

INTERNATIONAL STANDARD

IEC 62141

First edition
2005-10

Helical-scan digital video cassette recording format using 12,65 mm magnetic tape and incorporating MPEG-4 compression – Type D-16 format

© IEC 2005 — Copyright - all rights reserved

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from the publisher.

International Electrotechnical Commission, 3, rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: inmail@iec.ch Web: www.iec.ch



Commission Electrotechnique Internationale
International Electrotechnical Commission
Международная Электротехническая Комиссия

PRICE CODE

XD

For price, see current catalogue

CONTENTS

FOREWORD.....	6
1 Scope.....	8
2 Normative references.....	8
3 Terms, definitions and acronyms.....	9
3.1 Terms and definitions.....	9
3.2 Acronyms.....	10
4 Environment and test conditions.....	10
4.1 Calibration tape.....	11
4.2 Record locations and dimensions.....	11
5 Tape and cassette physical specifications.....	11
5.1 Magnetic tape specifications.....	11
5.2 Cassette specifications.....	11
6 Tape record physical parameters.....	34
6.1 Input reference signal.....	34
6.2 Tape speed.....	34
6.3 Helical record physical parameters.....	34
6.4 Longitudinal record physical parameters.....	35
7 Longitudinal track signal and magnetic parameters.....	39
7.1 Longitudinal track record parameters.....	39
7.2 Control track record parameters.....	39
7.3 Time and control code track record parameters.....	40
8 Source picture and audio processing.....	41
8.1 Introduction.....	41
8.2 Input formats.....	44
8.3 Input data segmentation and shuffling.....	46
8.4 Picture data encoding.....	60
8.5 Data packing.....	63
8.6 Audio input format and data packing.....	77
9 Helical track signal parameters and magnetization.....	80
9.1 Introduction.....	80
9.2 Video data outer correction and shuffling.....	80
9.3 Audio data outer correction and shuffling.....	82
9.4 Helical track data parameters.....	86
9.5 Channel coding.....	97
9.6 Magnetization.....	97
Annex A (normative) Digital interfaces.....	98
Annex B (informative) Tape transport and scanner.....	100
Annex C (informative) Compatibility with the other digital formats using Type-L derivative cassettes.....	103

Figure 1 – Top- and side-view dimensions (S-cassette)	14
Figure 2 – Bottom-view dimensions (S-cassette).....	15
Figure 3 – Datum areas, supporting areas, tape guides and associated dimensions (S-cassette).....	17
Figure 4 – Reel location in the unlocked position (S-cassette)	17
Figure 5 – Protecting lid dimensions (S-cassette)	18
Figure 6 – Reel dimensions (S-cassette).....	19
Figure 7 – Reel height in the unlocked position (S-cassette).....	19
Figure 8 – Unlocking lever insertion area (S-cassette)	20
Figure 9 – Lid unlocking force (S-cassette)	22
Figure 10 – Lid opening force (S-cassette).....	22
Figure 11 – Reel spring force (S-cassette).....	22
Figure 12 – Safety plug strength (S-cassette)	23
Figure 13 – Extraction force (F1, F2) and friction torque (S-cassette)	23
Figure 14 – Top and side views (L-cassette).....	24
Figure 15 – Bottom view (L-cassette).....	25
Figure 16 – Datum areas, supporting areas and tape guides (L-cassette)	27
Figure 17 – Reel location in unlocked position (L-cassette).....	27
Figure 18 – Protecting lid (L-cassette)	28
Figure 19 – Reel dimensions (L-cassette)	29
Figure 20 – Reel height in unlocked operation (L-cassette).....	29
Figure 21 – Unlocking lever insertion area (L-cassette).....	30
Figure 22 – Lid unlocking force (L-cassette)	32
Figure 23 – Lid opening force (L-cassette).....	32
Figure 24 – Reel spring force (L-cassette)	32
Figure 25 – Safety plug strength (L-cassette).....	33
Figure 26 – Extraction force (F1, F2) and friction torque (L-cassette).....	33
Figure 27 – Locations and dimensions of recorded tracks	37
Figure 28 – Locations and dimensions of tolerance zones of helical track records	38
Figure 29 – Recorded control code waveform	40
Figure 30 – Overall recording block diagram.....	41
Figure 31 – Overall playback block diagram.....	42
Figure 32 – Type D-16 encoding, one coding channel.....	43
Figure 33 – Type D-16 encoding, two coding channels	43
Figure 34 – 1920 × 1080/PsF 4:2:2 YC _B C _R shuffle blocks	46
Figure 35 – 1920 × 1080/PsF 4:4:4 RGB shuffle blocks	47
Figure 36 – 1920 × 540/I 4:2:2 YC _B C _R shuffle blocks.....	48
Figure 37 – 1920 × 540/I 4:4:4 RGB shuffle blocks	49
Figure 38 – 1280 × 720/P 4:2:2 YC _B C _R frame shuffle blocks.....	49
Figure 39 – 1920 × 1080/PsF 4:2:2 YC _B C _R shuffle sets	50
Figure 40 – 1920 × 1080/PsF 4:4:4 RGB shuffle sets	51

Figure 41 – 1920 × 1080/I 4:2:2 YC _B C _R shuffle sets	52
Figure 42 – 1920 × 1080/I 4:4:4 RGB shuffle sets	53
Figure 43 – 1280 × 720/P 4:2:2 YC _B C _R shuffle sets	54
Figure 44 – 1920 × 1080 4:2:2 YC _B C _R macro block unit number allocation	56
Figure 45 – 1920 × 1080 4:4:4 RGB macro block unit number allocation	57
Figure 46 – 1280 × 720 4:2:2 YC _B C _R macro block unit number allocation	57
Figure 47 – 1920 × 1080 ancillary data bursts	58
Figure 48 – 1280 × 720 ancillary data bursts	58
Figure 49 – Ancillary data headers	59
Figure 50 – Macro block encoding	61
Figure 51 – Basic block format	63
Figure 52 – Macro block identifier byte descriptions	64
Figure 53 – Auxiliary data time code	67
Figure 54 – 4:2:2 YC _B C _R differential DC block order	70
Figure 55 – 4:4:4 RGB differential DC block order	70
Figure 56 – 4:2:2 DCT code interleave	71
Figure 57 – 4:2:2 YC _B C _R DCT macro block interleaving example	72
Figure 58 – 4:4:4 DCT code interleave	72
Figure 59 – 4:4:4 RGB DCT macro block interleaving example	73
Figure 60 – 4:2:2 YC _B C _R DPCM code word interleave order	73
Figure 61 – 4:2:2 YC _B C _R DPCM macro block interleaving example	74
Figure 62 – 4:4:4 RGB DPCM code word interleave order	74
Figure 63 – 4:4:4 RGB DPCM macro block interleaving example	75
Figure 64 – 1920 × 1080 packing example	76
Figure 65 – 1280 × 720 packing example	76
Figure 66 – Start and end sample number of data recording mode	78
Figure 67 – Audio auxiliary data words	79
Figure 68 – Video data block in	81
Figure 69 – Audio data blocking for each audio channel	83
Figure 70 – Audio sync block alignments on helical tracks	85
Figure 71 – General sector arrangement on helical track	86
Figure 72 – Sector and segment arrangement on helical track	88
Figure 73 – Record unit, segment, channel and track pair counts	89
Figure 74 – Video sync block format	90
Figure 75 – Audio sync block format	90
Figure 76 – Sync block identification bytes	91
Figure 77 – Sync sequence number	93
Figure A1 – System overview	98
Figure B.1 – Possible scanner configuration (29,97 Hz, 25 Hz, 24 Hz and 23,98 Hz record unit rates)	101
Figure B.2 – Possible longitudinal head location and tape wrap (29,97 Hz, 25 Hz, 24 Hz and 23,98 Hz record unit rates)	102

Table 1 – Tape speeds for each record unit rate	34
Table 2 – Record location and dimensions	36
Table 3 – Control track pulse widths	39
Table 4 – Data rates associated with source picture rates	42
Table 5 – 1920 × 1080 ancillary data line number ranges	44
Table 6 – 1920 × 1080 source picture rates	45
Table 7 – 1280 × 720 ancillary data line number ranges	45
Table 8 – 1280 × 720 source picture rates	45
Table 9 – Shuffle-set allocation	55
Table 10 – Pseudo-random SIZE and RANGE value	55
Table 11 – Ancillary line ID values	60
Table 12 – General coding constraints	61
Table 13 – Range for quantizer_scale_code	62
Table 14 – Coded sequence segment numbers	65
Table 15 – Auxiliary basic block data	66
Table 16 – Frame-rate flags	67
Table 17 – Ancillary data line numbers for 1920 × 1080 sources	68
Table 18 – Macro block header syntax	69
Table 19 – Packing size for each record unit rate	77
Table 20 – Sync sequence number and UL	94
Table A1 – Audio sampling clock ratios	99
Table B.1 – Parameters for a possible scanner design	100
Table B.2 – Data rate and recorded wavelength	101

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HELICAL-SCAN DIGITAL VIDEO CASSETTE
RECORDING FORMAT USING 12,65 mm MAGNETIC TAPE
AND INCORPORATING MPEG-4 COMPRESSION –
TYPE D-16 FORMAT (TA6)**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as far as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62141 has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this standard is based on the following documents:

CDV	Report on voting
100/925/CDV	100/1004/RVC

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

Currently in preview, click buy full version

HELICAL-SCAN DIGITAL VIDEO CASSETTE RECORDING FORMAT USING 12,65 mm MAGNETIC TAPE AND INCORPORATING MPEG-4 COMPRESSION – TYPE D-16 FORMAT (TA6)

1 Scope

This International Standard specifies the track content, format, and recording method of the data blocks containing compressed video, AES3 audio data, and associated data which form the helical records on 12,65 mm tape in cassettes. This standard supports recording of source picture formats using 1920 × 1080 pixels with the 4:4:4 and 4:2:2 sampling structure specified in SMPTE 274M at the frame rate of 23,98 Hz, 24 Hz, 25 Hz and 29,97 Hz, and using 1280 × 720 pixels with the 4:2:2 sampling structure specified in SMPTE 296M at the frame rates of 50 Hz and 59,94 Hz (see note). This standard also supports recording of 12 channels of AES3 audio data and 3 lines of uncompressed blanking interval data. This standard includes packetizing and shuffling operations supporting picture compression using the DCT and DPCM encoding methods defined by ISO/IEC 14496-2 (MPEG-4 simple studio profile).

NOTE Early implementations of this standard might not comply to the frame rates of 50 Hz as specified in SMPTE 296M.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments), applies.

IEC 61213:1993, *Analogue audio recording on video tape – Polarity of magnetization*

IEC 61237-1:1994, *Broadcast video tape recorders – Methods of measurement – Part 1: Mechanical measurements*

ISO/IEC 14496-2:2004, *Information technology – Coding of audio-visual objects – Part 2: Visual*

ITU-R Recommendation BT.709:2002, *Parameter values for the HDTV standards for production and international programme exchange*

SMPTE 12M:1999, *Television – Audio and Film – Time and Control Code*

SMPTE 274M:2003, *Television – 1920 × 1080 Scanning and Analog and Parallel Digital Interfaces for Multiple Picture Rates*

SMPTE 276M:1995, *Transmission of AES-EBU Digital Audio Signals Over Coaxial Cable*

SMPTE 292M:1998, *Bit-Serial Digital Interface for High-Definition Television Systems*

SMPTE 296M:2001, *Television – 1280 × 720 Progressive Image Sample Structure – Analog and Digital Representation and Analog Interface*

SMPTE 299M:1997, *Television – 24-Bit Digital Audio Format for HDTV Bit-Serial Interface*

SMPTE 372M:2002, *Television – Dual Link 292M Interface for 1920 x 1080 Picture Raster*

SMPTE RP 188:1999, *Transmission of Time Code and Control Code in the Ancillary Data Space of a Digital Television Data Stream*

AES3-1997, *Serial transmission format for two-channel linearly represented digital audio data*