

Super Audio CD Unified CMF

Version 1.01

November 2004



SUPER AUDIO CD

PHILIPS

SONY

Super Audio CD Unified CMF

COPYRIGHT

The Super Audio CD Unified CMF is published by Royal Philips Electronics (Eindhoven, The Netherlands) and has been prepared in close co-operation with Sony Corporation (Tokyo, Japan). All rights are reserved. Reproduction in whole or in part is prohibited without express and prior written permission of Royal Philips Electronics.

RELATION WITH DDP

The Super Audio CD Unified CMF has been jointly developed by Philips and Sony, based on the DCA DDP as a derivative work.

DDP, DDP 1.00, DDP 1.01, DDP2.00, DDP2.10, DDP 2.11, and DDP 2.20 are registered trademarks of DCA Inc. DDP is copyright 1989-2004 DCA Inc.

DISCLAIMER

The information contained herein is believed to be accurate as of the date of publication. However, Royal Philips Electronics (Eindhoven, The Netherlands) nor Sony Corporation will not be liable for any damages, including indirect or consequential, from use of this specification or reliance on the accuracy of this document.

CLASSIFICATION

The information contained in this document is marked as non-confidential.

NOTICE

For any further explanation of the contents of this document, or in case of any perceived inconsistency or ambiguity of interpretation, Information can be obtained at:

Philips Intellectual Property & Standards

Business Support

Building WAH-2

P.O. Box 220

5600 AE Eindhoven

The Netherlands

Fax.: +31 40 27 32113

Internet: <http://www.licensing.philips.com/>

E-mail: info.licensing@philips.com (for general information)

TABLE OF CONTENTS

<u>DOCUMENT CHANGE HISTORY</u>	4
<u>1 INTRODUCTION TO THE UNIFIED CMF</u>	5
1.1 REFERENCES	6
1.2 CONVENTIONS	6
1.3 ABBREVIATIONS	6
<u>2 THE UCMF FILES</u>	7
2.1 GENERAL	7
2.2 DDVID.DAT	7
2.2.1 THE DDVID BLOCK	7
2.2.1.1 DDVID	7
2.2.1.2 MID	7
2.2.1.3 TYPE	8
2.2.1.4 N LAYER	8
2.2.1.5 DSIZE	8
2.2.1.6 HYBRID	8
2.2.1.7 LOLENGTH	8
2.2.2 THE DDVMS BLOCKS	8
2.2.2.1 MPV	8
2.2.2.2 DST	8
2.2.2.3 DSL	9
2.2.2.4 DSS	9
2.2.2.5 CDM	9
2.2.2.6 SSM	9
2.2.2.7 SIZ	9
2.2.2.8 DSI	9
2.2.2.9 HASH	9
2.2.3 OTHER DDVMS BLOCKS	9
2.3 CONTROL.DAT FILE	9
2.4 IMAGE.DAT FILE	10
<u>3 IMAGE CARRIERS</u>	11
3.1 RECOMMENDATIONS	11
3.2 OS ACCESSIBLE CARRIERS	11
3.3 TAPE CARRIERS	11
3.3.1 HOW FILES ARE STORED ON TAPE	11
3.3.2 TAPE BLOCK SIZES	12
3.3.3 FILE SEQUENCE ON TAPE	12
<u>APPENDIX A 13</u>	
A.1 SUPPORTED SUPER AUDIO CD STANDARDS	13
A.2 ADDRESS CALCULATION EXAMPLES	13
A.2.1 SINGLE LAYER EXAMPLE	13
A.2.2 DUAL LAYER EXAMPLE	14
<u>APPENDIX B INFORMATIVE</u>	15
B.1 MAXIMUM NUMBER OF SECTORS IN SUPER AUDIO CD	15

DOCUMENT CHANGE HISTORY

Date	Version	Reason
2003-05-06	0.9	Initial CMF for Unified CMF for Super Audio CD
2004-01-15	0.95	Rewritten some parts Added MD5 hash Added One CMF for Dual layer Added multiple files for one image
2004-07-13	0.96	Watermark removed Some DVD options removed Sector size limited to 2048 bytes.
2004-07-27	0.97	Update after Sony review.
2004-08-23	0.98	Some changes for clarification Multiple images removed, number of sectors for layer0 added in DVDID Copyright notice added.
2004-09-29	0.981	Sony remarks processed.
2004-10-07	0.982	Maximum number of sectors for Super Audio CD added.
2004-10-12	1.0	Removed specific tape information.
2004-11-11	1.01	Editorial changes and relation the to DDP has been changed on request of DCA.

1 INTRODUCTION TO THE UNIFIED CMF

The Unified Cutting Master Format or UCMF is used for transferring images from authoring to mastering. The UCMF can be put on any carrier if the carrier is sufficiently large. The UCMF gives explicit rules to the encoder for encoding. Since copy protection is mandatory on Super Audio CD, the encoder must have enough information to encrypt the image.

The targets for this UCMF are:

- Describe the UCMF for the HD layers only.
- Support one high-density image for one disc rather than one image for every layer (A dual layer disc is mastered from one UCMF image).
- To be carrier independent as much as possible.
- Improvement of data integrity. (By calculating an MD5 checksum for each file.)

The image according to the Super Audio CD standard shall not contain any copy protection settings. The encoder shall encode all copy protection according to SA-CD Part 3 (see SA-CD Standard part 3) during mastering.

1.1 REFERENCES

ASCII:	ISO/IEC 646, 7 bits code for strings, note: ISO 646 is language dependent as ASCII is not.
SA-CD Standard part 1:	Super Audio CD System Description Part 1, Physical specification, Royal Philips Electronics and Sony Corporation.
SA-CD Standard part 3:	Super Audio CD System Description Part 3, Copy Protection specification, Royal Philips Electronics and Sony Corporation.
MD5:	The hash function as defined in the RFC 1321, author R. Rivest, MIT, 1992

1.2 CONVENTIONS

Numbers without a prefix are decimal numbers (e.g. 78)

Hexadecimal numbers have a 0x prefix (e.g. 0x4E is equivalent to 78)

Fields with strings in the UCMF are categorized in three types:

ASCII string	This field shall be filled with ASCII characters. It shall be left justified and all unused positions shall be set to 0x00.
ASCII decimal strings	Decimal strings shall be filled with decimal characters ("0".. "9"). Fields shall be right aligned with leading characters set to "0".
ASCII hexadecimal strings	These strings are ASCII presentations of binary values. The allowed characters are "0".."9" and "A".."F" or "0".."9" and "a".."f".

A range is indicated as 1...5 (meaning 1,2,3,4 and 5).

1.3 ABBREVIATIONS

CMF	Cutting Master Format
DL	Dual layer
HD	High-Density
HDD	Hard Disk Drive
OS	Operating System
PSN	Physical Sector Number
SL	Single layer
UCMF	Super Audio CD Unified CMF

2 THE UCMF FILES

2.1 GENERAL

The UCMF makes use of several files for an image description. These files can reside anywhere on a mastering system (like HDD, DVD ROM, tape etc). For files on tape some additional requirements are given (see paragraph 3.3).

The files are:

- DDVID.DAT This is the main description file that contains links to all other files.
- CONTROL.DAT This is the control data as it will be put in the Lead-in by the encoder.
- IMAGE.DAT The main image.

2.2 DDVID.DAT

The DDVID.DAT contains a set of blocks of 128 bytes each. The first block (called the DDVID block) describes the disc (layer) in general. The other blocks called DDVMS blocks describe each of the other files. The DDVID.DAT file contains the link to the other files.

2.2.1 The DDVID block

The layout of the DDVID block in Table 1 below.

Byte	Length	Symbol	Description	Value	Remarks
0-7	8	DDVID	CMF identifier	"SACDvs1"	
8-37	30	-	Reserved	0x00	
38-85	48	MID	Master ID		
86	1	-	Reserved	0x00	
87-88	2	TYPE	Disc Type	"SA"	
89	1	-	Reserved	0x00	
90	1	-	Reserved	0x00	
91	1	NLAYER	Number of layers	"1" "2"	SL or hybrid disc DL disc
92	1	-	Reserved	0x00	
93	1	-	Reserved	0x00	
94	1	DSIZE	Size of Disc	"A" "B"	Disc is 8 cm Disc is 12 cm
95-101	7	-	Reserved	0x00	
102	1	HYBRID	Indicates a HD layer of a hybrid	"0" "1"	SL or DL HD layer of a Hybrid disc
103-114	12	-	Reserved	0x00	
115-122	8	LOLENGTH	Length of layer 0	"ddddddd"	
123-127	5	-	Reserved	0x00	

Table 1 The DDVID block layout

Note: All reserved fields must be set to zero, 0x00.

2.2.1.1 DDVID

This literal string indicates the CMF is according to the Unified Cutting Master Format. With the literal string, "SACDvs1" (0x53 0x41 0x43 0x44 0x76 0x73 0x31 0x00), the encoder can distinguish the UCMF from previous Cutting Master Formats.

2.2.1.2 MID

Master ID. The master ID is an ASCII string of maximal 48 characters.

2.2.1.3 TYPE

The type must always be "SA" for Super Audio CD.

2.2.1.4 NLAYER

Super Audio CD supports single, hybrid and dual layer discs. This item indicates the number of high-density layers. "1" for single layer or hybrid and "2" for dual layer.

2.2.1.5 DSIZE

Super Audio CD discs can be 8 or 12 cm in diameter. For an 8 cm disc DSIZE shall be set to "A". For 12 cm DSIZE shall be set to "B".

2.2.1.6 HYBRID

A "1" in this field indicates a hybrid disc; the HD layer will be recorded with the low reflectivity bit set. For a dual layer disc and a single layer disc this field shall be set to "0".

2.2.1.7 LOLENGTH

This field holds the length (in number of sectors) of layer 0 by ASCII decimal string. This field is mandatory. For single layer or hybrid layer this field contains the length of the image.

2.2.2 The DDVMS blocks

The next DDVMS blocks contain a description for each file they relate to.

Byte	Length	Symbol	CONTROL.DAT Value	IMAGE.DAT Value
0-3	4	MPV	"VVVM"	"VVVM"
4-5	2	DST	"D2"	"D0"
6-13	8	Reserved	0x00	0x00
14-21	8	DSL	"0000016"	Nr of sectors
22-29	8	DSS	"00193024"	"00196608"
30-37	8	Reserved	0x00	0x00
38-39	2	CDM	"SA"	"SA"
40	1	SSM	"0"	"0"
41-70	30	Reserved	0x00	0x00
71-73	3	SIZ	"011"	"009"
74-90	17	DSI	"CONTROL.DAT"	"IMAGE.DAT"
91-95	5	Reserved	0x00	0x00
96-127	32	HASH	Hash in hex	Hash in hex

Table 2 Mandatory DDVMS blocks

Any additional (not recognised and thus ignored by the encoder) DDVMS block can be located before or directly after the DDMVS block of the control data (CONTROL.DAT file).

The last DDVMS block shall contain the reference to the image data (IMAGE.DAT file)

2.2.2.1 MPV

The MPV indicates this is a valid map packet (or DDVMS block). This string must always be present and contain "VVVM".

2.2.2.2 DST

The Data Stream Type is used to identify the information the DDVMS refers to.

The valid DST types are:

Type	Description
"D0"	The main image file.
"D2"	Control data file.

Table 3 DST values

When other values are used, the DDVMS and the file the DDVMS refers to, are ignored by the encoder.

2.2.2.3 DSL

Data stream length. The format of the value is an ASCII decimal string. DSL indicates the length of the file in sectors.

2.2.2.4 DSS

The Data Stream Start indicates where the data of the corresponding file must be inserted in the encoding stream.

The format of the value is an ASCII decimal string. The decimal number specifies the PSN of the first sector in the stream.

The control data of a Super Audio CD is always inserted at PSN 193024.

The main data is normally inserted at PSN 196608 All other files are not inserted in the encoding stream and therefore need no valid DSS.

2.2.2.5 CDM

This value must be set to "SA".

2.2.2.6 SSM

The Source Storage Mode indicates the format of the source.

The value shall be set to "0" indicating a sector size of 2048 bytes.

2.2.2.7 SIZ

The SIZ indicates the length of the DSI string. The parameter is a decimal number represented as an ASCII decimal string of three digits. Since the maximum value of the length is 17, the first digit shall always be zero ASCII ("0" or 0x30).

2.2.2.8 DSI

The Data Stream Identifier contains the filename of the data file. The format is an ASCII string.

The system allows for maximal 17 characters for a filename with extension.

2.2.2.9 HASH

The hash value is mandatory and allows for an integrity check. The hash shall be calculated over the corresponding file according to rules in MD5. The hash calculation results in a 16-byte value of information. The hash value of 16 bytes shall be written as an ASCII hexadecimal string of 32 characters. The most significant character must be written on position 96 and the least significant character must be written on position 127.

2.2.3 Other DDVMS blocks

The UCMF allows for additional files linked via the DDVID.DAT file. (For instance files like T5TXT.DAT) These additional files must follow the general rules as stated above in paragraph 2.2.1. The system will use the DST parameter as a decisive factor to use or ignore the DDVMS blocks and associated files.

2.3 CONTROL.DAT FILE

The control data file contains the 16 sectors of the control data as defined by the standard (see SA-CD Standard part 1.)

The image must be stored with 2048 bytes per sector (Source Storage Mode is "0").

2.4 IMAGE.DAT FILE

The Image file contains the main image for the disc to be mastered.

The image must be stored with 2048 bytes per sector (Source Storage Mode is "0").

Note that the information of layer 0 and layer 1 are concatenated to one file in case of dual layer disc.

3 IMAGE CARRIERS

The images can be stored on any carrier as long as the files can be accessed through regular file accesses. A special case is when the files are stored on tape.

3.1 RECOMMENDATIONS

The UCMF can be stored on a great number of different carriers. However it is strongly recommended to use only the following carriers:

1. DVD+R, DVD+R DL and DVD-R discs.
2. Network

3.2 OS ACCESSIBLE CARRIERS

The UCMF is designed to be accessible by an encoder when all files reside together in one folder or directory. The DDVID.DAT file holds the file names of image and additional files belonging to that image. This way an encoder can find all information when the path to the DDVID is known. Since most (not necessarily all) SL (or HD hybrid) images have a size smaller than the maximum capacity of a recordable DVD (4.7 GByte), it is possible to write an image on a recordable DVD with the UDF file system.

Note: The DVD recordable allows for the ISO 9660 file system, but this limits the maximum file size. Therefore UDF is recommended.

3.3 TAPE CARRIERS

In general tape drives support a generic control over the different tape standards and Super Audio CD images can be stored on any tape device supporting this generic command set.

"As described in paragraph 3.1, tapes are not recommended as carrier of UCMF."

3.3.1 How files are stored on tape

When a file is stored on tape, the file must be labelled according to the ANSI X3.27 standard. This is called ANSI labelling for short. For each file the following objects must be recorded.

Objects on tape	ANSI Label type	Content	Remark
Volume Label	Vol1	Volume information	Only for the first file
File Header 1	HDR1	File name and date	
File Header 2	HDR2	Block lengths and record lengths	
File Mark	-	Physical Mark	
File content	-	Data	
File Mark	-	Physical Mark	
End of file	EOF1	File name and file length	
End of File	EOF2	Block length and record length	
File Mark	-	Physical Mark	
File Mark	-	Physical Mark	Only for the last file

Table 4 Tape objects

Note that a Volume Label is written before the first file and an additional File Mark is written after the last file. The File Header 1 contains the file name. This file name must be an exact copy of the filename used in the DDVID.DAT file.

3.3.2 Tape block sizes

The files on tape (the file content when referring to Table 4 above) must be written with a specific block size.

File	Block sizes (Bytes)	Blocking factor	Remark
DDVID.DAT	128	1	
CONTROL.DAT	2048	16	
IMAGE.DAT	2048	16	

Table 5 Block sizes on tape

3.3.3 File Sequence on tape

Since tape is a sequential medium the file sequence does matter. The first file must always be the DDVID.DAT file since this file contains all info for the other files. The last file must always be the IMAGE.DAT file. When mastering from tape, the IMAGE.DAT file will be read when mastering the program area. Any file after the IMAGE.DAT will be discarded because of the sequential nature of tape.

The order is:

1. DDVID.DAT
2. CONTROL.DAT
3. IMAGE.DAT

APPENDIX A

A.1 SUPPORTED SUPER AUDIO CD STANDARDS

This UCMF supports the features for the following Super Audio CD versions.

Version 1.0 March 1999
 Version 1.1 March 2000
 Version 1.2 May 2001
 Version 1.3 June 2002
 Version 2.0 March 2004

A.2 ADDRESS CALCULATION EXAMPLES

Two examples are given to clarify the address calculations.

A.2.1 Single layer example

For a single layer disc with an image of 2 million sectors the DDVID and the DDVMS look as follows.

Byte	Length	Symbol	Description	Value	Remarks
0-7	8	DDVID	CMF identifier	"SACDvs1"	
8-37	30	-	Reserved	0x00	
38-85	48	MID	Master ID	"some master"	
86	1	-	Reserved	0x00	
87-88	2	TYPE	Disc Type	"SA"	
89-90	2	-	Reserved	0x00	
91	1	NLAYER	Number of layers	"1"	SL
92-93	2	-	Reserved	0x00	
94	1	DSIZE	Size of Disc	"B"	Disc is 12 cm
95-101	7	-	Reserved	0x00	
102	1	HYBRID	Indicates a HD layer of a hybrid	"0"	SL
103-114	12 25	-	Reserved	0x00	
115-122	8	LOLENGTH	Length of layer 0	"02000000"	Number of sectors
123-127	5	-	Reserved	0x00	

Table 6 DDVID Single layer example

Byte	Length	Symbol	CONTROL.DAT Value	IMAGE.DAT Value
0-3	4	MPV	"VVVM"	"VVVM"
4-5	2	DST	"D2"	"D0"
6-13	8	Reserved	0x00	0x00
14-21	8	DSL	"00000016"	"02000000"
22-29	8	DSS	"00193024"	"00196608"
30-37	8	Reserved	0x00	0x00
38-39	2	CDM	"SA"	"SA"
40	1	SSM	"0"	"0"
41-70	30	Reserved	0x00	0x00
71-73	3	SIZ	"011"	"009"
74-90	17	DSI	"CONTROL.DAT"	"IMAGE.DAT"
91-95	5	Reserved	0x00	0x00
96-127	32	HASH	Hash in hex	Hash in hex

Table 7 DDVMS Single Layer example

Note: The length of layer 0 (LOLENGTH) shall correspond with the value in the control data. The length is equal to the Sector number of the last physical sector of the data zone subtracted with the sector number of the first Physical sector of the data zone plus one.

A.2.2 Dual layer example

A dual layer example with 3 million sectors divided equally over two layers.

Byte	Length	Symbol	Description	Value	Remarks
0-7	8	DDVID	CMF identifier	"SACDvs1"	
8-37	30	-	Reserved	0x00	
38-85	48	MID	Master ID	"some master"	
86	1	-	Reserved	0x00	
87-88	2	TYPE	Disc Type	"SA"	
89	1	NSIDE	Reserved	0x00	
90	1	SIDE	Reserved	0x00	
91	1	NLAYER	Number of layers	"2"	DL
92	1	LAYER	Reserved	0x00	
93	1	DIR	Reserved	0x00	
94	1	DSIZE	Size of Disc	"B"	Disc is 12 cm
95-101	7	-	Reserved	0x00	
102	1	HYBRID	Indicates a HD layer of a hybrid	"0"	-
103-114	12 25	-	Reserved	0x00	
115-122	8	LOLENGTH	Length of layer 0	"01500000"	Number of sectors
123-127	5	-	Reserved	0x00	

Table 8 DDVID Single layer example

Byte	Length	Symbol	CONTROL.DAT Value	IMAGE.DAT Value
0-3	4	MPV	"VVVM"	"VVVM"
4-5	2	DST	"D2"	"D0"
6-13	8	Reserved	0x00	0x00
14-21	8	DSL	"00000016"	"03000000"
22-29	8	DSS	"00193024"	"00196608"
30-37	8	Reserved	0x00	0x00
38-39	2	CDM	"SA"	"SA"
40	1	SSM	"0"	"0"
41-70	30	Reserved	0x00	0x00
71-73	3	SIZ	"011"	"009"
74-90	17	DSI	"CONTROL.DAT"	"IMAGE.DAT"
91-95	5	Reserved	0x00	0x00
96-127	32	HASH	Hash in hex	Hash in hex

Table 9 DDVMS Single Layer example

Note: The length of layer 0 (LOLENGTH) shall correspond with the value in the control data. The length is equal to the Sector number of the last physical sector of layer 0 subtracted with the sector number of the first Physical sector of the data zone plus one.

APPENDIX B INFORMATIVE

B.1 MAXIMUM NUMBER OF SECTORS IN SUPER AUDIO CD

In case of 12cm SL or hybrid disc, the maximum number of sectors is 2294912.

In case of 8cm SL or hybrid disc, the maximum number of sectors is 712880.

In case of 12cm DL disc, the maximum number of sectors is 4169920 (2084960 sectors for each layer).

