Mbs inter-frame 4:2:2

7.4 3D Comfort

3D images should be comfortable to watch for the duration of the programme and must not cause a viewer in a normal (living room) environment discomfort from excessive negative parallax.

In general the point of convergence for the main subject of interest should be kept between 1% negative (out of the screen) to 2% positive (into the screen) parallax. These are *not* absolute boundaries but more guidance for comfortable viewing.

Edge violation (images out of the screen plane that cross the edge of screen boundary) and Divergent Parallax (trying to make the eyes diverge!) should be avoided if possible.

7.5 3D Captions and Subtitles

For some time there will be a separate 2D delivery therefore burnt in captions can be 16:9 safe (not 14:9).

Captions should be carefully placed on the z-axis and far enough forward of the image to avoid violation BUT not too far forward of the 1% recommendation

Guidance on 3D subtitling will be added at a later date

7.6 3D PSE Requirements

In the absence of any clear directives, 3D programmes must comply with the Ofcom requirements (section 2.9). A Harding FPA v2.54 should be used to test either the left or the right full frame image, The FPA should not be used to test a processed e.g. Side by Side image.

Appendix 1 – Encoders used for Live Delivery – Additional Requirements

MPEG 2 Encoders – additional requirements

- GOP (Group-of-Pictures) should be 15 frames. This represents a good balance between coding efficiency (requiring long GOPs) and error resilience (requiring short GOPs).
- B-frames should not be used as these are typically coded at a lower quality than I and P frames and will lead to poor picture quality in the home. Note: not all encoders on the market allow B-Frames to be disabled, so please check before accepting the unit.
- GOP structure should be **/IPPPPPPPPPPPPPPP/**
- 4:2:2 colour subsampling should be used to avoid colour smearing when concatenated with the 4:2:0 emission coders used for broadcast transmission.
- “**Intra-DC precision**” should be set to 11 bits. 11 bits are required in the DCT (discrete cosine transform) domain in order to accurately convey an 8 bit video signal. This is not normally a user setting but should be checked with an analyser before accepting the encoder.

MPEG 4 Encoders – additional requirements

MPEG4 encoder testing is still on-going but the following is recommended:

- 10-bit video is preferred. There is no bitrate penalty.
- GOP length should be a minimum of 15, in line with MPEG2
- Tests suggest MPEG4 encoders do not suffer from the poor quality B-frames. Currently B- and hierarchical B-frames are permitted.
- 4:2:2 colour subsampling is preferred but 4:2:0 may be acceptable whilst encoder technology is developing.

Appendix 2 – Audio Track Layout for Live Delivery

This table gives the current legacy layout for primary audio tracks for each broadcaster, where they are different from the proposed future layout.

This table is subject to change.

AES	Track	PROPOSED	Current (legacy) layout - differences from proposed layout				
			BBC	ITV	C4	Five	Sky
				contact broadcaster		contact broadcaster	contact broadcaster
1	1	Main Stereo L	Y				
	2	Main Stereo R	Y				
2	3	M&E Stereo L	Main Dolby E*		Main Dolby E*		
	4	M&E Stereo R					
3	5	Main Front L	Not Required for transmission but can be used as required by the programme				
	6	Main Front R					
4	7	Main Centre					
	8	Main LFE					
5	9	Main Surround L					
	10	Main Surround R					
6	11	M&E Front L					
	12	M&E Front R					
7	13	M&E Centre					
	14	M&E LFE					
8	15	M&E Surround L					
	16	M&E Surround R					

*If required by the Broadcaster, Main Dolby E will be distributed on AES Pair 2 (Tracks 3 and 4)

Appendix 3 - Dolby E

Dolby DP571 (or equivalent Dolby E encoder)

- The first DP571 in the chain must be set to "internal" metadata source.
- Metadata from an external source cannot be edited in a DP571 - you have to set the metadata source to internal and rebuild it from scratch if this is required.
- A Dolby E stream uses 75Ω-unbalanced connections - if the loop-through connectors on a DP571 are not feeding another device they should be terminated.
- The most important DP571 setup parameters to check are:
 - Program Config (should be 5.1 + 2 for most things).
 - The Frame Rate (The factory default is 29.97fps, BBC default is 25fps).
 - The Bit Depth (should be 20 bits)
 - The Dolby E Metadata Source (internal or external)
 - Dolby D metadata is enabled (note – if this setting appears in the DP571 menu the unit is running out of date firmware and *MUST* be updated).
- The "Bit Depth" setting does not refer to the number of bits used by the audio signals but the number of bits available in the AES-3 channel used to transmit the Dolby E signal. Six channels of audio can be transmitted down a 16bit link while 8 channels must be transmitted down a 20bit link.
- The gain of a Dolby E stream must not be changed - it will break.
- A Dolby E stream suffers one frame of delay on each encode and decode. The UK Broadcaster standard is to align the stream to be "sync encoded" at each point in the chain.
- For tape delivery the stream must be laid so that the encoded audio is in sync with the video and any stereo audio. The Audio Advance function will be used to move the stream 1 frame ahead of the video before decoding. As Audio Advance applies to all audio tracks, the stereo audio will be delayed by 1 frame to compensate.
- For live or as live programmes the stream must be timed so that the encoded audio is in sync with the video and any stereo audio. It is the responsibility of the area receiving the stream to compensate for the decoding delay.
- The DP571 has a "reversion mode" which tells the unit what Dolby E and Dolby Digital metadata parameters to use in the event of a metadata failure. This should be set to "last used". This setting guards against temporary metadata failure – if failures occur the Dolby Digital encoding should not be affected.
- In the "Metadata Params" menu there are eight programs where metadata can be changed. The number of active programs depends on the "Program Config" setting. If Program Config is set to the default 5.1+2 value then Program 1 will contain the metadata for the 5.1 stream. Program 2 will set the metadata for the additional stereo pair. If the Program Config is set to 8X1 then Program 1 will set the metadata for channel 1, Program 2 for channel 2, Program 3 for channel 3 etc. It is worth noting that all eight programs remain viewable even if the selected channel configuration does not make use of them.

Troubleshooting

The DP571 gives some indication of error conditions the following table explains the meaning of the front panel error indication lights.

Light	Indication
TC	Green: Valid timecode signal Yellow: Frame rate does not match video reference Off: No TC signal detected
Fault	Red: Hardware-related fault condition Off: No fault condition
Remote	Not used
PCM Dly	Green: Valid PCM signal Yellow: non 48kHz signal Off: no PCM signal
Error	Red: Input not valid for current settings Off: No error condition
V Ref	Green: Lock with a valid analogue composite video signal Yellow: Video ref doesn't match the selected frame rate in the DP571 Flashing Red: The internal clock is not locked to the incoming reference

Factory Reset

The Dolby E encoder model DP571 can be reset to factory defaults by power cycling the unit while holding down the ENTER key until "FACTORY DEFAULTS" appears on the LCD. Press the SETUP key when prompted to confirm.

A soft reset can be performed by pressing the SHIFT, → and ESC keys simultaneously. The unit's settings will not be affected by a soft reset.

It is recommended a full reset is carried out when a unit is first used before entering the setting below

Notes:

- The two key parameters changed during a factory reset are Dolby Srnd EX parameter and the Srnd 3dB Attn.
- Lo/Ro stands for Left only / Right Only. This downmix is the best suited for reproduction from stereo speakers or headphones. It is created by mixing the Ls and Rs channels into the front L and R channels. The Centre is split between the L and R channels. The levels the other channels are mixed in at are set by the metadata. LFE is ignored. The Lo/Ro mix preserves left/right separation and allows a mono compatible downmix.
- **Lt/Rt stands for Left total / Right Total. Ls, Rs and Centre are folded down into the left / right pair using parameters set by the metadata. LFE is ignored. In an Lt/Rt mix the surrounds are summed and added to the left channel they are also added to the right channel out of phase which allows a Pro Logic decoder to reconstruct the surrounds. This is a stereo compatible Dolby downmix and is not the ideal downmix for stereo reproduction.

Dolby Metadata Settings

Setting in **BOLD** are required

Parameter	Recommendations	
DOLBY E STREAM	CONTINUOUS FROM START OF LINEUP TO END OF TRANSMISSION. EDITS IN INSERTED MATERIAL AND CONTRIBUTIONS FROM OTHER SOURCES MUST BE CAPABLE OF SUCCESSFUL DECODING ON DOLBY LICENSED AS WELL AS DOLBY BRANDED DECODERS	
PROGRAMME CONFIG	5.1 + 2	
FRAME RATE	25	
BIT DEPTH	20	
PROGRAMME DESCRIPTION	SERIAL NUMBER AND LOCATION OF THE FIRST ENCODER	
REVERSION MODE	LAST USED (FOR LIVE PROGRAMMES)	
METADATA SOURCE 1 ST UNIT IN CHAIN	INTERNAL (FOR LIVE PROGRAMMES)	
METADATA SOURCE OTHER UNITS	EXTERNAL (FOR LIVE PROGRAMMES)	
DOLBY D METADATA	ENABLED	IF THIS PARAMETER IS PRESENT THE UNIT'S FIRMWARE <i>MUST</i> BE UPDATED
DIALOGUE LEVEL (DIALNORM)	-23dB	
CHANNEL MODE	3/2	INDICATES WHICH CHANNELS ARE IN USE
LFE CHANNEL	ON or ENABLED	ENABLES OR DISABLES THE LFE CHANNEL
BIT-STREAM MODE	COMPLETE MAIN (CM)	DESCRIBES THE AUDIO SERVICE CARRIED IN THE BIT STREAM – INFORMATION ONLY
LINE MODE COMPRESSION	DISABLED or NONE	DESIGNATES PRESET COMPRESSION CONFIGURATION FOR LINE MODE DECODING. MOST HIGH END DECODERS ALLOW THE COMPRESSION TO BE DEFEATED.
RF MODE COMPRESSION	DISABLED or NONE	DESIGNATES PRESET COMPRESSION CONFIGURATION FOR RF MODE DECODING, CANNOT BE DEFEATED.
RF OVER MODULATION PROTECTION	DISABLED	PROTECTS AGAINST OVER MODULATION BY ADDING PRE-EMPHASIS WHEN A DOLBY DIGITAL STREAM IS RF MODULATED.
CENTRE DOWN MIX LEVEL	0.707 (-3.0DB)	THE LEVEL OF THE CENTRE CHANNEL IN THE L AND R IF THE LISTENER HAS NO CENTRE SPEAKER.
SURROUND DOWN MIX LEVEL	0.707 (-3.0DB)	THE LEVEL OF THE SURROUNDS IN THE L AND R IF THE LISTENER HAS NO REAR SPEAKERS. IF THE SURROUND CONTENT IS VERY IMPORTANT USE A HIGHER LEVEL. THE SURROUND CONTENT MAY INTERFERE WITH THE MAIN MIX
DOLBY SURROUND MODE	DISABLED	INDICATES WHETHER A TWO CHANNEL ENCODED BIT STREAM CONTAINS A DOLBY SURROUND LT/RT PROGRAM AND REQUIRES PRO LOGIC DECODING
AUDIO PRODUCTION INFORMATION	NO	INDICATES WHETHER THE MIXING LEVEL AND ROOM TYPE PARAMETERS ARE SET – NOT REQUIRED.
MIX LEVEL	80DB	INDICATES THE APPROX MIXING LEVEL IN THE CONTROL ROOM – INFORMATION ONLY.
ROOM TYPE	SMALL	INDICATES THE CONTROL ROOM TYPE – INFORMATION ONLY.

Parameter	Recommendations	
COPYRIGHT BIT	YES	INDICATES THE MATERIAL IS COPYRIGHT PROTECTED – INFORMATION ONLY, NOT COPY PROTECTION
ORIGINAL BIT-STREAM	ON	INDICATES WHETHER THE ENCODED DOLBY DIGITAL STREAM IS THE MASTER – INFORMATION ONLY
PREFERRED STEREO DOWN MIX	LO/RO	DESIGNATES PREFERENCE FOR LT/RT (PRO LOGIC – STEREO COMPATIBLE) OR LO/RO (STEREO) DOWN MIX
LT/RT CENTRE DOWN MIX LEVEL	0.707 (-3.0DB)	LEVEL OF CENTRE CHANNEL IN LT/RT DOWN MIX
LT/RT SURROUND DOWN MIX LEVEL	0.707 (-3.0DB)	LEVEL OF SURROUNDS IN LT/RT DOWN MIX
LO/RO CENTRE DOWN MIX LEVEL	0.707 (-3.0DB)	LEVEL OF CENTRE CHANNEL IN LO/RO DOWN MIX
LO/RO SURROUND DOWN MIX LEVEL	0.707 (-3.0DB)	LEVEL OF SURROUNDS IN LO/RO DOWN MIX
DOLBY SURROUND EX MODE	NOT SURROUND EX	IDENTIFIES THE STREAM AS BEING CODED FOR 6.1 DOLBY EX. N.B. THE DEFAULT IS NOT INDICATED WHICH MUST BE CHANGED .
A/D CONVERTER TYPE	STANDARD	INFORMATION ONLY
DC FILTER	ENABLED	APPLIES A 3HZ DC BLOCKING FILTER BEFORE ENCODING.
LOW PASS FILTER	ENABLED	PRE ENCODER ANTI-ALIASING FILTER.
LFE LOW PASS FILTER	ENABLED	APPLIES A 120 HZ 8 TH ORDER LOW PASS FILTER TO THE LFE CHANNEL BEFORE ENCODING
SURROUND 3 DB ATTENUATION	USER CHOICE	USED TO PRESERVE COMPATIBILITY WITH OLDER FILM FORMATS – NOT USED BY THE BBC