IEC 62330-2

Edition 1.0 2003-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Helical-scan digital video cassette recording system using 12,65 mm (0,5 in) magnetic tape – Format HD-D5 – Part 2: Compression format

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df6-cb3c-4991-8918-
f6b8b7b55b9c/iec-62330-2-2003

Système de magnétoscope numérique à cassette à balayage hélicoïdal sur bande magnétique de 12,65 mm (0,5 in) – Format HD-D5 – Partie 2: Format de compression

THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2003 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, 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 either IEC or IEC's member National Committee in the country of the requester.
If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de la CEI ou du Comité national de la CEI du pays du demandeur.
Si vous avez des questions sur le copyright de la CEI ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de la CEI de votre pays de résidence.

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

Useful links:

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-
bed8b653f56/iec-62330-2-2003

IEC publications search - www.iec.ch/searchpub

The advanced search enables you to find IEC publications by a variety of criteria (reference number, text, technical committee,…).
It also gives information on projects, replaced and withdrawn publications.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available on-line and also once a month by email.

Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

A propos de la CEI

La Commission Electrotechnique Internationale (CEI) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications CEI

Le contenu technique des publications de la CEI est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Liens utiles:

Recherche de publications CEI - www.iec.ch/searchpub

La recherche avancée vous permet de trouver des publications CEI en utilisant différents critères (numéro de référence, texte, comité d'études,…).
Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

Just Published CEI - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications de la CEI. Just Published détaille les nouvelles publications parues. Disponible en ligne et aussi une fois par mois par email.

Electropedia - www.electropedia.org

Le premier dictionnaire en ligne au monde de termes électroniques et électriques. Il contient plus de 30 000 termes et définitions en anglais et en français, ainsi que les termes équivalents dans les langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (VEI) en ligne.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: csc@iec.ch.

IEC 62330-2

Edition 1.0 2003-05

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Helical-scan digital video cassette recording system using 12,65 mm (0,5 in) magnetic tape – Format HD-D5 – Part 2: Compression format

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003

Système de magnétoscope numérique à cassette à balayage hélicoïdal sur bande magnétique de 12,65 mm (0,5 in) – Format HD-D5 – Partie 2: Format de compression

INTERNATIONAL ELECTROTECHNICAL COMMISSION

COMMISSION ELECTROTECHNIQUE INTERNATIONALE

PRICE CODE
CODE PRIX

X

ICS 33.160.40; 35.240.99

ISBN 978-2-83220-461-0

Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.

® Registered trademark of the International Electrotechnical Commission
Marque déposée de la Commission Electrotechnique Internationale

CONTENTS

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-bedd8b6591b6/iec-62330-2-2003

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-bedd8b653f56/iec-62330-2-2003

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HELICAL-SCAN DIGITAL VIDEO CASSETTE RECORDING SYSTEM USING 12,65 mm (0,5 in) MAGNETIC TAPE – FORMAT HD-D5 –

Part 2: Compression format

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested National Committees.
3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
6) Attentions drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-bedd8b653b6e/iec-62330-2-2003

International Standard IEC 62330-2 has been prepared by Technical Area 6: Higher data rate storage media and equipment of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This bilingual version (2012-11) corresponds to the monolingual English version, published in 2003-05.

It was submitted to the national committees for voting under the Fast Track Procedure as the following documents:

CDV	Report on voting
100/505/CDV	100/604/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.

The French version of this standard has not been voted upon.

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 2008. At this date, the publication will be

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

IEC 62330 consists of the following parts, under the general title *Helical-scan digital video cassette recording system using 12,65 mm (0,5 in) magnetic tape – Format HD-D5*.

Part 1: VTR specifications

Part 2: Compression format

Part 3: Data stream format

Part 1 describes the VTR specifications which are tape, magnetization, helical recording, modulation method and basic system data for high definition video compressed data on 29,97 or 59,94 frame rate.

This part 2 describes the specifications for encoding process and data format for 1080i and 720p systems.

Part 3 describes the specifications for transmission of HD-D5 compressed video and audio data stream over 360 Mb/s serial digital interface.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-bedd8b653f56/iec-62330-2-2003

HELICAL-SCAN DIGITAL VIDEO CASSETTE RECORDING SYSTEM USING 12,65 mm (0,5 in) MAGNETIC TAPE – FORMAT HD-D5 –

Part 2 – Compression format

1 Scope

This part of IEC 62330 defines the encoding process of the HD-D5 video compression and its data format for the 1 080/59,94i system (hereinafter referred to as the 1 080i system) and the 720/59,94p system (hereinafter referred to as the 720p system).

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.

ITU-R BT.1543, *1 280 × 720, 16 × 9 progressively-captured image format for production and international programme exchange in the 60 Hz*

iTeh STANDARD PREVIEW

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

(standards.iteh.ai)

IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-bedd8b653f56/iec-62330-2-2003

3 Acronyms

BUF	Buffer memory
C	Colour difference signal
C3RMB	Compressed data of 3 RMBs
C(t, u)	The value of the DCT coefficient at frequency (t, u)
C_B/C_R	Colour difference signal
CC0 ~ CC2	Categories for C DCT block
Ccoef( )	C DCT CG
CG	Coefficient group
CGNR	CG number of one Y/C DCT coefficient block in one RMB
CGNS	CG number of one Y/C DCT coefficient block in one SMB
CN	C3RMB number in one RMBG
CRcoef( )	Rearranged C DCT CG
CS	C DCT block number in one SMB
CY0 ~ CY3	Categories for Y DCT block
DCT	Discrete cosine transform
DIF	Digital interface
DIF(n)	DIF block numbered n
DN	DIF block number
EOB	“End of block” code
EOM	“End of 3 RMBs” code

exnor	Logical exclusive nor
f( )	Offset value table for SMBG distribution
FCB	Category flag of C_B DCT block
FCB′	Category flag of C_B DCT block
FCR	Category flag of C_R DCT block
FCR′	Category flag of C_R DCT block
FFL	Field number flag
FMB	Category flag of the MB
FMB′	Category flag of the MB
FYa ~ FYd	Category flags of the four DCT blocks (Ya ~ Yd) of the MB
FYa′ ~ FYd′	Category flags of the four DCT blocks (Ya ~ Yd) of the MB
H	The horizontal SMB position number in one video field (1 080i system) or one video frame (720p system)
HR	The column position number of RMB
HS	The column position number of SMB in one SMBG
IDCT	Inverse discrete cosine transform
int (A)	Integer part of A
LEN	The byte length of C3RMB
MB	Macro block
mod	Modulus operator
N.A.	Not applicable
Offset( )	Offset value for RMB shuffling
P(r, s)	The value of the pixel at the position (r, s) in Y/C DCT block
Qno	Quantization number
Qstep	Quantization step value
r	The horizontal pixel position number in Y/C DCT block
Rg	The RMBG number within the RMBs
RMB	Rearranged macro block
RMBG	Rearranged macro block group
Rn	The number of RMB coding order in each RMBG
s	The vertical pixel position number in Y/C DCT block
SA	The starting address of the remainder data in buffer memory
SABM	One byte data of SA (two bytes)
Sg	The SMBG number in one video field (1 080i system) or one video frame (720p system)
SMB	Super macro block
SMBG	Super macro block group
t	The horizontal frequency number in Y/C DCT coefficient block
TableCY0 ~ 3	Set up value tables for Y weighting function
TableCC0 ~ 2	Set up value tables for C weighting function
u	The vertical frequency number in Y/C DCT coefficient block
V	The vertical position number of SMB in one video field (1 080i system) or one video frame (720p system)
VLC	Variable length coding

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-bedd8b653b6/iec-62330-2-2003

VR	The row position number of RMB
VS	The row position number of SMB in one SMBG
W(t, u)	Weighting value at frequency (t, u)
Y	Luminance signal
Ya ~ Yd	Four Y DCT blocks in one MB
Ycoef( )	Y DCT CG
YR	The Y DCT coefficient block number in one RMB
YRcoef( )	Rearranged Y DCT CG
YS	The Y DCT block number in one SMB
Z	The row position number of the RMB after RMB shuffling
ZRL	Code of 15 successive zero coefficients followed by a coefficient of zero amplitude

4 Video processing

4.1 Overview

Luminance (Y) and colour difference components (C_B and C_R) from 1 080i or 720p video signal are sampled by 74,25/1,001 MHz and 37,125/1,001 MHz respectively.

After discarding samples in vertical and horizontal blanking periods, active video samples are divided into four super macro block groups (SMBG) per field (1 080i) or per frame (720p). Each SMBG consists of 1 080 super macro blocks (SMB).

iTeh STANDARD PREVIEW
(standards.iteh.ai)

Each SMB consists of two MBs. Each MB consists of four luminance DCT blocks (8 × 4 pixel matrix) and one each of C_B DCT block (8 × 8 pixel matrix) and C_R DCT block (8 × 8 pixel matrix).

IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-
bed8b652f56/iec-62330-2-2003

As described later, two horizontally adjacent luminance DCT blocks are overlapped by one pixel column at their junction. Two horizontally adjacent chrominance DCT blocks are overlapped by one pixel column at their junction when they are formed into SMB.

Each DCT block is transformed to represent DC and AC coefficients. Coefficients are weighted through the prearranged categories prior to shuffling, then formed into rearranged MBs (RMB).

DCT coefficients within one rearranged MB group (RMBG) are quantized, and made into a fixed length data set through VLC.

The VLC output code words from one RMBG are formed into 360 DIF blocks.

The compressed video data for one 1 080i field or one 720p frame consists of 5 760 DIF blocks.

The block diagram of the outline about video processing is shown in Figure 1.

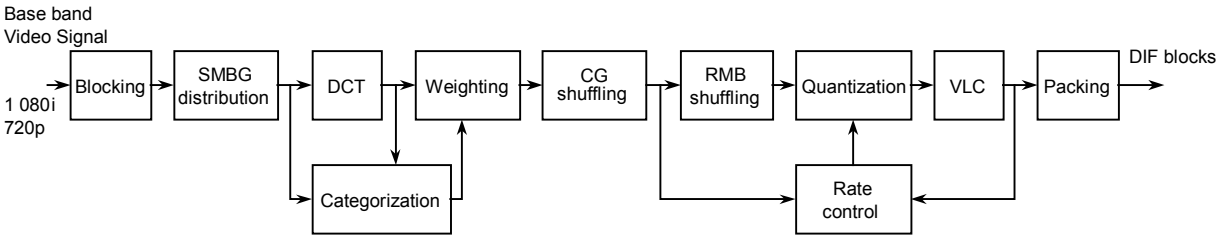


Figure 1 – Block diagram of outline about video processing

4.2 Video signal

4.2.1 Sampling process

The sampling structure is defined in ITU-R BT.709 and ITU-R BT.1543. Sampling structures of the luminance (Y) and the two colour difference signals (C_B/C_R) are described in Table 1.

4.2.1.1 Line structure in one field (1 080i system) or frame (720p system)

For the 1 080i system, 540 lines for Y, C_B and C_R signals from each field shall be transmitted. For the 720p system, 720 lines for Y, C_R and C_B signals from each frame shall be transmitted. The transmitting lines on a television frame are defined in Table 1.

iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-cb5c-4c91-b916-8edd8b653f56/iec-62330-2-2003

Table 1 – The construction of video signal sampling

		1 080i system		720p system	
Sampling frequency	Y	74,25 MHz / 1,001			
	C_B/C_R	37,125 MHz / 1,001			
Total number of pixels per line	Y	2 200		1 650	
	C_B/C_R	1 100		825	
The number of active pixels per line	Y	1 920		1 280	
	C_B/C_R	960		640	
Total number of lines per frame		1 125		750	
The number of active lines per frame		1 080		720	
The active line numbers		Field 1	21 to 560	Frame	26 to 745
		Field 2	584 to 1 123		
Quantization		Each sample is linearly quantized to 10 bits for Y, C_B and C_R			
The relation between video signal level and quantized level	Scale	4 to 1 019			
	Y	Quantized level: 877 Video signal level of white: 940 Video signal level of black: 64			
	C_B/C_R	Quantized level: 897 Video signal level of gray: 512			

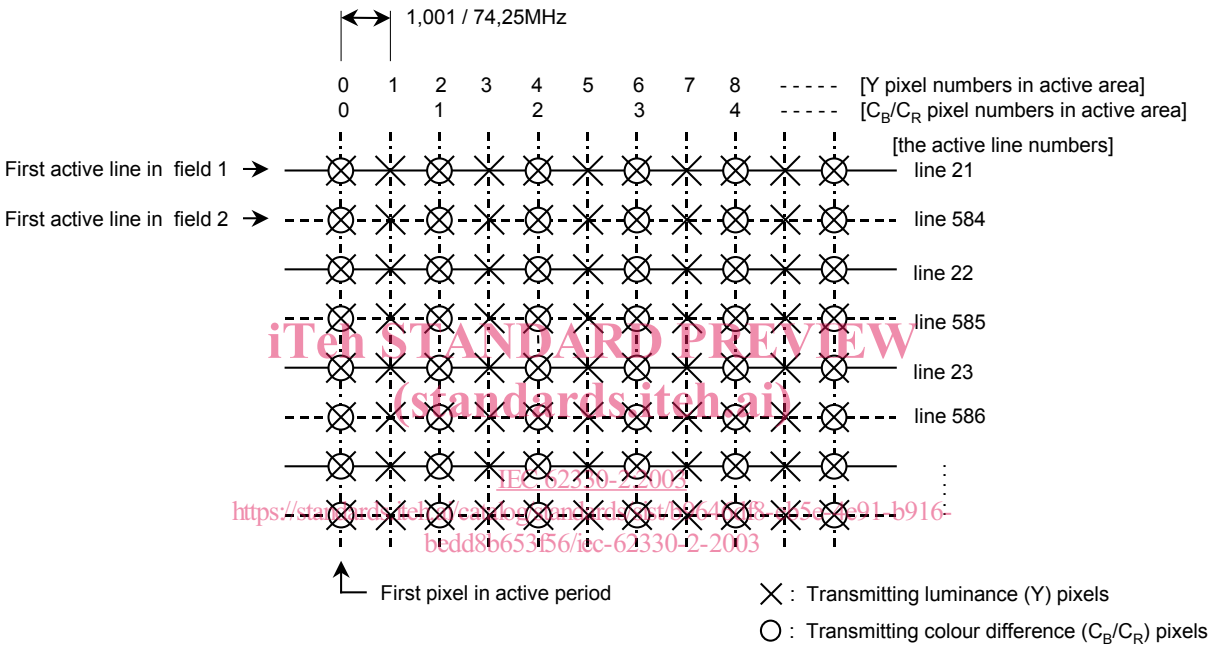
4.2.1.2 Pixel structure in one field (1 080i) / in one frame (720p)

– 1 080i system

All sampled pixels, 1 920 luminance pixels per line and 960 colour difference pixels, are retained for processing as shown in Figure 2. The sampling process starts simultaneously for both luminance and colour difference signals.

– 720p system

All sampled pixels, 1 280 pixels per line and 640 colour difference pixels, are retained for processing as shown in Figure 3. Sampling processes start simultaneously for both luminance and colour difference signals.



iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/0b4d0f8-2e5a-4e91-b916-bedd8b653f56/iec-62330-2-2003

Figure 2 – Transmitting samples of 1 080i system

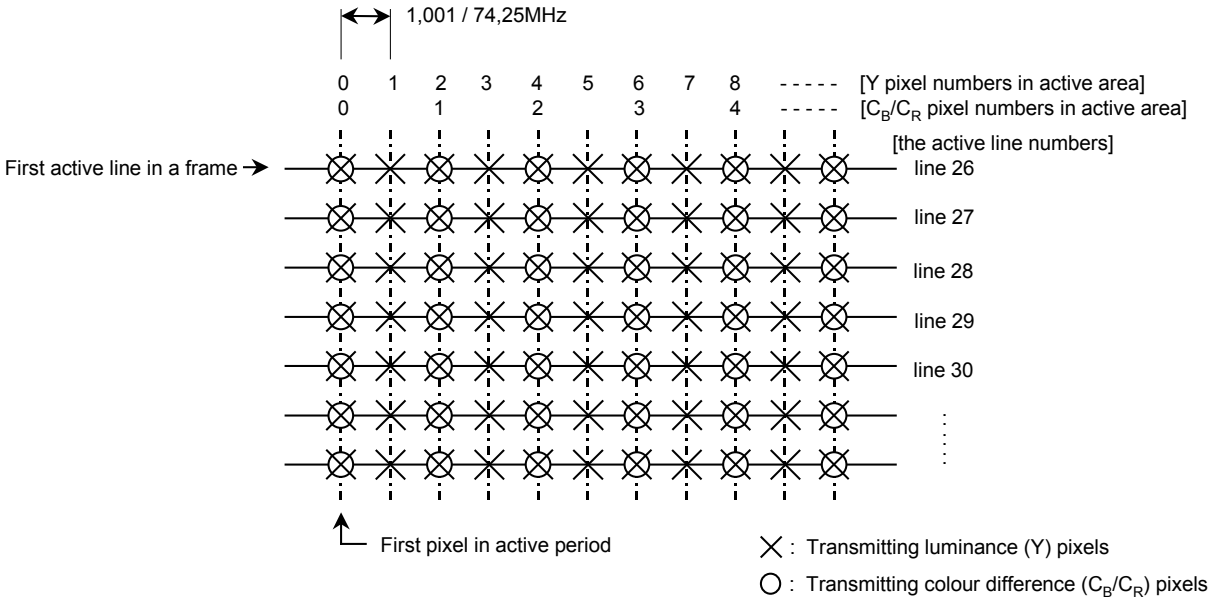


Figure 3 – Transmitting samples of 720p system

4.3 Block formation

4.3.1 DCT block, macro block (MB) and super macro block (SMB)

iTeh STANDARD PREVIEW
(standards.iteh.ai)

4.3.1.1 DCT block

The Y pixels in a field (1 080i system) and in a frame (720p system) shall be divided into rectangular areas of 15 horizontal pixels and 4 lines. Two Y DCT blocks (one Y DCT block pair) are made from each one of the rectangular areas as shown in Figure 4. In each Y DCT block pair, the rightmost pixel in the left DCT block is overlapped with the leftmost pixel in the right DCT block (overlapped blocking).

IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9b46df8-eb5e-4e91-b916-bedd8b653b6f/iec-62330-2-2003

The C_B/C_R pixels in a field (1 080i) and in a frame (720p) shall be divided into rectangular areas of 15 horizontal pixels and 8 lines. Two C DCT blocks (one C DCT block pair) are made from each one of the rectangular areas as shown in Figure 5. In each C DCT block pair, the rightmost pixel in the left block is overlapped with the leftmost pixel in the right block (overlapped blocking). Overlapped blocking is used for the robustness of error (see Annex A).

Let r be the horizontal pixel position number in Y/C DCT block

r = 0, 1, 2, ..., 7.

Let s be the vertical pixel position number in Y/C DCT block

For Y block s = 0, 1, 2, 3

For C block s = 0, 1, 2, ..., 7.

Let P(r, s) be the value of the pixel at the position (r, s)

4.3.1.2 Macro block (MB)

Each macro block (MB) in the 1 080i system and the 720p system consists of two Y DCT block pairs, one C_B DCT block and one C_R DCT block. Two Y DCT block pairs are vertically adjacent. C_B DCT block and C_R DCT block spatially correspond to the two Y DCT block pairs. Four Y DCT blocks (Ya, Yb, Yc, Yd), one C_B DCT block and one C_R DCT block are shown in Figure 6.

4.3.1.3 Super macro block (SMB)

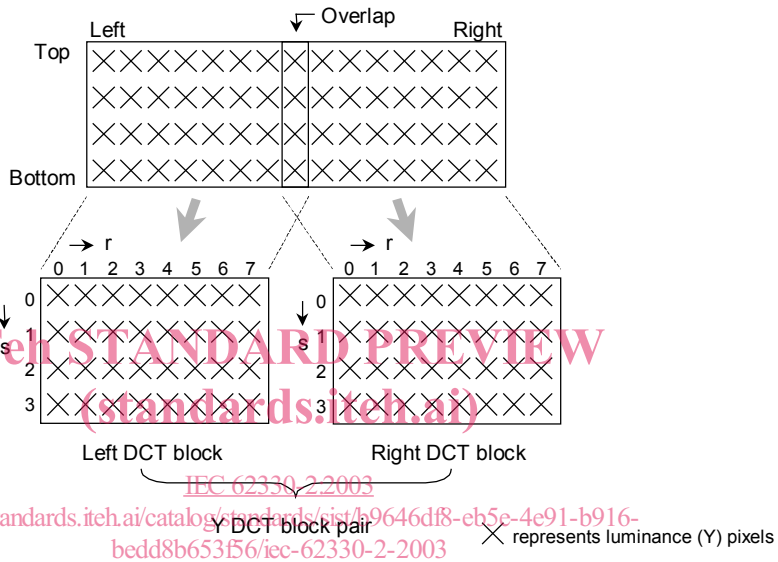
As shown in Figure 7, each super macro block (SMB) in the 1 080i system and the 720p system consists of two macro blocks which are horizontally adjacent. Two C DCT blocks of C_B/C_R in one super macro block are one C DCT block pair of C_B/C_R.

Let YS be the Y DCT block number in each SMB as shown in Figure 7.

YS = 0, 1, 2, ..., 7.

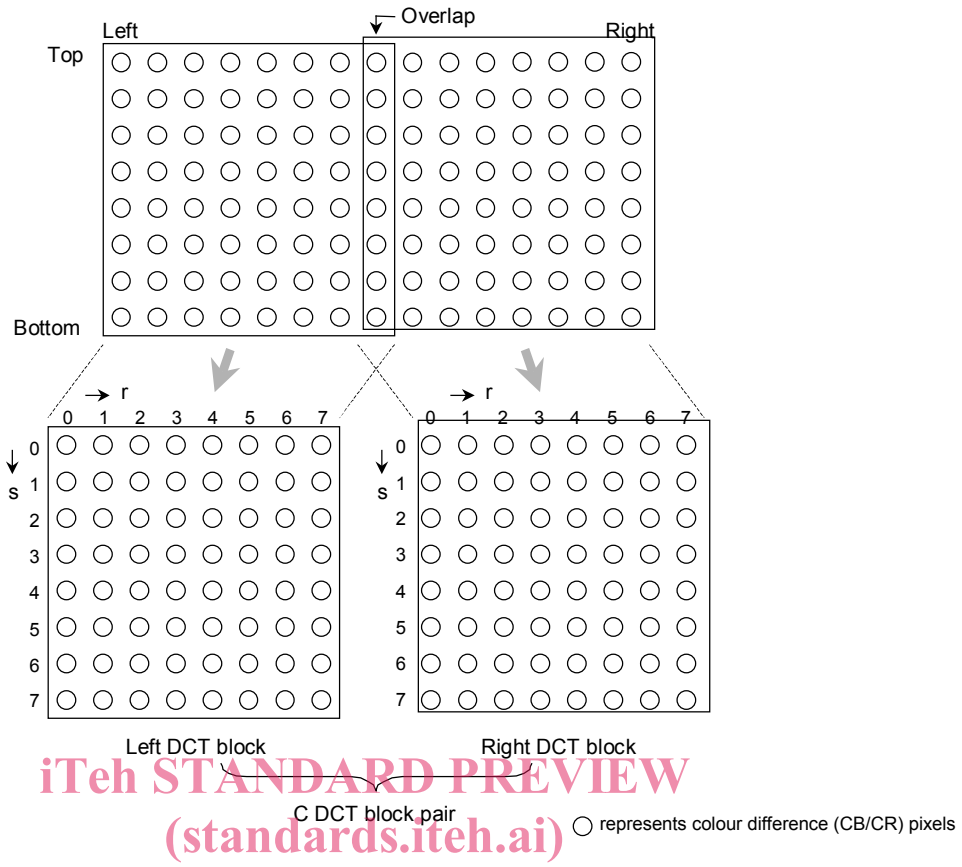
Let CS be the C DCT block number in each SMB as shown in Figure 7.

CS = 0, 1.



iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/b9646df8-eb5e-4e91-b916-bedd8b653f56/iec-62330-2-2003

Figure 4 – Overlapped blocking of luminance (Y) pixels



iTeh STANDARD PREVIEW
(standards.iteh.ai)
IEC 62330-2:2003
https://standards.iteh.ai/catalog/standards/sist/89046dh8-e85e-4e91-8994-bedd8b653f56/iec-62330-2-2003

Figure 5 – Overlapped blocking of colour difference C_B/C_R pixels

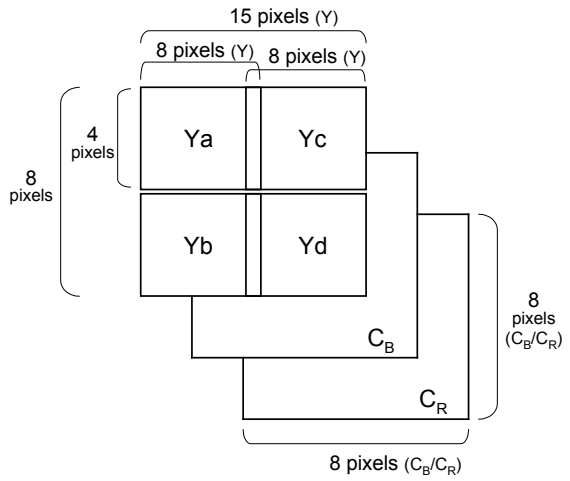


Figure 6 – Macro block structure in 1 080i system and 720p systems