Media Solutions Technical Standards

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6/21/2011

Author	Date	Title	Version	Changes
F.Shabangu/Z.Mahomed	24/05/2011	Media Solutions Technical Standards	01	Draft
F.Shabangu/Z.Mahomed	01/06/2011	Media Solutions Technical Standards	02	Comments incorporated
F.Shabangu/Z.Mahomed	10/06/2011	Media Solutions Technical Standards	03	Comments incorporated
F.Shabangu/Z.Mahomed	21/06/2011	Media Solutions Technical Standards	04	Final
F.Shabangu/Z.Mahomed	10/10/2011	Media Solutions Technical Standards	05	Revision on Section 6 and 12, Adoption of EBU 1770 R128(loudness normalisation)

NOTE

This document contains the technical standards and delivery requirements for both **High Definition and Standard Definition** content to Media Solutions.

Media Solutions reserves the right to re-issue or update this document as and when the need arises. As a result of this, please ensure that the most up to date version is referenced when delivering content to Media Solutions.

1   Scope and Intent of this document.

This document is meant as a complete guide to the common technical standards agreed to by SuperSport Media Solutions and its clients and partners: M-net and SuperSport.

1.1   The Standards document includes

• **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 broadcaster.

• **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 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 content supplier for repair. Any rejected material will be returned with a TX report outlining the reasons for the rejection of that content.

1.2   HD Tape Format Summary

HDCam is the tape format for the delivery of all tape-based HD content to Media Solutions.

HDCam can accept and output a 1920 x 1080 interlaced video signal in aspect ratio of 16:9, but records to tape in a compressed 1440 x 1080 raster.

Whilst Media Solutions acknowledges this with respect to the HD TAPE FORMAT SUMMARY tabled below, it is imperative that all HD content acquisition, PRE and POST PRODUCTION workflows employ the full 1920 x 1080 raster

- All HD content must be delivered on HDCAM tapes
- 1920 x 1080 pixels interlaced in an aspect ratio of 16:9 at 25 frames per second (also referred to as 1080i50)
- 90" Lineup bars and 1KHz tone at -18dBFS.
- Time code of start of programme 10:00:00:00.
- Circular countdown clock of at least 20" with details exactly as Section 4.2 on page 11.
- Audio as specified in Section 3Fade to silence at end point, end slate held in vision for further 10" after end of programme.

1.3 HD File format summary

Delivery mechanisms for file-based HD content differ, depending on the area within Media Solutions to which they are being delivered and the intended use of that Content. These technical areas and the associated acceptable file-based delivery formats are further discussed in section 5.

- All file-based HD content will correspond to pre-requisites in Section 5.
- 1920 x 1080 pixels interlaced in an aspect ratio of 16:9 at 25 frames per second
- 90" Lineup bars and 1KHz tone at -18dBFS.
- Time code of start of programme 10:00:00:00.
- Circular countdown clock of at least 20" with details exactly as Section 4.2 on page 11.
- Audio as specified in section 3
- Fade to silence at end point, end slate held in vision for further 10" after end of programme.

2   Exceptions

It is the responsibility of Media Solutions (on behalf of it's partners and clients) to uphold the technical standards and delivery requirements for all content either intended for broadcast on the DSTV platform, or content intended for use within the Media Solutions Production environment.

Whilst Media Solutions reserves the right to reject any content that does not meet some or all of the technical requirements outlined in this document, it ultimately remains the responsibility of the channel head's to decide whether that content is indeed fit for broadcast or production purposes.

Media Solutions therefore cannot accept any responsibility for content that does not meet the requirements stated in this document.

3   Technical Responsibility and Contacts:

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

Production Duty Engineering Manager   +27 (11) 696 6796

Transmission Duty Engineering Manager   +27 (11) 686 6724

Transfer and Ingest Manager   +27 (11) 686 6834

4   General Quality Requirements

4.1   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 artifacts.
- 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 legalizers) must not cause visible artifacts 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 / artifacts caused by digital processing. Quantisation noise must not be apparent.
- There must be no noticeable spurious signals or artifacts e.g. streaking, ringing, smear, echoes, overshoots, moiré, hum, cross-talk etc.

4.2   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 and loudness 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 artifacts as a result of the action of noise reduction or low bit rate coding systems.

4.3   Access for People with Disabilities

SS Media Solutions does not currently cater for any disability services on its broadcasts in HD, but does do so in SD (see SD document).

This however is subject to change and whilst not discussed in this technical document, will be addressed by the broadcaster at a time when it is required to do so.

5   Technical Requirements – Video

5.1   High Definition Format

The HD format utilized within Super Sport Media Solutions (SSMS) is

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

- 25 frames per second (50 fields) interlaced - now known as 1080i/25 or 1080i/50

- Colour sub-sampled at a ratio of 4:2:2

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

5.1.1   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.

5.1.2   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.

5.1.3   Film motion or 'film effect'

It is not acceptable to shoot in 1080i/25 and add a film motion effect in postproduction. 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.

5.1.4   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.

5.2   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.

5.3   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.

5.4 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).

5.4.1 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) therefore:

• 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

5.5 '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.

5.6 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.

5.6.1 '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. It must be noted that any content delivered in an aspect ratio (other than the full 16:9 raster for HD specified in this document), will only be accepted as a last resort and in only in agreement with the broadcaster.

5.6.2   Postage Stamps (floating images)

Short sequences of images surrounded by black borders, (postage stamps), 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.

5.6.3   '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(perforations) at an aspect ratio narrower than 16:9. The pictures must be centrally framed in a 16:9 raster with no geometrical distortion.

5.7   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:

5.8   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 equalization.)

5.8.1   Aspect ratio - archive

Archive material must 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 artifacts 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.

5.8.2   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.

5.9   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.

5.9.1   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
- Cameras with image sensors under ½ inch
- Frame based (intra-frame) recording formats below 100Mbs.
- 720 line equipment

5.9.2   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.

5.10 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 is one primary caption safe areas defined for 16:9 material for SA transmission:

• 4:3 required for certain programmes or for programmes distributed internationally.

CAPTION SAFE AREA	DEFINED AS (%)	HD PIXELS	TV LINE NUMBERS
4:3 CAPTION SAFE	70% OF ACTIVE WIDTH	289-1632	48 TO 532 (FIELD1)
	90% OF ACTIVE HEIGHT	55-1025	611 TO 1095(FIELD2)

At the Discretion of the broadcaster, programmes and some content may be excluded from this requirement
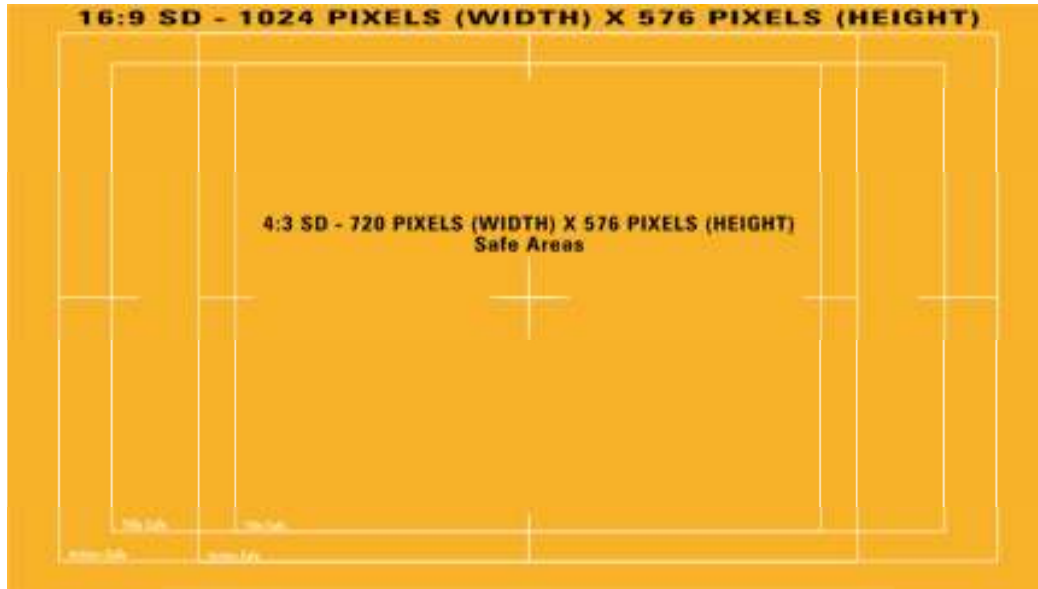
5.11 Standards Conversion

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.

6   Technical Requirements – Audio

SuperSport Media Solutions has adopted the EBU Recommendation R128 ITU-R BS1770 [3]. Loudness normalization and permitted maximum level of audio signals on all content delivered shall comply with this standard.

The EBU recommends that an audio-levelling paradigm is needed based on loudness measurement. The QPPM does not reflect the loudness of an audio signal as well as is not designed to indicate a long-term average. Programme Loudness, Loudness Range and Maximum True Peak Level shall be used to characterise an audio signal. The signal shall be

measured in its entirety, without emphasis on specific elements such as voice, music or sound effects. All the characteristics shall be measured with a meter compliant with both ITU-R BS.1770 and EBU Tech Doc 3341 and 3342.

The loudness metadata shall always correctly indicate the actual programme loudness, even if for any reason a programme may not be loudness normalised to -24 LKFS

The audio processes, systems and operations concerning production, distribution and implementation should be made in compliance with EBU Tech Doc 3343 and 3344.

Normalize audio at -24 LKFS

All resources can be accessed on http://tech.ebu.ch/loudness

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

AES	TRACK	FORMAT	CONTENT
1	1	HDCam, File[1]	Main Stereo, L
	2		Main Stereo, R
2	3	HDCam, File[1]	Alt Lang Stereo L/ Main Dolby E*
	4		Alt Lang Stereo R/ Main Dolby E*

AES	TRACK	FORMAT	CONTENT
1	1	SDI[2]	Main Stereo, L
	2		Main Stereo, R
2	3	SDI[2]	Clean FX L/ M&E Dolby E*
	4		Clean FX R/ M&E Dolby E*

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[1] Files refers to any content delivered to SSMS by means of the following
- Disk-based delivery
- Digital Delivery methods utilizing a LAN infrastructure (FTP, DDP etc.)

[2] SDI refers to any externally contributed content such as Satellite, microwave etc.

3	5	SDI²	Alt Lang1, L
	6		Alt Lang1, R
4	7	SDI²	Directors Comms
	8		Alt LANG2, mono

*DOLBY E and its requirements are discussed further in section 3.2 under Surround Sound requirements.

Programmes delivering surround sound must as a minimum also carry a stereo mix meeting all requirements for stereo.

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

6.1   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.

6.2   Stereo phase

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

6.3   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.

6.4   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 ARE DESIRABLE AS MEASURED ON A DIGITAL PPM (SPECIFIED UNDER IEC 60268-18), WHERE REFERENCE LEVEL IS SET AT -18dBFs

AUDIO CONTENT	NORMAL in dBFs	PEAKS in dBFs (FULL RANGE)
DIALOGUE	-22 TO -14	-22 TO -10
UNCOMPRESSED MUSIC	-14	-26 TO -10
COMPRESSED MUSIC	-18	-22 TO -18
HEAVY M&E	-14 TO -10	
BACKGROUND M&E	-30 TO -22	

6.5 Surround Sound Requirements

Surround sound is transmitted in a 5.1 format, and must be delivered as a Dolby E compressed stream. The audio channel order for HD tape and File delivery formats are outlined in Section 3 (Technical requirements-Audio)

The DOLBY E encoded audio must be discreet channels corresponding to the following order:

AUDIO CHANNEL NUMBER	SURROUND CHANNEL
CHANNEL 1	LEFT
CHANNEL 2	RIGHT
CHANNEL 3	CENTRE
CHANNEL 4	LFe
CHANNEL 5	LEFT SURROUND
CHANNEL 6	RIGHT SURROUND

- The Dolby E stream must be delivered in a 20 bit format
- The Dolby E stream must be delivered in a 5.1+2 configuration with the additional 2 channels being a stereo pair meeting all the requirements for stereo prescribed in section 3.1
- DOLBY E audio soundtracks must be delivered in sync with the video; no sync offsets may be induced.
- Lo/Ro (stands for Left only, Right only) is the preferred down-mix (conversion from 5.1 to stereo) option for the surround sound track. Lo/Ro preserves stereo separation as well as a mono compatible down-mix.

- The DOLBY E soundtrack must have metadata values that correspond to the values tabled in section 3.2.1 below. Those highlighted in BOLD are imperative and may not be omitted or altered.

6.5.1   METADATA PARAMETERS

METADATA PARAMETER	VALUE
Bitstream Mode	**Main Audio Service: Complete Main**
AC Mode:	**3/2**
Dolby Surround Mode	Not Indicated
LFE Channel	**Enabled**
Dialogue Normalization:	**-23dBFs**
Audio Production Info	Yes
Mix Level	85 dB
Room Type	Small
Copyright Bit	No
Original Bitstream	Yes
Preferred Stereo Downmix:	**Lo/Ro Preferred**
Lt/Rt Center Mix Level:	0.707 (-3.0 dB)
Lt/Rt Surround Mix Level:	0.707 (-3.0 dB)
Lo/Ro Center Mix Level:	0.707 (-3.0 dB)
Lo/Ro Surround Mix Level:	0.707 (-3.0 dB)
Dolby Surround EX Mode	Not Surround EX
A/D Converter Type	Standard
DC Filter	Disabled
Lowpass Filter	Disabled
LFE lowpass Filter	Enabled
Surround Phase Shift	Enabled
Surround 3dB Attenuation	Enabled

RF Mode Compression	Film Standard
Line Mode Compression	Film Standard

6.5.2   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
http://www.bbc.co.uk/commissioning/tv/production/delivery/hd-production-delivery.shtml

6.5.3   Surround audio levels and measurement (loudness or volume)

All loudness levels shall be normalised at -24LKFS.

6.6   Sound to Vision Synchronization

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. No delays may be induced

6.6.1   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 timecode 00:01:57:06 and 00:01:57:07

•The audio plop must be 1kHz tone on all tracks at -18dBFs (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.

7   Delivery Requirements

7.1   Programme Layout / Format

TIME-CODE	DURATION	PICTURE	SOUND
09.58.00.00	90 SECS	EBU BARS	LINE-UP TONE
09.59.30.00	27 SECS 5 FRAMES	IDENT AND COUNTDOWN CLOCK	SILENCE
09.59.57.06	1 FRAME	1 FRAMES PEAK WHITE	1 FRAME TONE
09:59:57:07	2 SECS 19 FRAMES	BLACK	SILENCE
10:00:00:00		PROGRAM	PROGRAM
END OF PROG	10 SECS	FREEZE ON LAST FRAME (LIVE HOLD)	FADE OR CUT TO SILENCE

7.2   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.

7.2.1   Programmes longer than a single tape-Long Form Content
If a programme must be delivered on two or more tapes because it is longer than the capacity of a single HDCam tape, the second part must begin at the next whole minute timecode after the end of the first part - e.g. 12:05:00:00 or 12:06:00:00 with at least 15 seconds of black before the next clock and the Time-code must be continuous throughout this programme break.

7.2.2   Compilation tapes-Short Form Content
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

7.2.3   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

7.3   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,

Digital clocks are acceptable as well

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

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

7.4.1   Tape format
HDCam 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 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.

7.4.2   Content Checklist

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

7.4.3   Time-code

LTC and ancillary time code (referred to as VITC on HDCam 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.

7.5   File Delivery

7.5.1   HD File Delivery Summary

- 1920 x 1080 interlaced at 25 frames per second
- 90" Lineup bars and 1KHz tone at -18dBFS.
- Time code of start of programme 10:00:00:00.
- Countdown clock of at least 20" with details exactly as Section 7.3 on page 21.
- Audio as specified in Section 3.
- Fade to silence at end point, end slate held in vision for further 10" after end of programme.

Non-Tape media or file-based HD content may be delivered to dedicated areas within Media Solutions. These area's are

- PMR (Production Media Room)
- Media Services Library
- Media Services Digital Delivery (Transfers and Ingest)

7.5.2   Drive requirements
- Drives must be formatted in the windows NTFS standard
- Drives must support the USB 2.0 interface as a minimum.
- Drives utilizing a FIREWIRE 400 interface may also be utilized. (IN PMR ONLY)
- E-SATA for library
- Drives must be free of VIRUS's. Drives that contain a virus will be rejected immediately.

File-based HD content must be delivered to MS in specific formats, which must not only satisfy all video, audio and content delivery requirements stated in this document but must further meet the format requirements tabled below

7.5.3   File Delivery for POST PRODUCTION (PMR)
The Production Media Room (PMR) is an area that can accommodate HD content delivered on HDCAM but can further accommodate other disk-based formats typically employed in POST PRODUCTION or STUDIO environments.

7.5.3.1   Card-based formats
Several Camera manufacturers have developed systems that can capture HD content directly to PCMCIA cards or optical disks.

Tabled below are the only HD VTR formats utilizing disk based or card based delivery mediums that will be accepted in PMR

MAKE	VIDEO RESOLUTION	FRAME RATE	CODEC	BIT-RATE (Mb/s)	WRAPPER
PANASONIC P2	1920 x1080 interlaced	25fps	P2 4:2:2 10 bit	100	Native MXF
XDCAM HD	1920 x 1080 interlaced	25fps	XDCAM HD 4:2:2	50	Native MXF

7.5.3.2   Removable Drive formats
HD content delivered to Media Solutions PMR on a drive-based medium will need to fulfill all the pre-requisites of this document as well as the format requirements tabled below

VIDEO RESOLUTION	FRAME RATE	CODEC	BITRATE Mb/s	STRUCTURE	WRAPPER
1920 x 1080 Interlaced	25fps	P2 4:2:2 10 bit	100	I-FRAME	Native MXF or QT (uncompressed)
1920 x 1080 Interlaced	25fps	DVC Pro HD	100	I-FRAME	Native MXF or QT (uncompressed)
1920 x 1080 Interlaced	25fps	AVC-Intra	100	I-FRAME	Native MXF or QT (uncompressed)
1920 x 1080 Interlaced	25fps	XDCAM 4:2:2	50	I-FRAME	Native MXF or QT (uncompressed)

7.5.4   File delivery to Library

The Media Solutions library is responsible for managing all media owned by the broadcaster and as such has very strict guidelines for disk-based delivery of HD content

All video, audio, content delivery and drive requirements outlined in this document must firstly be met in addition to the format specified in the table below

VIDEO RESOLUTION	FRAME RATE	CODEC	BITRATE Mb/s	WRAPPER
1920 x1080 Interlaced	25fps	DnxHD 120	120	MXF OP1a

7.5.5   File Delivery via Digital Delivery (DDP)

Common technical standards for the file-based delivery of programmes via DIGITAL DELIVERY are currently in development. Digital Delivery allows content suppliers the capability to deliver their content to Media Solutions in a digital manner utilizing specific LAN delivery mechanisms and dedicated HD content formats.

In order for content suppliers to be able to utilize this workflow, the content supplier is required to complete documentation that acts as a contract and binding agreement between the supplier and Media Solutions.

This agreement is referred to as "on-boarding" and the documentation that needs to be completed is attached as APPENDIX A.

There are specific media formats that must further be adhered to if a content supplier delivers HD content utilizing the DDP infrastructure and workflows, these are tabled below:

FORMAT	VIDEO RESOLUTION	FRAME RATE	CODEC	BIT-RATE (Mb/s)	STRUCTURE	WRAPPER
1	1080 i	25	BLACKMAGIC IMX 4:2:2 10 BIT	100	I - FRAME	AVI
2	1080 i	25	P2 4:2:2 10 BIT	100	I – FRAME	MXF OP1a
3	1080 i	25	P2 4:2:2 10 BIT	50	I – FRAME	MXF OP1a
4	1080 i	25	DVCPro HD	100	I – FRAME	MXF OP1a
5	1080 i	25	AVC Intra	100	I – FRAME	MXF OP1a
6	1080 i	25	XDCAM 4:2:2	50	I – FRAME	MXF OP1a
7	1080 i	25	MPEG 2	80	LGOP	PS
8	1080 i	25	DVCPro HD	100	I – FRAME	QT
9	1080 i	25	MPEG - 2	50,70	LGOP	MXF OP1a
10	1080 i	25	MPEG – 2	50	I – FRAME	GXF
11	1080 i	25	MPEG – 2	100	I – FRAME	MXF OP1a
12	PAL	25	MPEG 2 IMX	30	I – FRAME	PS
13	PAL	25	MPEG - 2	15/30	LGOP	MXF OP1a
14	PAL	25	MPEG – 2	15/30	LGOP	PS
15	PAL	25	MPEG – 4(H264)	15/30	I - FRAME	QT

7.5.6 Live Delivery

Common technical standards for the live delivery of programmes are currently in development. In the interim, please contact the relevant broadcaster.

8 STANDARD DEFINITION DELIVERY

Technical standards for delivery of content to Supersport Media Solutions

This document is meant as a complete guide to the common technical standards agreed to by SuperSport Media Solutions and its clients and partners: M-net and SuperSport.

The Standards document includes

• **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 broadcaster.

• **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 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 content supplier for repair. Any rejected material will be returned with a TX report outlining the reasons for the rejection of that content.

8.1 SD Tape format summary

SD Tape Format Summary

- Content shall be delivered on Betacam SP, Betacam SX and Digital Betacam
- PAL 4:3 at 25 frames a second for 4:3 SD Channels
- PAL 16:9 at 25 frames a second for 16:9 SD Channels
- 90" Line-up bars and 1KHz tone at -18dBFS.
- Timecode of start of programme 10:00:00:00
- Circular countdown clock of at least 20" as detailed
- Audio detailed in Section 3
- Fade to silence at end point, end slate held in vision for further 10" after the end of the programme.

8.2 SD File format summary

Delivery mechanisms for file-based SD content differ, depending on the area within Media Solutions to which they are being delivered and the intended use of that Content. These area's and the associated acceptable file-based delivery formats are further discussed in section 5.

All file-based SD content will correspond to pre-requisites in Section 5.1.2

For all 4:3 SD Channels - PAL aspect ratio of 4:3 full screen or 4:3 letter box

For 16:9 SD Channels - PAL in an aspect ratio of 16:9 FHA (Full Height Anamorphic)

- interlaced at 25 frames per second
- 90" Line-up bars and 1KHz tone at -18dBFS.
- Timecode of start of programme 10:00:00:00
- Circular countdown clock of at least 20" as detailed
- Audio detailed in Section 3
- Fade to silence at end point, end slate held in vision for further 10" after the end of the programme..

9   Exceptions

It is the responsibility of Media Solutions (on behalf of it's partners and clients) to uphold the technical standards and delivery requirements for all content either intended for broadcast on the DSTV platform, or content intended for use within the Media Solutions Production environment.

Whilst Media Solutions reserves the right to reject any content that does not meet some or all of the technical requirements outlined in this document, it ultimately remains the responsibility of the channel head's to decide whether that content is indeed fit for broadcast or production purposes.

Media Solutions therefore cannot accept any responsibility for content that does not meet the requirements stated in this document.

10 General Quality Requirements

10.1 Picture Quality

- The picture is to be well lit and sharp but not artificially.
- Excessive black crushing and highlight compression shall not be present.
- The picture must be free of excessive flare, reflections, lens dirt, markings and obstructions (e.g. lens hood), and lens aberrations.
- There must be no noticeable spurious signals or artifacts e.g. streaking, ringing, smear, echoes, overshoots, moiré, hum, cross-talk etc.
- 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.
- 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 otherwise to meet special artistic/production requirements

- The picture must be stable and continuous - i.e. no jumps, movements, shifts in level or position.
- There must be no visible contouring / artifacts caused by digital processing. Quantisation noise must not be apparent.

10.2 Sound Quality

- Sound must be recorded with appropriately placed microphones, giving minimum background noise and without peak distortion.
- The Audio shall be free of spurious signals inclusive of noise, hum and crosstalk. Artifacts such as Distortion, sibilance and wow & flutter must not be apparent.
- The audio must be reasonably continuous and smoothly mixed and edited.
- Audio and loudness 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 artifacts as a result of the action of noise reduction or low bit rate coding systems.
- No programming with a dynamic range suited to Theatrical presentation (Cinema audio mix) will be accepted, as these are not suitable for the audio range required for broadcast.
- Dolby noise reduction –Betacam SP Dolby C = Noise reduction is to be switched - ON.
- Special attention is to be given to hiss, buzz, hum & compression when quality assessing audio.

10.3 Access for People with Disabilities

Programme suppliers are required to consider the needs of people with hearing or visual impairments while generating captions, subtitles and graphics, using voiceovers, and while mixing sound. Some channels provide hard of hearing subtitling so suppliers may be asked to provide appropriate additional material. Line 22 should be left clear for this purpose internally.

11 Technical Requirements - Video

11.1 Standard Definition Format

All material delivered for SD TV transmission must be:

625 line 25 frames per second (50 fields) 2:1 interlace system produced in accordance with ITU-R Rec BT.601, colour sub-sampled at a ratio of 4:2:2

For all 4:3 SD Channels - PAL in an aspect ratio of 4:3 full screen or 4:3 letter box

For 16:9 SD Channels - PAL in an aspect ratio of 16:9 FHA (Full Height Anamorphic)

Origination

Material must be originated with an interlaced scan system, no mixing of progressive and interlaced scan.

Post-production

All 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.

Film motion or 'film effect'

Only film effect processes that attempt to maintain the full resolution of the original are acceptable. Straight field duplication is not acceptable.

11.2 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 4:3 or 16:9 raster. SMPTE pattern bars are not acceptable.

Programme video signal levels shall be accurately related to their associated line-up signals within the maximum deviation specification of 2% for Video Luminance and 5% in respect of Video Chrominance.

The line-up colour bar test signal shall replay at the correct levels at the VTR manufacturers "Preset" position.

The line-up colour bar test signal shall replay at the correct chroma phase with the chroma phase control in the manufacturers "Preset" position.

The start of programme and any subsequent part should be preceded by 30 seconds line –up colour bar test signal.

A countdown clock indicating programme title, subtitle or episode number, part number must provide a clear countdown of at least 30 seconds fading to black at 3 seconds to first programme pictures.

11.3 Video Levels and Gamut (illegal signals)

Standard Definition digital signals will be assessed according to the recommendation ITU-R BT601-5 Part A

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.

11.3.1 Measuring signal levels

SYSTEM	TYPE	PAL		
		Level in Volts	Max. Level (Ref. 1V)	Min. Level (Ref. 1V)
Composite	Luminance	700 mV	106% Ref. 1V 760 mV	0% Ref. 1V 0 mV
	Black Level Setup	0 mV		0% Ref. 1V 0 mV
	Chroma		123% Ref. 1V 930 mV	-18% Ref. 1V 180 mV
	Sync	300 mV	309 mV	291 mV
	Burst	300 mV	300 mV	291 mV

Component	Luminance	700 mV	700 mV	0 mV
	Colour difference	700 mV	700 mV	0 mV

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.

Black level shall not extend below blanking level (0mV luma)

Maximum video levels of material with reference to line-up signals shall be 700mV including an operational tolerance of +25mV for luma (Y) and 700mV for each colour difference signal (Pr,Pb).Whatever the combination of lima and chrominance components the signal shall not produce an R.G.B or PAL coded gamut error when measured by an appropriate instrument.

11.3.2 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) therefore
- 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.

11.4 'Blanking'

Digitally delivered pictures are considered to have a nominal active width of 702 pixels (52us[micro seconds]) starting on the10th pixel and ending on the 711th pixel in a standard REC 601 (720 sample) width. A minimum width of 699 pixels (51.75us[micro seconds]) within these limits must be achieved. Additional active pixels outside the above limits must be an extension of the main picture.

Vertical Blanking must not exceed 26 lines per field.

Line 23 may not contain any line of picture or any signaling as this line is used for widescreen signal

ing which is inserted internally.

Black level shall not extend below blanking level (0mV luma)

11.5 Aspect Ratio

For 4:3 SD Channels

Content to be delivered in 4:3 aspect ratio full screen or letterbox

For 16:9 SD Channels

Content to be delivered in 16: 9 (FHA) Full Height Anamorphic.

This means that the active picture must fill a 16:9 screens vertically and horizontally without geometric distortion.

Must be 4:3 title/graphic safe

11.5.1 Active Picture Width

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

11.5.2 Postage Stamps (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.

11.5.3 'Pillarboxed' material

Some 'pillar-boxed' material is acceptable at the discretion of the broadcaster for example 35mm filmshot using 4 perf(perforations) at an aspect ratio narrower than 16:9. The pictures must be centrally framed in a 16:9raster with no geometrical distortion.

11.6 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:

11.6.1 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.)

11.6.2 Aspect ratio - archive

Archive material should be zoomed to fill the 4:3 or 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 4:3 or 16:9 raster, no geometrical distortion,
- must have clean and sharp pillar-box edges (i.e. any video or film edge artifacts 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.

11.7 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.

11.8 Use of HD material

Some standard definition content will contain material from high definition sources. Particular care must be taken to deliver the best possible quality of down-converted material.

It is acceptable to use a broadcast VTR's "on board" down converter to produce standard definition copies of high definition programmes.

Most non linear editing packages do not produce acceptable down conversion and should not be used without the broadcaster's permission

11.9 Film Acquisition

To avoid causing problems with transmission encoding film should be well exposed and not forced more than one stop. Super16 film must be cleaned before transfer and de-spotted and preferably processed to remove grain.

11.10 Safe Areas for Captions

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

All electronic titles must be placed within the picture "safe area" defined as 80% of the picture width and height to accommodate differences in picture areas is played on domestic receivers compared to those on professional monitors.

11.10.1   4:3 Caption area safe for 16:9 Content

Caption Safe area	Defined as (%)	Pixels (inclusive) First pixel number 1	TV line numbers (inclusive)
4:3 Caption Safe	65% of Active width 90% of active height	123-579 30-546	38 to 295
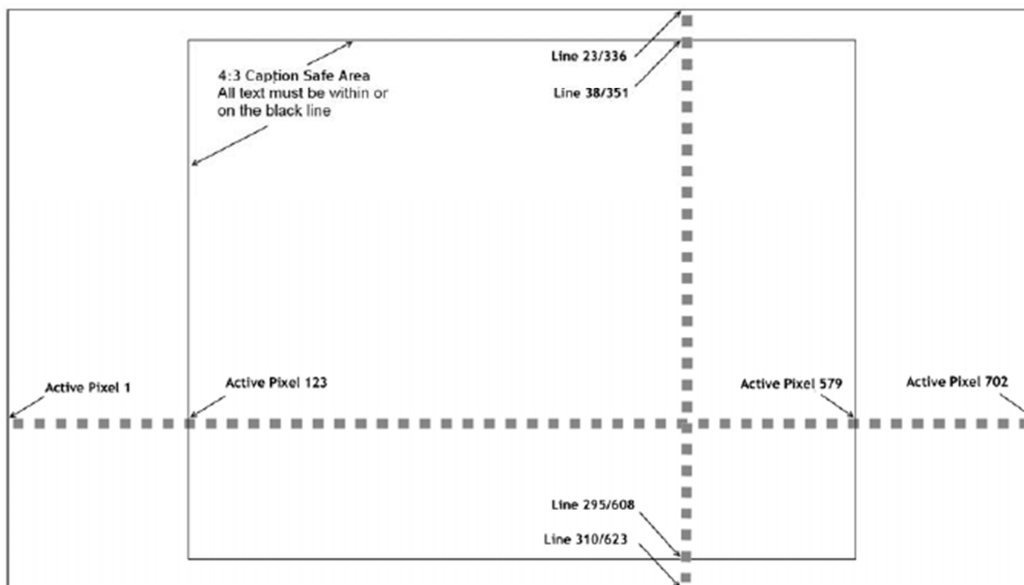
11.11 Standards Conversion

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.

11.12 Video quality assessment

Media Solutions retains the right to final acceptation or rejection of any material delivered which does not meet its minimum technical specification requirements, whether measured or subjectively assessed.

For subjective quality assessment, as especially referred to under consumer formats, special visual attention must be given to assess the following items when recording material to tape:

Chroma Break up

Chroma Noise

RF Drop out

Bearding

YC Delay

Digital Artifacts or Channel Condition

Betacam SP's to be at least first generation/sub masters, YUV copies (Dolby encoded).

Digital clones or YUV, component recordings are preferable.

12 Technical Requirements - Audio

SuperSport Media Solutions has adopted the EBU Recommendation R128 ITU-R BS1770 [3]. Loudness normalization and permitted maximum level of audio signals on all content delivered shall comply with this standard.

The EBU recommends that an audio-levelling paradigm is needed based on loudness measurement. The QPPM does not reflect the loudness of an audio signal as well as is not designed to indicate a long-term average. Programme Loudness, Loudness Range and Maximum True Peak Level shall be used to characterise an audio signal. The signal shall be measured in its entirety, without emphasis on specific elements such as voice, music or sound effects. All the characteristics shall be measured with a meter compliant with both ITU-R BS.1770 and EBU Tech Doc 3341 and 3342.

The loudness metadata shall always correctly indicate the actual programme loudness, even if for any reason a programme may not be loudness normalised to -24 LKFS

The audio processes, systems and operations concerning production, distribution and implementation should be made in compliance with EBU Tech Doc 3343 and 3344.

Normalize audio at -24 LKFS

All resources can be accessed on http://tech.ebu.ch/loudness

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

AES	TRACK	FORMAT	CONTENT
1	1	Digibeta/Betacam SP/SX File[3]	Main Stereo, L
	2		Main Stereo, R
2	3	Digibeta/Betacam SP/SX File[1]	Alt Lang Stereo L/ Main Dolby E*
	4		Alt Lang Stereo R/ Main Dolby E*

SDI (Content delivered by external means e.g. Satellite)

AES	TRACK	FORMAT	CONTENT
1	1	SDI[4]	Main Stereo, L
	2		Main Stereo, R
2	3	SDI[2]	Clean FX L/ M&E Dolby E*
	4		Clean FX R/ M&E Dolby E*
3	5	SDI[2]	Alt Lang1, L
	6		Alt Lang1, R
4	7	SDI[2]	Directors Comms
	8		Alt LANG2, mono

*DOLBY E and its requirements are discussed further in section 3.2 under Surround Sound requirements.

Programmes delivering surround sound must as a minimum also carry a stereo mix meeting all requirements for stereo.

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.

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[3] Files refers to any content delivered to SSMS by means of the following
- Disk-based delivery
- Digital Delivery methods utilizing a LAN infrastructure (FTP, DDP etc.)

[4] SDI refers to any externally contributed content such as Satellite, microwave etc.

12.1 Track allocation

1. A stereo PCM programme pair on channels 1 & 2
2. A stereo PCM programme pair on channels 3 & 4.
3. Channels 3 & 4 may alternatively include a 5.1 DOLBY E encoded surround soundtrack. The requirement to have a 5.1 soundtrack included may be necessitated by a request from the commissioning editor or as a creative decision by the producers' of the programme

12.2 The surround sound channels

These channels must be discreet audio channels corresponding to the following order:

1. Left
2. Right
3. Centre
4. Lfe(Low Frequency Effects)
5. Left Surround
6. Right surround

- Both Stereo and DOLBY E audio soundtracks must be delivered in sync with the video; no sync offsets must be induced.
- The DOLBY E soundtrack must have metadata values that correspond to the values tables in section 3.2.**Those highlighted in BOLD are imperative and may not be omitted or altered.**
- Metadata values are parameters set during the creation of the DOLBY E soundtrack and specify what occurs during the reproduction of the audio bit-stream when the consumer listens to the resultant audio.
- Lo/Ro (stands for Left only, Right only) is the preferred down-mix (conversion from 5.1 to stereo) option for the surround sound track. Lo/Ro preserves stereo separation and a mono compatible down-mix.
- The Dolby E stream must be delivered in a 20 bit format

12.3 Metadata values for DOLBY E delivery

METADATA PARAMETER	VALUE
Bitstream Mode	**Main Audio Service: Complete Main**
AC Mode:	**3/2**
Dolby Surround Mode	Not Indicated
LFE Channel	**Enabled**

Dialogue Normalization:	-23dBFs (note that this is in line with the EBU loudness Recommendation R128) -24LKFS (loudness)
Audio Production Info	Yes
Mix Level	85 dB
Room Type	Small
Copyright Bit	No
Original Bitstream	Yes
Preferred Stereo Downmix:	**Lo/Ro Preferred**
Lt/Rt Center Mix Level:	0.707 (-3.0 dB)
Lt/Rt Surround Mix Level:	0.707 (-3.0 dB)
Lo/Ro Center Mix Level:	0.707 (-3.0 dB)
Lo/Ro Surround Mix Level:	0.707 (-3.0 dB)
Dolby Surround EX Mode	Not Surround EX
A/D Converter Type	Standard
DC Filter	Disabled
Lowpass Filter	Disabled
LFE lowpass Filter	Enabled
Surround Phase Shift	Enabled
Surround 3dB Attenuation	Enabled
RF Mode Compression	Film Standard
Line Mode Compression	Film Standard

12.4 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.

12.5 Stereo line-up tones

Audio line-up shall be 1kHz tone recorded at the reference level (0dBu). Interrupted

tone identifying the left channel of a stereo recording should be broken for 0.25 secevery 3 seconds.

The reference level of AES recordings must correspond to -18dB with respect to maximum coding level. This means that the audio reference level 0dbu (PPM4) corresponds to 18dbFS. (AES pre-emphasis should not be used)

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

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

12.6 Stereo audio levels and measurement (loudness or volume)

Stereo programme audio levels are currently measured by Peak Programme Meters (PPM) as well as loudness meters. 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.

Content	Normal	Peaks Full Range
	PPM	PPM
Dialogue	3-5	3-6
Uncompressed Music	5	2-6
Compressed Music (depending on degree of comparison	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	

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

12.6.1 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 PPM4, are indicative of typical levels suitable for television, and are given as guidance only.

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

12.7 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.

12.8 Audio / Video sync markers

To assist in maintaining A/V sync through the post-production process, a 'sync plop' may be used. If 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.

12.9 Loudness

The loudness metadata shall always correctly indicate the actual programme loudness, even if for any reason a programme may not be loudness normalised to -24 LKFS

The audio processes, systems and operations concerning production, distribution and implementation should be made in compliance with EBU Tech Doc 3343 and 3344.

Normalize audio at -24 LKFS/ tolerance of -1LKFS

Generally:

- Sustained high levels of heavily compressed material are not acceptable.
- Care should be taken to ensure levels of perceived loudness remain within acceptable limits. Dynamic range should be constrained such that it is appropriate for reproduction in a domestic environment.
- Normal peaks of audio level should be controlled in accordance with the specification on audio outlined in the section "levels and measurements"

13 Delivery Requirements

13.1 Programme Layout / Format

TIME-CODE	DURATION	PICTURE	SOUND
09.58.00.00	90 SECS	EBU BARS	LINE-UP TONE
09.59.30.00	27 SECS 5 FRAMES	IDENT AND COUNTDOWN CLOCK	SILENCE
09.59.57.06	1 FRAME	1 FRAMES PEAK WHITE	1 FRAME TONE
09:59:57:07	2 SECS 19 FRAMES	BLACK	SILENCE
10:00:00:00		PROGRAM	PROGRAM
END OF PROG	10 SECS	FREEZE ON LAST FRAME (LIVE HOLD)	FADE OR CUT TO SILENCE

13.1.1 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.

13.1.2 Programmes longer than a single tape – Long form Content

If a programme must be delivered on two or more tapes because it is longer than the capacity of a single Digital Betacam 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 theline-up and clock sequence above.

13.1.3 Compilation tapes – Short form Content

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

13.1.4 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

13.2 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,

Digital clocks are acceptable as well

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

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

• Programme title (and series number if applicable)
• subtitle or episode number
• Episode subtitle (if applicable)
• Part number (if applicable)
• provide a clear countdown of at least 30 seconds fading to black at 3 seconds to first programme pictures

No technical information may be included. This means SD 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.

Clocks with only digital countdown are not acceptable.

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

13.3 Tape Delivery

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

13.3.1 Tape format

Betacam SP, Betacam SX and Digital Betacam are the formats acceptable for SD 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 packs. Labels must be fixed to both the cassette case and cassette and must not obscure the spools or obstruct the flap mechanism.

13.3.2 Paperwork

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

The following details are to be supplied by the programme supplier on their recording report:-

Programme Supplier.

ProgrammeTitle / Subtitle

Episode number (if applicable)

Origination Format.

Video and Colour Standard.

13.3.3 Aspect Ratio

4:3 and 16:9 SD material to be on different tapes with their own tape numbers (as the content is different) - when material is prepped it is stated as 4:3 or 16:9 in brackets after the code in the title field, if material is received on the same tape only one of the versions can be inputted

Log of contents by Time Code indication of the start and end of the actual program plus its duration. The Audio Channel and Track Assignment used for the recording must be noted on the label. Subtitling delivery is to be supplied on a DVD in the format of "*.pac".The "use of" and "type" of Dolby Noise Reduction.

If the recorded tape format is composite, the black signal must be colour black and the eight-field colour sequence for PAL must be uninterrupted. Telestreamed tapes are fine as this is separated onto 2 different tapes

13.4 Time-code

13.4.1 Longitudinal Time Code - Professional Videotape.
- LTC and VITC 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 ofthe programme, as they may introduce LTC discontinuities.
- Time code is to be delivered on the embedded video tape machine track.
- Professional video tape recordings should have continuous longitudinal
- Time code (LTC) – refer later to delivery requirements.
- The LTC and VITC time code must be the same time code value.
- User bit information is not required.
- Time code level to be 0dBu maximum and –6dBu minimum

Vertical Interval Time Code Line Allocations for Professional Video Tape Formats

Time Code Type	Betacam SP	Betacam SX	Digital Betacam
VITC	19, 21, 332, 334	19, 21, 332, 334	19, 21, 332, 334

Line 22 – must be clean. This is used internally for hard of hearing subtitling insertion.

Line 23 – must be clean. This is used internally for Wide screen signaling insertion.

14 Non-Tape Delivery
The internal format for SD digital media is : **MPEG-2 IMX (D10) MXF 30 Mb/s**

14.1 Hard Drives
On external storage devices that utilize the following transport/access protocols

- Drives must support the USB 2.0 interface as a minimum.
- FireWire 400
- **Format must be MPEG-2 IMX (D10) MXF 30 Mb/s**
- Drives must be be formatted in the windows NTFS standard
- Drives utilizing a firewire 400 interface may also be utilized. (IN PMR ONLY)
- E-SATA for library
- Drives must be free of VIRUS's. Drives that contain a virus will be rejected immediately

14.2 File –Transfer (DDPP) as an end to end processing of a file
SD File Delivery Summary

- PAL interlaced at 25 frames per second
- 90" Lineup bars and 1KHz tone at -18dBFS.
- Time code of start of programme 10:00:00:00.
- Circular countdown clock of at least 20" with details exactly as Section 4.2 on page 11.
- Audio as specified on page 40 Section 13.2
- Fade to silence at end point, end slate held in vision for further 10" after end of programme.

Non-Tape media or file-based SD content may be delivered to dedicated areas within Media Solutions. These area's are

- PMR (Production Media Room)
- Media Services Library
- Media Services Digital Delivery (Transfers and Ingest)

14.2.1 File delivery to Media Solutions Library

The Media Solutions library is responsible for managing all media owned by the broadcaster and as such has very strict guidelines for disk-based delivery of SD content

All video, audio, content delivery and drive requirements outlined in this document must firstly be met in addition to the format specified in the table below

FORMAT	VIDEO RESOLUTION	FRAME RATE	CODEC	BITRATE (Mb/s)	STRUCTURE	WRAPPER
F1	1080i	25	BLACKMAGIC IMX 4:2:2 10-bit	100	I-FRAME	AVI
F2	1080i	25	P2 4:2:2 10-bit	100	I-FRAME	MXF OP1a
F3	1080i	25	P2 4:2:0 10-bit	50	I-FRAME	MXF OP1a
F4	1080i	25	DVCPro HD	100	I-FRAME	MXF OP1a
F5	1080i	25	AVC-Intra	100	I-FRAME	MXF OP1a
F6	1080i	25	XDCAM 4:2:2	50	I-FRAME	MXF OP1a
F7	1080i	25	MPEG-2	80	LGOP	PS
F8	1080i	25	DVCPro HD	100	I-FRAME	QT
F9	1080i	25	MPEG-2	50, 70	LGOP	MXF OP1a
F10						
F11	1080i	25	MPEG-2	50	I-FRAME	GXF
F12	1080i	25	MPEG-2	100	I-FRAME	MXF OP1a
F13	PAL	25	MPEG-2 IMX	30	I-FRAME	PS
F14	PAL	25	MPEG-2	15, 30	LGOP	MXF OP1a
F15	PAL	25	MPEG-2	15, 30	LGOP	PS
F16	PAL	25	MPEG-4 (H.264)	15, 30	I-FRAME	QT

14.3 Live Delivery

Common technical standards for the live delivery of programmes are currently in development. In the interim, please contact the relevant broadcaster.

14.4 File Delivery via Digital Delivery mechanisms (is not operational yet)

Common technical standards for the file-based delivery of programmes via DIGITAL DELIVERY are currently in development. In the interim, please contact the broadcaster.

15 Glossary of Terms

15.1 Organizational

SMS or MS	SuperSport Media Solutions or Media Solutions
SS	SuperSport
Production Services	Department internal to Media Solutions that maintains and manages all production-related processes and systems.This includes all edit systems, studio's, galleries, Final Mix area's and production Tech Support.
Media Services	Department internal to Media Solutions that maintains manages transfers, ingests, the MAM infrastructure,physical library technical support and playout
PMR	Production Media Resource
Transfers and Ingest	Technical department within MS that deal with the transfer between tape formats and ingest of all content destined for transmission

15.2 Technical

QC	Quality Control
HD	High Definition
SD	Standard definition
HDCam	Sony HD Tape format
Production	All Post and Pre-production processes involved in the creation or editing of content
Interlaced	Interlaced scan is a method used for presenting an image on a television screen interlaced scanning uses two fields to create a frame. One field contains all the odd lines in the image; the other contains all the even lines of the image.
Progressive	Progressive scan is a method of presenting an image on a television screen using 1 frame every 1/60th of a second instead of interlaced where 1 frame
Pixels	Short for Picture Element, a pixel is a single point in a graphic image
Raster	The rectangular area of a display screen actually being used to display images. e.g 1920 by 1080

Aspect ratio	Television aspect ratio refers to the screens width compared to its height. e.g 16:9 indicates a width of 16t to a height of 9
Time Code	A digitally encoded signal that is recorded on videotape to identify each frame of video by hour, minute, second and frame number. There are two kinds of recorded signal: longitudinal time code (LTC) and vertical interval time code (VITC).
Field	A filed is merely a still image which is displayed sequentially to create the impression of motion on the screen.
Frames	A frame is a single full representation (picture) of an image on a television screen.
Frame rate	frequency at which an imaging device produces unique consecutive images called frames
Luminance	represents the brightness in an image (the "black and white" or achromatic portion of the image)
Chrominance	is the signal used in video systems to convey the color information of the picture
Chroma sub-sampling	The manner in which video is encoded into a digital format.4:2:2 indicates a 4 bit encoding for luminance,2 for the colour red and 2 bits for the colour blue
DVE	Digital Video Effects
PSF	Progressive Segmented Frame.
R,G,B	Red,Green and Blue colour components found in a video picture.
HDV	An HD tape format developed by SONY
Inter-Frame	An inter frame is a frame in a video compression stream which is expressed in terms of one or more neighboring frames.
Intra-frame	A frame-based coding techniques that utilize's I frames predominately in its coding structure, and not necessarily relevant to frames before or after that I frame.
Up-convert	When SD video is subjected to a process that ultimately creates an HD version of the SD video
Down-convert	When HD video is subjected to a process that ultimately creates an SD version of the HD video
720p	A format of High definition that utilizes a progressive manner of

	displaying and transmitting video content.720 refers to the number of lines in that progressive image
1080p	A format of high definition that utilizes a progressive manner of displaying and transmitting HD video content.1080 refers to the number of lines in that progressive image.
EBU	European Broadcasting Union
SMPTE	Society of Television and Motion Picture Engineers
mV	MilliVolts
Bit	A unit of digital information expressed either as a zero or one in binary notation
CG	Character generator or character generation
Gamut	A metric which denotes the magnitude of colour saturation.
PAL	Phase alternative line.
NTSC	National Television System Committee. Analogue television system standard used primarily in North America, South America etc.
Standards conversion	The process of changing from one one type of Tv system to another i.e. PAL to NTSC or vice versa
Fps	Frames per second
Non-linear editing(NLE)	Computerised method of editing video content.
DOLBY E	A data compression technology that compresses multiple audio channels onto 2 AES tracks
SDI	Serial digital Interface- a digital coding and coaxial transmission technology used specifically for video and audio.
M&E	Mix and Effects
LAN	Local Area Network
FTP	File Transfer Protocol
Stereo	Audio that is directed through 2 or more speakers.
Mono	Designation sound transmission or recording or re-production over a single channel or speaker
Phase (audio)	Term used to describe the position of one sound wave in relative to another.

PPM	Peak program meter
dBFs	Notation and/or measure of audio on a digital scale
5.1	Surround sound audio which is usually represented by 5 identical speakers as well as an Lfe speaker
Lfe	Low Frequency Effects
Metadata	A term used to describe additional or ancillary data about other data
ms	Milli-seconds
NTFS	New Technology File system. Windows file system
USB 2.0	Universal serial Bus.An external data transfer bus used on computers
Firewire 400	A high-speed data transfer protocol for connecting drives or other devices to a computer at 400 Mb/s
E-SATA	External Serial Advanced Technology Attachment.Allows SATA drives to be attached externally
PANASONIC P2	A professional digital video storage media format developed by Panasonic
XDCAM HD	A disk-based digital video storage format developed by SONY in 2004
DVCPro	A format for playing back and recording digital video
AVC INTRA	A type of video coding developed by Panasonic that is compliant with MPEG4/H264
I-Frame	Intra frame.A frame which serves as a reference to construct other frames relative to the I frame
MPEG-4/H.264	Moving Pictures Experts Group. Standard for video compression.
MPEG2	Moving Pictures Experts Group.Standard for video compression
DNxHD	Digital Non-linear Extensible High Definition. A high definition Video Codec developed by AVI
MXF	Material Exchange Format, is a container format for professional digital video and audio media defined by a set of SMPTE standards
QT	Quicktime, a video and audio codec developed by APPLE for use with file-based content
MXF OP1a	A format-specific version of the MXF container

EBU Tech Doc 3205-E: The EBU standard peak-programme meter for the control of

international transmissions.

ITU-R BS.645 :   Test signals and metering to be used on international sound programme connections.

ITU-R BS.1770:   Algorithms to measure audio programme loudness and true-peak audio level.

EBU Tech Doc 3341:   Loudness Metering: 'EBU Mode.' metering to supplement loudness normalisation in accordance with EBU R 128.

EBU Tech Doc 3342:   Loudness Range: A measure to supplement loudness normalisation in accordance with EBU R 128.

EBU Tech Doc 3343:   Practical Guidelines for Production and Implementation in accordance with EBU R 128.

EBU Tech Doc 3344:   Practical Guidelines for Distribution of programmes in accordance with EBU R 128.

Programme: An individual, self-contained audio-visual media; A commercial, promo interstitial or similar item shall be considered to be a programme in this context;

Programme Loudness: The integrated loudness over the duration of a programme

Programme Loudness Level: is the value (in LKFS) of Programme Loudness

Loudness Range (LRA):   This describes the distribution of loudness within a programme

Maximum True Peak Level: The maximum value of the audio signal waveform of a programme in the continuous time domain.