

1. Title

Operational Practices for the Digital HDCAM¹ videotape format.

2. Scope

2.1 This document specifies Operational Practices when employing the Digital HDCAM videotape format. It recommends the Video and Audio alignment signals² to precede the program content, the Video/Audio Identification, Countdown and Time and Control Code requirements.

2.2 Audio input/output may be in either Analogue or AES/EBU digital formats. This will require a reference level alignment test signal in both the digital and analogue forms producing the same reference meter reading. This is defined as -20dbFS by SMPTE RP155. References below to the audio alignment test signal do not define the input format of the signal. This is at the users discretion.
To facilitate the recording of encoded 5.1 multi-channel audio, a suitable coding system should be used and recorded on the AES 2 track (3/4).

3. Alignment Signals

3.1 As the system is cassette based, there is no requirement for any black video and silence at the head of the tape.

3.2 At the start of the recording there shall be a minimum 60 seconds of an alignment video signal consisting of a colour bar signal of either 100/0/100/0 or 100/0/75/0 content. This signal shall occupy at least half the picture height. The 100/0/100/0 signal is preferred.

It is essential that if a colour bar signal other than that recommended is used, it must be accompanied by a visual identification specifying the signal used.

‘Matrix³ type’ alignment signals which meet the intent of the above are acceptable.

Note: The content of the remaining half picture is optional. The maintenance of legal PAL chroma levels when down converting from HD would be aided by the use of a ‘Rainbow⁴’ type test signal at 100% chroma.

1 HDCAM is SMPTE 369M Television – Type D-11 Data Stream and AES3 Data Mapping over SDTI.

2 Even though the HDTV system is a fully digital system not requiring alignment signals, the system will contain variables that may cause errors. Thus alignment signals will still be necessary.

3 Matrix alignment signal - A test picture consisting of a spatial mix of a number of test signals.

4 Rainbow – a line rate continuous all phase chroma signal of 100% amplitude.

- 3.3 In the case of tape duplication, the alignment signal shall be derived from the actual source material. (This is necessary due to the use of SDTI as the preferred dubbing interface.).
- 3.4 Simultaneously with the video alignment signal, a reference level audio tone of 1000Hz \pm 20Hz should be recorded in phase and from a single source on all tracks intended to carry program material. This reference level audio tone shall be at -20dbFS [SMPTE R.P. 155]. When encoded 5.1 multi-channel audio is not present the audio test signal on tracks 1 and 3 should remain at constant level whilst the audio test signal on tracks 2 and 4 should be interrupted every 3 seconds for a period of approx 0.25 seconds to identify the right channel of a stereo pair or pairs.
- 3.5 The reference tone recordings should be made under the same conditions of equipment adjustment as used for the sound portion of the program.

4. Audio Track Assignment

- 4.1 The Digital HDCAM system has four identical high quality digital audio tracks. On a monophonic recording the mono program sound shall be dual recorded in phase on both tracks 1 and 2. If an associated mono M and E track is present, it shall be recorded on track 3.
- 4.2 In a stereophonic recording of either Lt/Rt or Lo/Ro⁵ type the stereo program sound shall be recorded with the left channel on track 1 and the right channel on track 2. Stereophonic M and E shall be recorded with the left channel on track 3 and the right channel on track 4.

Correct relative phasing and synchronisation of M and E to final mix should be maintained at all times.

- 4.3 An encoded 5.1 multi-channel audio shall be recorded on the second AES 2 track (3/4). The audio data representing up to 8 channels plus Meta data will be carried as a suitably encoded audio multiplex. When the second AES 2 track (3/4) carries an encoded 5.1 multi-channel audio signal, then the first AES 1 track (1/2) will carry a suitably downmixed Lt/Rt Surround Sound version of the encoded 5.1 multi-channel audio signal. If an encoded audio multiplex is used to record 5.1 multi-channel audio on AES 2 (3/4), the same processing delay should be applied to the down-mixed Lt/Rt Surround sound version recorded on AES 1 (1/2).

Note: Both AES 1 (1/2) and AES 2 (3/4) should be in sync with the vision as recorded on tape.

5 Lt/Rt – Dolby Surround (Pro Logic) encoded Left Total/Right Total.
Lo/Ro – Stereophonic left and right.

- 4.4 Track assignments within the encoded 5.1 multi-channel audio multiplex should be as follows;

Track 1	Left
Track 2	Right
Track 3	Centre
Track 4	LFE
Track 5	Left Surround
Track 6	Right Surround
Track 7	Lt or Freely Assignable
Track 8	Rt or Freely Assignable

Note: It is recognised that in post production activities other track arrangements may be used. The assignments above correspond to SMPTE 320M.

- 4.5 The analogue cue track is a “users track” and is available at the users discretion for recording cueing information where necessary.

5. Time and Control Code

- 5.1 25Hz Longitudinal Time and Control Code according to EBU Tech 3097 and N12 should be recorded on the Time Code track.
- 5.2 24Hz Longitudinal Time and Control Code according to SMPTE 12M. HDCAM supports only Non Drop Frame mode for 24Hz Time and Control Code.
- 5.3 In an 1125 line HDTV recording (25Hz or 24Hz), the Ancillary Data Time and Control Code according to a standard yet to be defined.
- 5.4 Both Longitudinal and Ancillary Data Time Code should match and be continuous for the duration of the recording.
- 5.5 The Time Code shall not pass through 2400 hours for the duration of the recording.
- 5.6 The use of “User Bits” within the Time and Control Code for the purpose of indicating program identification and segment duration is to be encouraged.

6. Visual and Aural Identification Information

- 6.1 Visual identification information (clapper board) should be recorded, following the alignment signal, for a minimum of 30 seconds. Aural identification is optional and may be dual recorded on audio tracks 1 and 2.
- 6.2 The visual identification should contain information relative to:
- (a) Title – exactly the same as on screen
 - (b) Episode/CAD number
 - (c) Production number
 - (d) Production House name
 - (e) Date of recording
 - (f) Frame rate
 - (g) Audio status including track assignments and content e.g. Lt/Rt or Lo/Ro or 5.1 Multi-channel / Meta Data
 - (h) Aspect Ratio of Image (Protected state of product)
 - (i) If converted – type of Standards Conversion
 - (j) Closed Captions

7. Countdown

- 7.1 A visual/aural countdown signal should be recorded following the Identification section.
- 7.2 The audio countdown signal as described below should be recorded on both audio tracks 1 and 2.
- 7.3 The audio countdown signal should consist of a series of reference level 400 Hz \pm 20 Hz bursts each of 1/5th second duration, occurring at 1 second intervals over the range from 10 seconds ahead of program start to 2 seconds ahead of program start.
- 7.4 In addition, a steady component of the countdown audio tone should be recorded approximately 20db below the level of the tone bursts, starting with the first burst and ending with the last, leaving a 2 second silent interval before program start.
- 7.5 A numerical visual countdown signal should be recorded during the entire period of the steady component of the above described audio tone signal. Video black should be recorded during the 2 second interval from the end of the tone bursts to active program start.

- 7.6 Accurate identification of first frame of active video on commercials should be provided by the inclusion of a white marker top right of picture during the 2 second interval before active video. The white marker should be present up to the first frame of active video and be positioned outside the picture safe area. The white marker should be a minimum picture height of 24 lines and a minimum width of 36 pixels. Timing of the commercial is referenced from the first frame of active video.

8. Continuity of Recorded Signals

- 8.1 There must be continuity of recorded signals from a point at least 30 seconds before program start.
- 8.2 Video black should continue for at least 10 seconds following the conclusion of the program. The accompanying audio track should be silent.

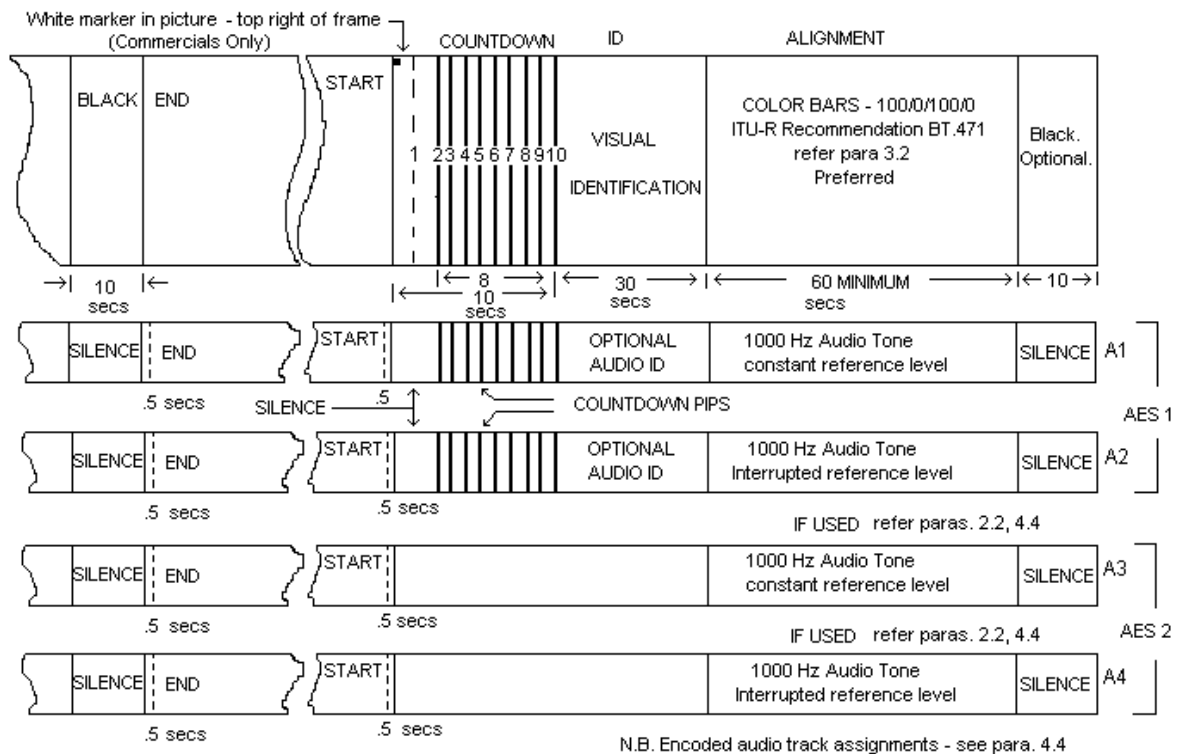
9. Generation Loss / Pixel Shifts

- 9.1 As the HDCAM format is a compressed data recording system it is recommended that where practicable dubs should be done using the SDTI dubbing output connector. This is available as an option as a 1.5Gb/s output or as a SDTI 270 Mb/s output on the HDW-500; but only as a 270 Mb/s SDTI output on the HDW-F500.
- 9.2 Pixel shifts should be avoided when dubbing through switchers and/or DVE equipment in order to minimize concatenation effects that will generate artefacts thus degrading the picture quality.

10. CLOSED CAPTIONS – HIGH DEFINITION

- 10.1 Carriage of closed captions for High Definition is yet to be identified or standardised.

Figure 1. HDCAM VTR FORMAT ALIGNMENT SIGNALS, LEADER AND TIMING.



THIS DRAWING SHOWS THE START AND END TIMES OF AUDIO AS DEFINED FOR COMMERCIAL AND PROMOTIONAL MATERIAL (BETWEEN DOTTED LINES). THE START AND END TIMES FOR PROGRAMME MATERIAL TEND TO BE ARBITRARY AND NOT CAPABLE OF DEFINITION.

DRAWING NOT TO SCALE.

