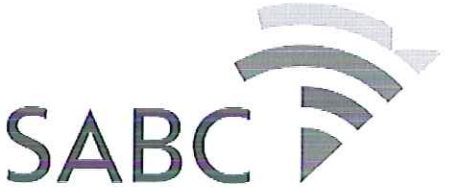

SABC TECHNICAL STANDARDS FOR DELIVERY OF HIGH DEFINITION (HD) 16:9 TELEVISION PROGRAMMES

Version 1.5

Document control

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TECHNICAL STANDARDS FOR DELIVERY OF HIGH DEFINITION (HD) 16:9 TELEVISION PROGRAMMES TO

This document is a complete guide to the High Definition (HD) common technical delivery standards agreed by the SABC'S internal interest groups. They are all the SABC broadcast channels, SABC Board/Executive, SABC Technology and SABC content. The document includes a summary of the most important technical standards deliverables as an abbreviated guideline to content producers and suppliers.

This document is an adaptation of common HD technical delivery standards and benchmark referenced from the UK Digital Production Partnership. Standards were relaxed in some genres to accommodate a broader spectrum of content producers in South Africa and also allow for more cost effective low end HD content contribution.

NOTE

The primary delivery method will be a broadcast media MXF file as specified in the Broadcast HD formats that follows. Only where delivery mechanisms do not allow broadcast media file delivery, exceptions can be made and must be clearly specified in the commissioning brief.

The SABC reserves the right to update this document as and when it deems appropriate.

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 SABC 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 judgment as to whether the quality expectations of the intended audience will be fulfilled, and whether the SABC will feel that **value for money has been achieved.**
- Delivery Requirements, which specify the form and layout of the programme material.

Technical Standards For Delivery Of Television Programmes

SABC High Definition (HD) 16 X 9

Tape, Disc and File Format Delivery

Summary of Programme Delivery Standards

Please read the SABC Technical standards delivery document in full for a detailed breakdown of specifications on deliverables:

Video Media file delivery on removable computer storage devices is fully supported but will only be deemed as delivered after the media file passes the SABC'S quality acceptance process. The supplier will thereafter be notified that their respective submission was successful.

All programmes will comply with the 1920 x 1080i HD Standard in a 16:9 aspect ratio at 25 frames per second,

- 90 seconds 100% Line-up colour bars
- And 1 KHz tone.

Digital Audio Reference level is defined as 18dB below the maximum coding value (-18dBFS) as per EBU recommended practice R128.

Time code of programme start is at 10:00:00:00.

Circular countdown clock of 30 seconds with details exactly as Section 4.5.2. must be present with Stereo audio on tracks 1&2.

Fade to silence at programme end. End slate held in vision for further 10 seconds after end of programme.

All cameras used for **Drama's, programmes for international distribution and sport** productions must be **professional cameras with 3 CCD'S** and a minimum native horizontal resolution of **1920 pixels.**

All cameras used for **Documentaries, actuality programs and news** productions must be

professional cameras with 3 CCD'S and a minimum native horizontal resolution of **1440 pixels (Non high-end HD productions).**

All Postproduction must be done using a native HD edit project video codec setting with a minimum of 8 bits and an intra-frame bit-rate of 100Mbits/Sec or better in the 4:2:2 colour space.

HD PROGRAMME FILE FORMAT DELIVERY (ALL GENRES)

All HD programmes will be delivered on a removable USB-3 windows formatted hard drive and each media file will comply with the DPP AS11 HD technical specifications below: (Broadband file delivery will be implemented in the near future and content providers will be updated accordingly)

- AVC INTRA 100 AS-11 WITH OP1A MXF WRAPPER.

Technical Description of DPP AS11 HD format:

Video essence must be encoded as AVC Intra Class 100 as defined by SMPTE RP 2027:2011. This equates to an actual video essence data rate of approximately 113Mbits/s.

(Final media file must be prepped with completed Metadata fields using the **DPP Metadata application** available at https://www.digitalproductionpartnership.co.uk)

PS: THE DPP APPLICATION WILL ONLY ACCEPT MEDIA COMPLYING 100% WITH THE HD AVC INTRA 100 4:2:2 100Mbits SPECIFICATION! THE APPLICATION IS AVAILABLE BOTH FOR WINDOWS AND MAC OS X.

HD PRODUCTION CAMERA FILE FORMATS GUIDELINE FOR DIFFERENT PROGRAMME GENRES MINIMUM REQUIREMENTS

The section refers to the minimum HD production camera/equipment codec specifications needed to produce programmes for the different genres.

Some other codecs not listed below do comply with the minimum production specifications, but the general rule is that high end codecs have a 4.2.2 colour space and the non-high-end codecs have a 4.2.0 colour space.

Drama's, programmes for international distribution and sport production (4.2.2)

• Avid DNXHD (4:2:2 120Mbits/Sec or higher)	OP1 Atom or OP1A MXF WRAPPER
• Apple ProRes (4:2:2 120Mbits/Sec or higher)	OP1A MXF WRAPPER
• XDCAM HD 422 (50Mbits/Sec only)	OP1A MXF WRAPPER
• AVC INTRA 100 (4:2:2 100Mbits/Sec or higher)	OP1 Atom or OP1A MXF WRAPPER

Documentaries, actuality programs and news production (Non high-end HD productions 4.2.0)

• HD XDCAM (4:2:0 25Mbits/sec or higher)	OP1A MXF WRAPPER
• AVCHD (35Mbits/sec or higher)	mts , m2ts, mp4 WRAPPER
• MPEG-2 4:2:0 interframe (25Mbits/sec only)	m2t WRAPPER

DIGITAL VIDEO OPTICAL DISC DELIVERY REQUIREMENTS:

(Only if file delivery is not possible)

Drama's, programmes for international distribution and sport

- XDCAM HD 422 (50Mbits/sec only) inter-frame OPTICAL DISC

Documentaries, actuality programs and news (Non high-end HD productions)

- HD XDCAM (4:2:0 25Mbits/sec or higher) OPTICAL DISC

Technical Responsibility and Contacts:

Odette Ferreira: (011) 714-5924	ferreiraom@sabc.co.za	Transfer Facilities
Jasper Van der Westhuizen: (011) 714-5667	jasper@sabc.co.za	Transmission

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SABC General Responsibility

SABC content is required to ensure that all programmes commissioned must adhere to the technical standards for delivery.

Technical Acceptance Procedures

All programmes delivered 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 for corrections and or replacement.**
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 a full QAR.

Guidelines for QAR

SABC Technology can provide QAR facilities at an additional cost. Alternatively the QAR can be carried out by any approved facility houses authorised to carry out a QAR.
The review covers both technical quality of each master programme, and that the master programme contains the various content elements required for internal and international distribution.

Overall quality of sound and vision will be separately assessed in controlled monitoring conditions against the **ITU/CCIR 5 point impairments grading scale** as shown below and any impairments noted.

ITU/CCIR 5 point impairments grading scale

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/impairment report. Grades 1 and 2 are automatic fails.

Final 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:

- Incorrect Line up Bars and Tone
- Missing or incomplete VRR - Videotape Recording Report
- Ident Clock and Captions fall outside Caption Safe Area
- Programme does not have the correct Aspect Ratio
- Music and Effects are not fully filled if required
- Doc M&E for drama sequences
- Missing M&E
- Incorrect audio layout
- Audio Peaks
- Distorted audio
- Masters and DA88/BWAV are out of sync
- Clean Elements for Titles and Credits are missing on Texted masters
- Texted Elements for Titles and Credits are missing on Textless masters. This includes texted maps or graphics, which should be included as a point of reference
- Clean Elements have not been included for all captions within the body of the programme including clean maps for textless versions. Note: not applicable in cases where Texted & Textless masters are being supplied.
- Film Effect on HD material causing aliasing or soft pictures
- Time specific trails/redcaps and teasers
- Lipsync errors
- Blanking errors
- Luminance peaks
- Neg scratches
- Inappropriate Grading changes
- Loudness Normalisation/Correction

Definitions of a Music and Effects Track

All programmes are required to have an "M&E" track, unless otherwise specified in the programme commissioning contract.

Drama

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

Documentaries

We accept Final Mix Minus narration and non-sync dialogue, this means:
No commentary, no extra readings or voiceovers should be on the music and effects. The levels should not be dipped.
Any dialogue recorded on location but not used in sync should not appear on the M&E.
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 the vision throughout.

Definition of Clean Title Backgrounds

Sometimes referred to as Textless backgrounds or Neutral backgrounds, they are used by 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.
Clean backgrounds should be supplied for opening sequences and closing credits on all SABC masters. If this cannot be provided clean due to digitally created titles then some kind of alternative should be supplied and discussions with relevant commissioning editor should take place.

SABC Logo

All masters delivered to the SABC have to include the SABC logo in the programme countdown clock.
All programmes must add the SABC end sting (duration 3" additional to programme duration) after the existing transmission end card.
The SABC logo and end sting are available from SABC Content. (see contacts page)

Programme Duration

Include title sequence and end credits. SABC commissions and pays for either 24' or 48' programmes, with an allowance of 2 minutes No unders will be permitted.

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

The commissioning contract must clearly specify the HD delivery format, audio and sub-title requirements.

SABC Quality control (Transfer Facilities)

All delivered programmes must go through the quality control process and must pass the ITU-R/CCIR 5 point grading scale quality control process.

Contents

Page

4 FILE DELIVERY REQUIREMENTS (When in Place)

4.1 File format

4.2 Video codec

4.3 Image format

4.4 Audio

4.4.1 Track allocations

4.5 Programme Layout / Format

4.5.1 Start and end

4.5.2 The Ident Clock or Slate

4.6 3D Delivery

4.7 Closed captions (Subtitles)

4.8 Time code

4.9 Audio only files

4.10 SD Files (Legacy programmes only)

4.10.1 File format

4.10.2 Video codec

4.10.3 Image format

4.10.4 Audio essence

4.11 Metadata

4.11.1 Filenames

4.11.3 Delivery Requirements in MXF

4.11.4 Delivery requirements in XML

4.11.5 Required Metadata

5 TAPE DELIVERY REQUIREMENTS

5.1 Videotape recording

5.1.1 Tape format

5.1.2 'i' and 'psf' Flags

5.1.3 Time-code

5.2 Programme Layout / Format

5.2.1 Start and end

5.2.2 Programmes longer than a single tape

5.2.3 Compilation tapes

5.2.4 Ad breaks

5.2.5 The Ident Clock

5.3 Paperwork

5.4 Audio Track layout

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. In case of doubt contact SABC Technology at sabctechnology@sabc.co.za.

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 "Act no 4 of 2000" 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.

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 2005 sets targets for broadcasters (monitored by ICASA) 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 (HD) Format

All material delivered for HD transmission must be:

- **1920 x 1080 pixels in an aspect ratio of 16:9**

- **25 frames per second (50 fields) interlaced (Upper Field First) - now known as *1080i/25*.**
- **Colour sub-sampled at a ratio of 4:2:2/4:2:0 determined by the specification contained in the commissioning brief.**

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. Upper Field First).

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 of **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 time codes 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.

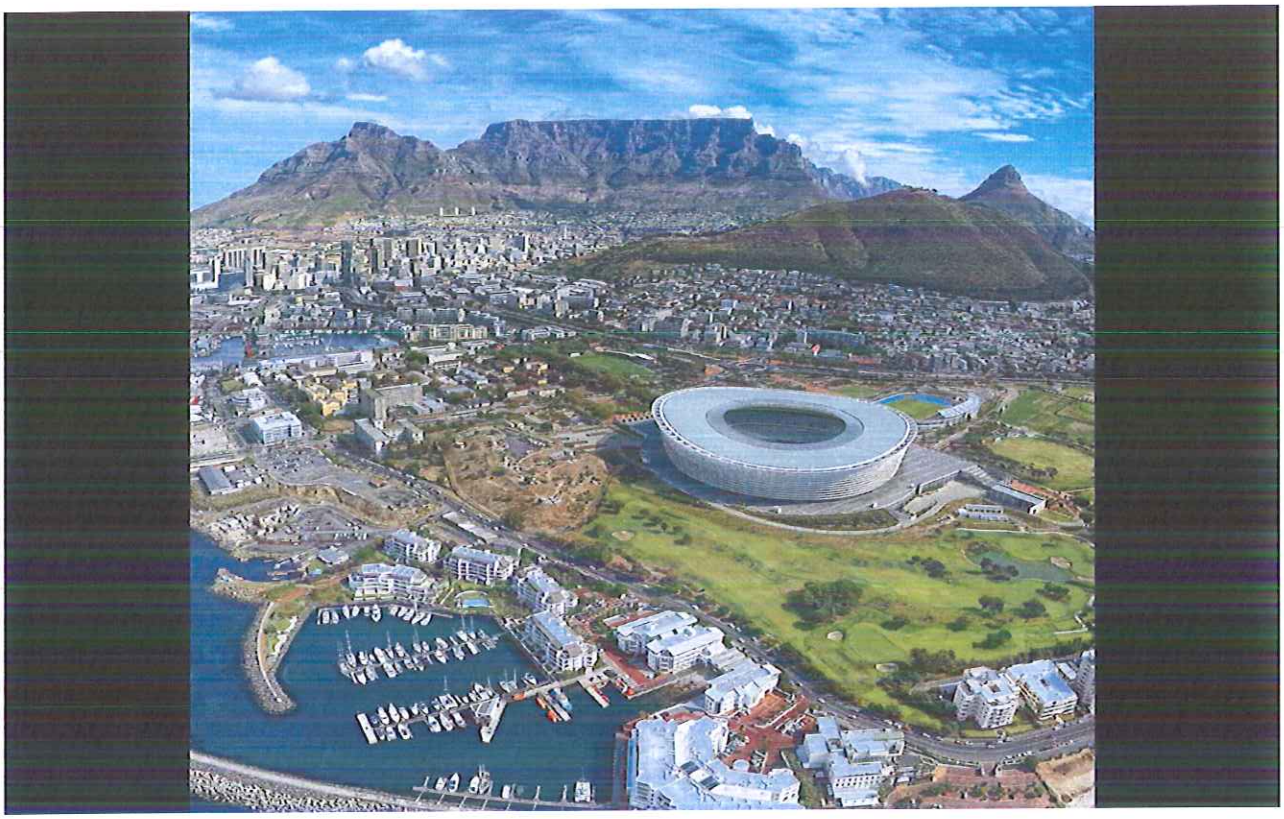
2.5.2 Floating images

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 'Pillar boxed' 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. In most cases pillar boxed footage will be archive footage and previously delivered programming.

4:3 video framed for 16:9 using the Pillar-box aspect ratio conversion



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-in 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 ½"
- 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) (Content to advise if this is really necessary)

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 EBU broadcasters 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.

2.9.1 Testing for flashes and patterning

Tape Delivery

Programmes delivered on tape must be tested using the Harding Flash Pattern Analyser Algorithm v2.5 on an SD (down-converted) SDI feed from playback of the TX tape itself. A test certificate must be printed and inserted into the tape box.

File Delivery

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

- Test certificates for file delivered programmes must be in pdf form
- The relevant metadata details must be completed (see File Delivery Section 4.11.5)

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

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.

2.10 Safe Areas for Captions

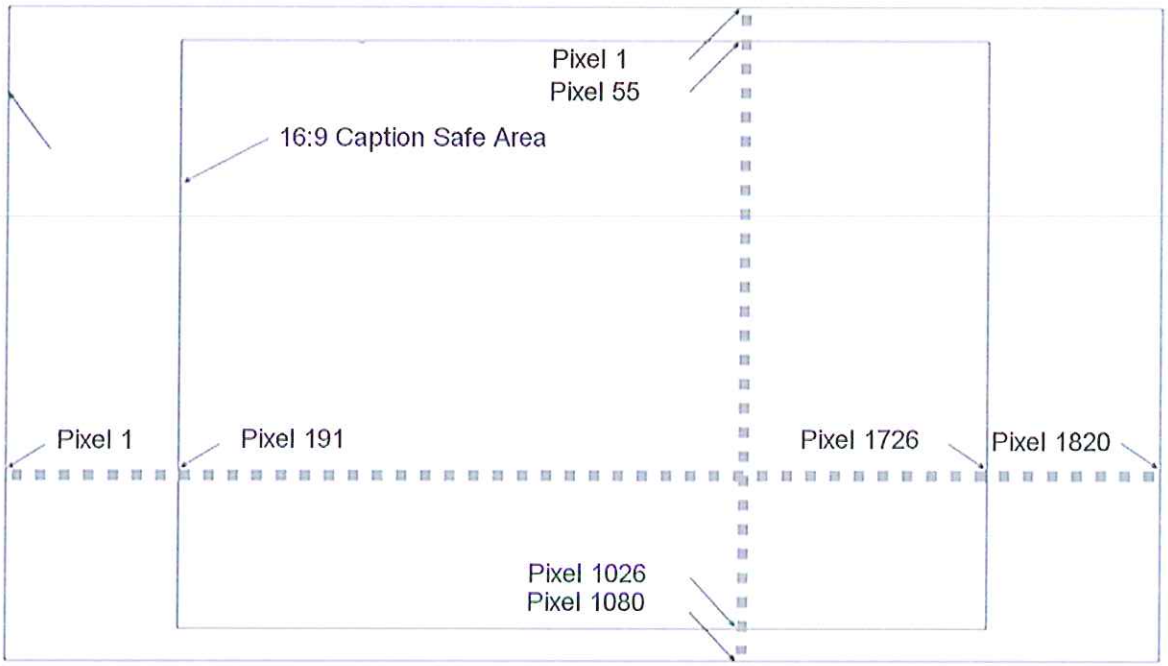
Captions and credits must be clear and legible and must be within the safe areas specified. All font sizes must be legible as HD and also after down conversion for the SD viewer. There are two primary caption safe areas defined for 16:9 material for SABC transmission:

- **16:9**
- **4:3** **required for certain programmes/broadcasters for end credits or for programmes distributed internationally.**

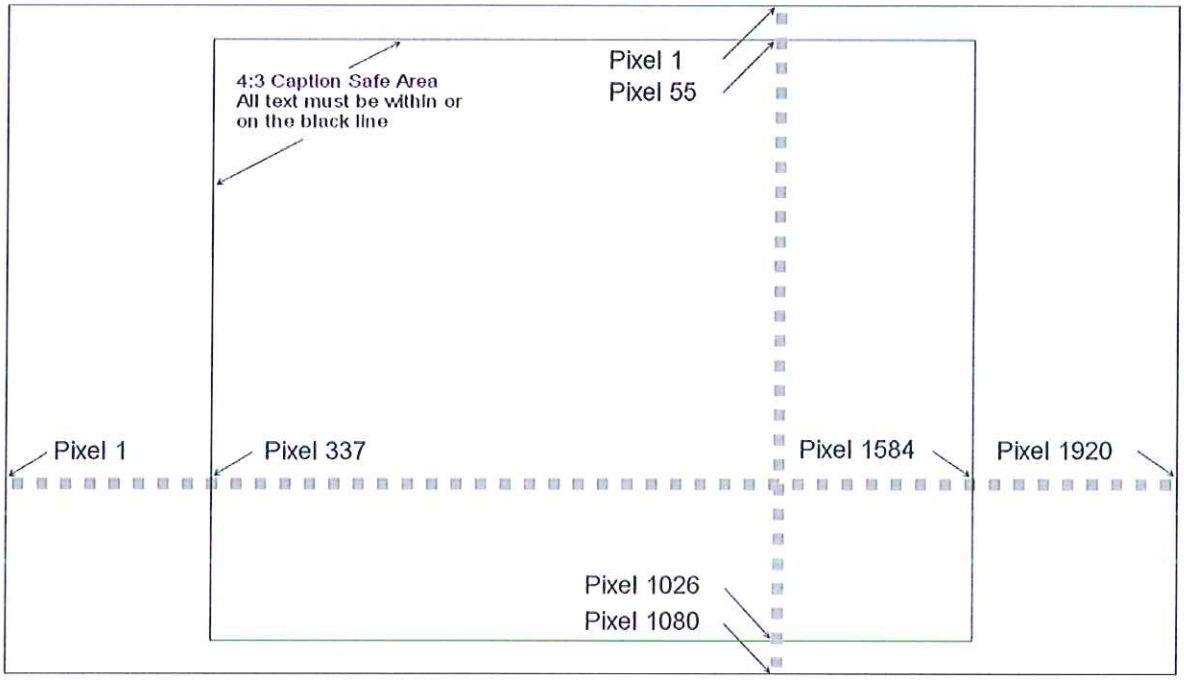
Caption Safe Area	**Defined as (%)**	**HD pixels** (inclusive) first pixel numbered 1	**TV line numbers** (inclusive) numbering as per "Rec709"
16:9 Caption safe	80% of Active Width 90% of Active Height	191 – 1726 55 – 1026	48 to 532 (F1) and 611 to 1095 (F2)
4:3 Caption safe	65% of Active Width 90% 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 16:9 Caption Safe Area



2.10.2 4:3 Caption Safe Area (where required)



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.

2.12 Single Sensor HD cameras (including DSLR)

The minimum sensor resolution (pixel count) for single sensor cameras is 2880 x 1620 (Bayer patterned). EBU R118 has details of the minimum criteria for single sensor cameras.

DSLR cameras are acceptable for time-lapse sequences and stop-frame animation but are currently not suitable for use as video cameras. Exceptions can be made for covert shoots or dangerous locations at the discretion of the broadcaster. The broadcaster must agree in writing to the use of DSLR cameras in advance of any shooting.

3 Technical Requirements – Audio

NOTE - This This section of the DPP delivery documents gives guidance for the mixing and delivery of programmes using the EBU Recommendation on Loudness Measurement EBU R128 (August 2011)

All programmes must be mixed to comply with the EBU Recommendation EBU R128. Programmes which have been mixed to the old PPM6 standard will only be accepted by prior agreement with the Broadcaster.

To avoid doubt during the QC process, file metadata or tape paperwork should note whether the programme has been mixed to EBU R128 or to PPM6.

For track layout and allocations, see the relevant format delivery requirements sections:

File:	Section 4.4.1
Tape:	Section 5.4

3.1 Terms, Requirements and Guidelines

3.1.1 Terms and Requirements

R128 introduces new terms for the measurements of audio. The terms used in this document, how they are measured and the DPP delivery requirements are listed below.

All programmes must be compliant with the Programme Loudness and Maximum True Peak requirements below.

Other parameters are currently given for guidance only.

Term	Description	Measurement	Reference
LU	Loudness Unit	1LU = 1dB change in	EBU Tech 3343
LUFS	Loudness Unit relative to Full Scale	LUFS	EBU Tech 3343
LRA	Loudness Range	LU	EBU Tech 3342
DPP Delivery Requirements			
Term	**Description**	**Measurement**	**DPP Requirement**
Programme Loudness (EBU Tech 3343)	The loudness measured over the duration of the programme.	LUFS	Non-live -23.0 LUFS ±1.0LU Live (including as-live) -23.0 LUFS ±2.0LU
Maximum True Peak	The maximum value of the audio signal waveform.	dBTP (True Peak)	-3dBTP recommended. Programmes are deemed to have failed QC if level exceeds -1dBTP
Loudness Range is for guidance only			
Term	**Description**	**Measurement**	**DPP Recommendation**
Loudness Range (EBU Tech 3342 & 3)	This describes the perceptual dynamic range measured over the duration of the programme	LU	Programmes should *aim* for an LRA of no more than 18LU
Loudness Range of Dialogue	Dialogue must be acquired and mixed so that it is clear and easy to understand	LU	Speech content in factual programmes should aim for an LRA of no more than 6LU A minimum separation of 4LU between dialogue and background is recommended

Although the target loudness is -23 LUFS, in exceptional circumstances other target levels may be permitted by agreement with the broadcaster. Other target levels must be agreed by the broadcaster in writing before the final mix.

3.1.2 Guidelines for True Peak audio levels

The following table is only **for guidance** on the true peak levels of different types of audio. At all times dialogue should be distinct and clear.

Material	Recommended Maximum Peaks
Uncompressed Music	**-3 dBTP**
Compressed Music (depending on degree of compression)	**-10 dBTP**
Heavy M & E (gunshots, warfare, aircraft, loud traffic, etc.)	**-3 dBTP**
Background M & E (office/street noise, light mood music etc.)	**-18 dBTP**

3.2 Metering Requirements

Meters must comply with the specifications in EBU Tech 3341 (August 2011). Programmes must be measured using the EBU Integrated (I) mode and the measurement must be applied to the whole programme (EBU Tech 3343 Section 5). The optional LFE (Low Frequency Effects) channel must be excluded from all measurements.

3.3 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

3.3.1 Stereo line-up tones

Each stereo audio pair must have either EBU stereo or GLITS (Graham's Line Identification Tone System line-up tone 5.1) (not a mix of both). Tone must be 1kHz, sinusoidal, free of distortion and phase coherent between channels). Audio files of GLITS and EBU stereo tones may be downloaded from the DPP web site (see Appendix 1).

Digital Audio Reference level is defined as 18dB below the maximum coding value (-18dBFS).

3.3.2 Stereo phase

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

3.4 Surround Sound Requirements

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

Programmes delivering surround sound must also carry a stereo mix meeting all requirements for stereo delivery. This should generally be an automated down-mix of the surround channels, using the same down- mix parameters as are held in the surround metadata.

In order for both the surround mix and stereo down-mix to comply with EBU R128 the down-mix should be normalised before layback (for file or tape delivered programmes).

For Live programmes, where the down-mix is being produced in the mixing desk, it will probably be necessary to reduce the gain of the stereo down-mix by approximately 2dB to achieve compliance with EBU R128.Stereo and surround audio tracks must be synchronous.

3.4.1 Surround line-up tones

Each group of surround tracks must carry BLITS (Black & Lane's Ident Tones for Surround) tone. Tones must be sinusoidal; free of distortion and phase coherent between channels. Stereo tracks derived by down-mixing from the 5.1 audio should carry a down-mix of the BLITS tones, using the same down-mix parameters as those specified in the accompanying metadata. Any other stereo tracks delivered with the programme must carry stereo tone as per section 3.3.1.

An audio file of BLITS tone may be downloaded from the DPP web site (see Appendix 1).

3.4.2 AES Sample timing

This section refers to timing requirements for AES audio pairs embedded in HD SDI signals. Very small timing differences between audio tracks in a surround programme will not be heard unless the stereo down-mix is monitored acoustically. An error of as little as one or two samples between the Left, Right and Centre channels can cause phasing and comb filtering for those listening in stereo.

Timing differences between audio tracks in each AES pair in an SDI group and between each group containing a single audio programme must be no more than 0.2 samples (i.e. the timing between each track of the six audio tracks of a surround signal.)

Note: This error has not been noticed on devices that treat audio as multi mono channel audio (e.g. NLEs).

3.4.3 Dolby Metadata Settings

For the correct reproduction of the audio by domestic receivers, it is vital that the correct metadata is input and carried through the broadcast chain to the consumer. There are differences in the settings based on programme type or genre as well as requirements for specific or dedicated television channels (e.g. Sport Channels, Movie Channels, Music Channels etc.)
Dolby metadata must remain constant throughout programmes delivered on tape or by file.

During Live programmes Dolby metadata should remain present and constant throughout. If however some segments must switch to stereo for any reason there should be no Dolby metadata for the duration of such segments. If such a programme is also recorded for later delivery by tape or file, please contact the broadcaster.

It is not yet possible to publish a common set of Dolby metadata settings that would be appropriate for all programmes styles. The SABC have limited the parameters that can be varied to the following;

Parameter

- Dialogue Level
- Line Mode Compression
- RF Mode Compression
- Centre Down-Mix Level
- Surround Down-Mix Level
  Surround 3dB Attn.
- Dolby Surround
- Mode Preferred
- Stereo Down-Mix
- Surround Phase Shift

For details of the settings required for each programme type see the broadcaster section at the beginning of this document

3.4.4 Multichannel (Dolby) Metadata for file delivery

It is intended that Dolby metadata will be held in a SMPTE 436M track within the MXF OP1A file. Please contact the broadcaster to confirm the current status before delivering a programme with surround audio by file.

3.5 Surround Sound Mixing Requirements

To help programme makers meet their responsibilities, it is important that all transmitted audio can be easily and clearly monitored by both Editorial and Technical staff during the production process.

In order to maintain a house style for certain programme types or strands, broadcasters may have particular requirements for the mixing mode as described below.

3.5.1 Dialogue in a surround mix

There are three options for the placing of dialogue in a surround mix:

Mode 1 All dialogue should be present in each of the three front channels - but this does not mean that the dialogue has to be at equal level in each of the front channels. Mode 1 is generally more suited to the home listening environment.

Mode 2 In-vision dialogue across the three front channels and out of vision dialogue in the centre channel only.

Mode 3 All dialogue in the centre channel only. Mode 3 is similar to cinema mixing and as such may be the least suited to the home listening environment.

For details of the mode required for each programme type see the broadcaster section at the beginning of this document

3.5.2 General mixing requirements

The stereo mix delivered with a surround programme will not be transmitted on the HD platforms. Viewers of the HD channels listening in stereo (or mono) will always hear an automated down-mix of a surround sound programme. HD platforms only transmit AC3 (DSAT) or AAC (DTT) audio (either as Stereo or Surround); the stereo down-mix of surround programmes is generated in the home receiver, using the Dolby Metadata parameters.

The stereo mix may not be transmitted on the Standard Definition channel(s) either, depending on platform. Some SD channels already only transmit an automated down-mix and this practice will increase. Therefore it is essential that a metadata controlled down-mix is monitored during the production process.

The audio parameters controlled by the metadata include: centre and rear down-mix levels, LFE level, and the extent of any dynamic range control applied. Therefore;

- It is essential to check the automated down-mix using a monitoring system that applies or simulates the metadata settings. Any external processor (e.g. a Dolby DP570) must be set to apply the programme's metadata.

- The Lt/Rt and Lo/Ro fold-down parameters used for down-mixing must match the settings in the Dolby metadata - especially the down-mix levels of the CENTRE and SURROUND legs.

- Pre-mixed stereo content should be up-mixed, where appropriate, to match the surround sound in order to maintain the audio image throughout a surround broadcast. A method of up-mixing approved by the broadcaster must be adopted, which anchors dialogue to the front and disperses effects around the image.

- Up-mixed material must also down-mix to stereo and mono with no audible artefacts. In particular the injudicious use of phase shifting and delay within some up-mixing algorithms may become more noticeable in the subsequent receiver down-mix process, and result in unacceptable down-mixed audio

- Where up-mixing is not available, stereo sections or inserts containing speech should be "converged" (spread) across LEFT, RIGHT and CENTRE channels adding an element into the Centre channel of the surround mix. **The front L/R channel levels should generally be 6dB lower than the Centre-channel level.**

For general surround sound (e.g. audience reaction) phase-coherence invariably benefits both the wrap-around effect in 5.1 and the stereo down-mix. To coincident microphone techniques (e.g. crossed-pairs) tend to outperform spaced mono microphones in this context.

3.5.3 Stereo and Centre channel monitoring

- It is essential that the mono and stereo down-mixes of a surround programme are monitored in at least equal measure to the surround mix. A large majority of viewers will be listening in stereo rather than 5.1 for some time to come.

- It is also important to be aware that the centre channel could allow viewers listening in surround to overhear off-microphone conversation not intended for broadcast, but which is masked when monitoring in stereo or mono.

3.5.4 Commentary lazy talkback

- Spill of crowd or general background noise picked up by the commentary microphones contribute acoustically to the width of the front image.

- In sports coverage (and other programmes produced in very noisy locations) it is important to ensure that there is some residual crowd sound in the centre channel, to minimise the audible
'hole' that otherwise results when a commentary microphone is muted, for example by the activation of 'Lazy Talkback'.

3.5.5 Consistency of image

- When a surround programme has mono content interleaved with stereo pre-recorded items it is important to maintain the consistency of the sound image and prevent the effect of dialogue appearing to jump between Centre Only and Phantom Centre (Left/Right) only

3.6 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 5ms.

3.6.1 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 time code 09:59:57:06 and 09:59:57:08
- The audio plop must be 1 kHz tone on all tracks at -24dBFS (-18dBFS is acceptable for stereo programmes)
- 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 relevant points above.

3.7 Guidance for acquired programmes and movies

Acquired programmes and movies can be delivered with or without metadata. Unless the audio is re-mixed during a compliance edit, any supplied metadata should be passed though. If no metadata exists the following parameters should be used.

Parameter	
Dialogue Level	-23dB (LUFS)
Line Mode Compression	Film Standard
RF Mode Compression	Film Standard
Centre Down-Mix Level	-3dB
Surround Down-Mix Level	-3dB
Surround 3dB Attn.	**Movies** - Enabled **All** others – Disabled
Dolby Surround Mode	Enabled
Preferred Stereo Down-Mix	LtRt
Surround Phase Shift	Enabled

4 File Delivery Requirements

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.

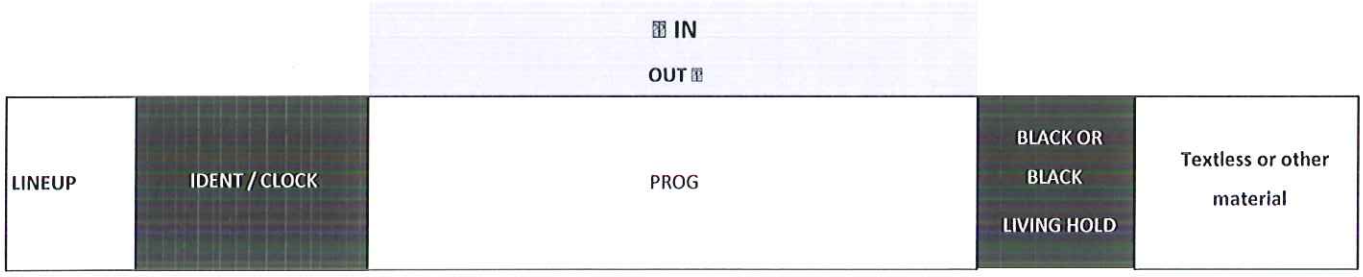
The method of delivery to the broadcaster of programme files is to be agreed with the relevant broadcaster. Information on the options is available is available on the DPP website, http://www.digitalproductionpartnership.co.uk/

Each programme should be delivered as a single principal MXF file containing the audio and video. There must be only one programme in each file.

All programme's must be soft parted or delivered as a single part as described 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 time codes for breaks should not be included.



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 v1.1. The AS-11 file must use the 'UK DPP shim specifications' that describe 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 HD and SD AS-11 shims for HD file delivery in the UK.

The AS-11 specifications are provided here: http://www.amwa.tv/projects/AS-11.shtml. 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 2.1.2 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.

		Audio track numbers															
EBU Reference code	Prog Type	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														
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	5.1 Lang 1	5.1 Lang 1	5.1 Lang 1	5.1 Lang 1	5.1 Lang 1			5.1 Lang 2	5.1 Lang 2	5.1 Lang 2	5.1 Lang 2	5.1 Lang 2	5.1 Lang 2		
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				

Note:

- R123:16c is the normal layout.
- 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 must be laid out with elements in the following pattern relative to time code:

Time-code	Duration	Picture	Sound
09.59.30.00	20"	100% Bars (100/0/100/0)	Line-up tone
09.59.50.00	between 7" 00fr and 7" 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	***Note*	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 part + 5" (multipart programmes)	minimum 1"	Black	Silence
next whole minute minus 10" *(optional for multipart progs)*	*7"*	*Ident Clock or Slate – next part*	*Silence*
Start of part minus 3" (multipart programmes)	3"	Black	Silence
end of prog	5"	freeze or 'living hold'	fade or cut to silence by end of prog
end of prog + 10" (optional)	*2fr*	*2 Frames peak white*	*1 Frame tone* *(on first video white frame)*

**Note: For legacy delivery the 90 second line-up and 30 second Ident Clock or Slate can be used*

***Note: For programmes delivered on multiple files, 2nd and subsequent files should have programme part starting at the next*

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 5" 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. A clock or slate is optional for subsequent parts of a multi-part programme:

- 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 7 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 the SABC. The separate file must be named identically to the principal MXF file, apart from the filename extension. The subtitle file for closed captions must be in the (EBU) *.stl format.

Currently two transmission masters must be delivered. One with open captions and the other with clean video and a separate (*.stl) caption file for closed captions.

4.8 Time code

Time code 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 time code 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 time code 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 v1.1 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 wrapped within the file.

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 files must be supplied as specified, 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', '-' & '_' . No abbreviations are to be used. The unique house code is the most important element and then the name of the programme, series number, and episode number

The SABC specific naming convention example is shown below

Housecode_ProgrammeName_S00_Ep000

4.11.2 UK DPP Metadata application

Where no other option exists, metadata should be generated by the programme supplier using the **UK DPP Metadata application**, which is available for download from the DPP website:

(http://www.digitalproductionpartnership.co.uk/what-we-do/metadata-application-2/)

This is an application which will allow entry and insertion of the metadata into the MXF programme file.

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

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.

4.11.4 Required Metadata

The table below gives an overview of the metadata required. It must be used in conjunction with the DPP Metadata spread sheet v1.1, which is available here: http://www.digitalproductionpartnership.co.uk/download/minimum-metadata-set/

The mandatory column indicates which fields must be entered before delivery of the file. The entries highlighted as 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.

Note that there is a character limit of 127 characters for free text fields.

Field Name	Definition and usage	Mandatory	Allowable values in bold *Examples in italics*
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. • 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**	*Isidingo - Season 4 (2011)*
Programme Title	The final title of a Programme Version for a specific purpose. • One off programmes must repeat the title used as the Series Title. • May change between commission and delivery.	**Yes**	*Isidingo - SABC TX*
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**	*Episode 7777*
Production Number	A unique number used to identify an individual Programme Version. • Also known as Clock Number, Programme number or Material ID. • The commissioning broadcaster will inform you of their required number.	**Yes**	*XPR4321-1*
Synopsis	A brief descriptive summary of the content, in no more than 127 characters, suitable for EPG / billings purposes.	**Yes**	
Originator	Company responsible for creating the programme. • Programmes may also be delivered via a distributor - see below.	**Yes**	*Endemol*
Copyright Year	Year in which the production was completed.	**Yes**	**Year only, as yyyy**
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	Conditional : mandatory if 'Other Identifier' is given	
Genre	A genre categorising the whole asset.	Yes	*Drama*
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** **UK DPP SD**
Shim Version	The version of the shim used for the creation of the file	**Yes**	**1.1**
Video			
Video Bit Rate	Nominal video bit rate in megabits per second.	Yes	**100 (For HD)** **50 (For SD)**
Video Codec	Name of the video codec used for creation of the file.	Yes	**AVCI (For HD)** **AVC-Intra (For HD)** **D10 (For SD)** **IMX (For SD)**
Video Codec Parameters	The detailed codec profile and level information used to create the file.	Yes	**High 4:2:2 level 4.1(For HD)** **4:2:2 P@ML (For SD)**
Picture Format	This describes the picture structure, using pre-defined codes.	Yes	**1080i 50 16:9 (For HD)** **576i 16:9 (For SD)** **576i 4:3 (For SD)**
AFD	This will be used to determine the aspect ratio of the frame intended for display (including any safe action and caption areas).	**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 pillar boxed.	**No**	**4:3** **14:9** **15:9** **16:9** **16.65:9** **21:9** **21.6:9**
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.	Conditional: mandatory if '3D' is 'Yes'	**Side by side** **Dual** **Left eye only** **Right eye only**
Product Placement	To be set if the content contains product placement.	**No**	**Yes / No**
PSE Pass	Status of any flashing and pattern analyser test carried out on the material for PSE.	**Yes**	**Yes** **No** **Not tested**
PSE Manufacturer	Product used to carry out the PSE analysis.	Conditional: mandatory if 'PSE Pass' is set to **Yes** or **No.**	
PSE Version	Version of algorithm used to carry out the PSE analysis.	Conditional: mandatory if 'PSE Pass' is set to **Yes** or **No.**	
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**
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 (For HD)** **AES3 (For SD)**
Audio Track Layout	Code in accordance with EBU R123 and R48 - See section 4.4.1 • The assumption is to always have 16 tracks (4 for SD) and align with tape spec definitions. • Digital silence must be encoded on tracks not used for audio	**Yes**	**R 48: 2a (4 ch. Only)** **R 123: 4b (4 ch. Only)** **R 123: 4c (4 ch. Only)** **R 123: 16c (16 ch. Only)** **R 123: 16d (16 ch. Only)** **R 123: 16f (16 ch. Only)**
Primary Audio Language	Main language used on primary audio tracks • Use ISO 639.2 values - three letter codes	**Yes**	*zxx* (none), *eng, afr, zul xho, etc.*
Secondary Audio Language	Main language used on secondary audio tracks • Use ISO 639.2 values - three letter codes	**Yes**	*zxx* (none), *eng, afr, zul xho, etc.*
Tertiary Audio Language	Main language used on tertiary audio tracks • Use ISO 639.2 values - three letter codes	**Yes**	*zxx* (none), *eng, afr, zul xho, etc.*
Compliant Audio Standard	Details of any compliant audio standard used to set the loudness level of the stereo audio tracks during programme production.	**Yes**	**EBU R128** **None**
Audio Comments	QC comments to illustrate subjective quality and any known artifacts or defects	No	
Time codes			
Line-up start	Time code for start of line-up test signals.	**Yes**	**09:58:00:00** **09:59:30:00**

Ident Clock Start	Time code for start of the initial ident or countdown clock.	**Yes**	**09:59:30:00** *(if L/U start is 09:58:00:00)* **09:59:50:00** *(if L/U start is 09:59:30:00)*
Repeating Group: Time code			
Part Number	Identifier for the hard part no. (Not required for soft parted materials)	**Yes**	*1, 2, 3*
Part Total	The total number of parts in the programme. (May be over more than one file) (Not required for soft parted materials)	**Yes**	*1, 3, 6*
Part SOM	SMPTE time code for first frame of the part number.	**Yes**	*10:00:00:00*
Part Duration	SMPTE time code for the duration of the part number.	**Yes**	*00:08:22:00*
End of repeating group: Time code			
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	Total of all part durations	Yes	*00:57:22:00*
Access Services			
Audio Description	Whether the programme contains an Audio Description soundtrack	**Yes**	**Yes / No**
Audio Description Type	Type of Audio Description soundtrack	Conditional: mandatory if 'Audio	**Control data / Narration AD Mix**
Closed Captions	Whether the programme contains closed captions.	**Yes**	**Yes / No**
Closed Captions Type	Type of closed captions used	Conditional: mandatory if 'Closed	**Hard of Hearing / Translation**
Closed Captions Language	Language used in closed captions • Use ISO 639.2 values - three letter codes	Conditional: mandatory if 'Closed	*eng, afr, zul xho, etc.*

Open Captions Present	Whether open captions are present	Yes	Yes / No
Open Captions Type	Type of open captions	Conditional: mandatory if 'Open	Hard of Hearing/ Translation
Open Captions Language	Language used in open captions • Use ISO 639.2 values - three letter codes	Conditional: mandatory if 'Open	*eng, afr, zul xho, 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	Conditional: mandatory if 'Signing	BSL (British Sign Language)/ BSL (Makaton)
Additional			
Completion Date	Date of completion of the edit before delivery of the programme	Yes	yyyy-mm-dd
Textless Elements Exist	Whether clean textless 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	Conditional: mandatory if 'Programme Has Text' is Yes	*eng, afr, zul xho, etc.etc.*
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, HDCAM and XDCAM HD 422 are the only formats 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 labeled. 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 rewound. 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 time code (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 tape must be laid out with elements in the following pattern relative to time code:

Time-code	Duration	Picture	Sound
09.58.00.00	90"	100% colour bars (100/0/100/0)	Line-up tone
09.59.30.00	between 27" 00fr and	Ident Clock	Silence
09.59.57.06 (optional)	*2fr*	*2 Frames peak white*	*1 Frame tone*
09.59.57.06	2" 19fr	Black	Silence
10.00.00.00		Programme	Programme
end of part	5"	freeze or 'living hold' after end of part	fade or cut to silence by end of part
end of part + 5" (multipart programmes)	15"	black	silence
end of prog	5"	freeze or 'living hold'	fade or cut to silence
end of prog + 10" (optional)	*2fr*	*2 Frames peak white*	*1 Frame tone*

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 5" 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, check with broadcaster which of the requirements below applies.

Either:

The second part must begin at the next whole hour time code after the end of the first part - e.g. 12:00:00:00 or 13:00:00:00 with appropriate continuous time code throughout the line-up and clock sequence above.

The second part must have time code continuing from the first part with no overlap of programme material, with appropriate continuous time code 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. Time code HH:MM:00:00

5.2.4 Interstitial 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 5" freeze)

Each part must be recorded to begin at a 'full minute' - i.e. Time code 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 time code
- 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 generally be one of the options available in the following table.

HDCamSR tapes containing discrete surround sound should also include ST.2020 metadata to the same specification as detailed in section 3.4.5 above.

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	nd	Main Dolby E*
	4	Digi/SR/SDI	M&E Stereo R	2nd Language R (Digi)	
3	5	SR/SDI	Main Front L		
	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	nd	AD L (SR Only)
	12	SR/SDI	M&E Front R	2nd 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		

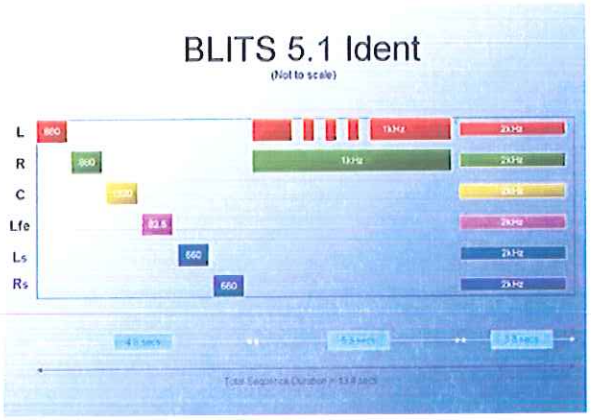
Appendix 1 – Line-up tones

This section gives details of the line-up tones that may be used for File, Tape and Live programmes

1.1 BLITS – Surround Line-up

BLITS tone is defined in EBU Tech 3304

(http://tech.ebu.ch/docs/tech/tech3304.pdf)



The BLITS tone sequence has three sections;
The first is made up of short tones at -18dBFS, to identify each channel individually:

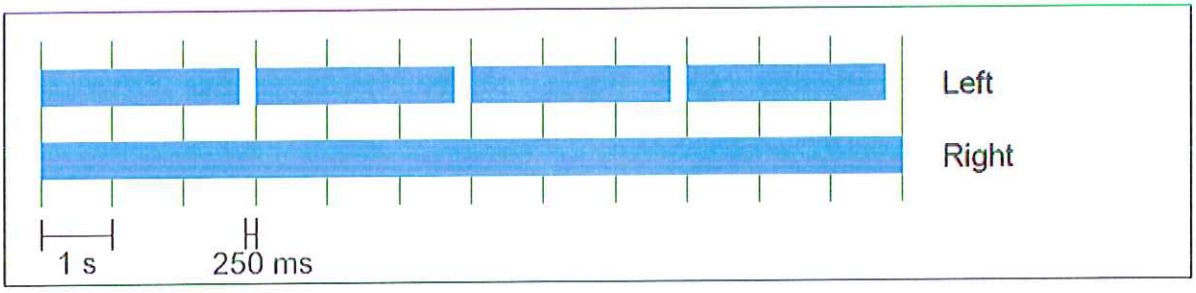
- L/R: Front LEFT and Front RIGHT – 880 Hz
- C: CENTRE - 1320 Hz
- LFE: (Low Frequency Effects) - 82.5 Hz
- Ls/Rs: Surround LEFT and Surround RIGHT - 660Hz.

The second section identifies front left and right channels (L/R) only. 1kHz tone at -18dBfs is interrupted four times on the left channel and is continuous on the right.

The last section consists of 2kHz tone at -24dBFS on all six channels. This can be used to check phase-reversal between any of the 5.1 legs. When the tone is summed to stereo using default - down-mix values this section should produce tones of approximately -18dBfs on the L & R channels.

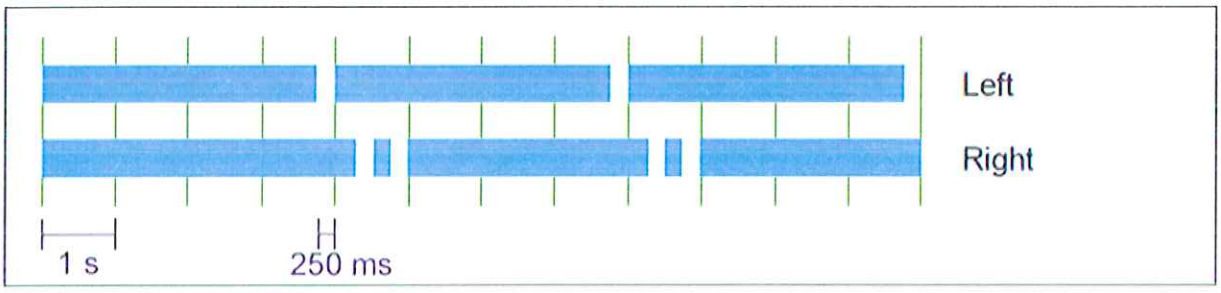
The BLITS sequence repeats approximately every 14 seconds.

1.2 EBU – Stereo Line-up



The EBU stereo tone sequence is a 1KHz tone at -18dBFS on Left and Right channels. The Left channel is interrupted for 250ms every 3 seconds

It is acceptable to use 440Hz EBU tone to identify international audio channels in a multi-channel bundle



1.3 GLITS – Stereo Line-up

The GLITS stereo tone sequence is a 1KHz tone at -18dBFS on Left and Right channels. The Left channel is interrupted for 250ms every 4 seconds and the Right channel interrupted twice 250ms after the Left channel. Each Right channel interruption lasts 250ms and the separation is also 250ms.

It is acceptable to use 2KHz GLITS tone to identify international audio channels in a multi-channel bundle.

1.4 Line-up tone downloads

A zip file of acceptable line up tones can be downloaded from the DPP website:

http://www.digitalproductionpartnership.co.uk/downloads/standards/

It contains:

Surround Programmes - BLITS -18dBfs

Stereo Programmes - EBU 1kHz, GLITS 1kHz, GLITS 2kHz

For SABC Media Technology Infrastructure:

Contact: +27 11 714 2179 kobus@sabc.co.za

Acknowledged References:

BBC Technology

DPP UK (Digital Production Partnership United Kingdom)

EBU (European Broadcast Union)

CCIR (Consultative Committee on International Radio)

ITU (International Telecommunication Union)

SABC Standard Practices