

**Cutting Master Format for
HD DVD-ROM and
3X-SPEED DVD-ROM
(HD DVD CMF)**

Version 1.0

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1. General

1.1 Scope

HD DVD CMF (Cutting Master Format) is a standardized way of communicating and transferring data between HD DVD title authoring workstations and HD DVD glass master cutting systems. HD DVD CMF will contain the final "HD DVD Image File" as well as certain descriptive information that is required by HD DVD glass master cutting systems to perform the final HD DVD Encoding steps, including lead-in, lead-out and middle area data generation, compute proper HD DVD error correction and add optional HD DVD copy protection. HD DVD also contains information concerning desired HD DVD Layer and Side which are used by the Laser Beam Recorder to establish required rotation and translation directions.

HD DVD CMF can be used to describe HD DVD Image Files on any carrier that uses named files.

NOTE: THIS FORMAT IS A RECOMMENDED PRACTICE BETWEEN AUTHORIZING STUDIOS AND REPLICATION PLANTS, AND THERE IS NO ENFORCEMENT AND RESTRICTION FOR PRACTICAL USE. ANYONE WHO MAY USE THIS FORMAT SHALL TAKE MEASURES FOR PROTECTING FROM ANY ILLEGAL USE OF THE RECORDED MEDIA WHICH APPLIED THIS FORMAT. BE AWARE THAT THIS FORMAT DOES NOT ADOPT ANY COPY RIGHT PROTECTION SYSTEM BECAUSE OF THE NATURE OF CMF.

1.1.1 Relation with DDP

HD DVD CMF has been jointly developed by DCA, Toshiba, and the DVD Forum WG1/CMF voluntary members primary based on DCA DDP as a derivative work.

HD DVD CMF is technically equivalent to DCA DDP 3.00 subset concerning HD DVD. DDP and all its versions are registered trademarks of DCA Inc. DDP is copyright 1989-2006 DCA Inc and DDP ® is a Registered trademark of DCA Inc.

The HD DVD Cutting Master Format Specification describes the cutting master media layout for HD DVD disc.

The CMF file consisted of two kinds of data packet CMFID and CMFMS. The CMFID and CMFMS packet will be placed in one file, named CMFID.DAT. The first packet of 128 bytes of the file will contain the CMFID information, and the second packet immediately following will contain the CMFMS information. For identification purposes, the first three bytes of the CMFID packet will contain the symbols CMF.

All fields in the CMFID and CMFMS packets shall contain valid ASCII printable text. All numeric fields shall be right justified and padded with either '0' (30h) or space (20h). All alphanumeric fields shall be left justified and shall be padded with space (20h). The CMF File Set will contain the final HD DVD-ROM or 3X-SPEED DVD-ROM image as well as other descriptive information that may be required by the physical disc manufacturing

plant in order to manufacture the disc including any information required for proper application of copy protection mechanisms as well as the information required for setting up the Laser Beam Recorder.

CMF can be used to describe HD DVD-ROM or 3X-SPEED DVD-ROM content on virtually any possible carrier including sequential tape, media accessed via a file system, and recordable media.

1.2 Normative References

DVD Specifications for High Definition VIDEO (HD DVD-Video), Version 1.0

DVD Specifications for High Density Read-Only Disc (HD DVD-ROM), Part 1
PHYSICAL SPECIFICATION, Version 1.20

DVD Specifications for Read-Only Disc (DVD-ROM) Part 1 Optional Specifications (3X-SPEED DVD-ROM), Revision 1.1

1.3 Definitions

1.3.1 Content Authoring System

The system used to create the content that is to be placed on an HD DVD-ROM or 3X-SPEED DVD-ROM disc.

1.3.2 Physical Disc Formatter

The system used by disc manufacturers to create the actual modulation signal that exists on the HD DVD-ROM or 3X-SPEED DVD-ROM media.

1.3.3 Copy Protection Processing

The process of either applying copy protection to HD DVD-ROM or 3X-SPEED DVD-ROM disc.

1.3.4 Disc Description Protocol

A protocol developed to describe the content from an HD DVD-ROM or 3X SPEED DVD-ROM authoring system. This protocol is used by physical disc formatters to properly create the desired HD DVD-ROM or 3X-SPEED DVD-ROM disc.

1.3.5 HD DVD CMF

A protocol developed as a subset of DDP 3.00 to describe the content from an HD DVD-ROM or 3X SPEED DVD-ROM authoring system. This protocol is used by physical disc formatters to properly create the desired HD DVD-ROM or 3X-SPEED DVD-ROM disc.

1.3.6 CMF File

A file named CMFID.DAT. This file contains the CMF packets and serves as the catalog of all other files in the CMF system.

1.3.7 CMF File Set

A set of files containing a CMF file and all of the files pointed to by the CMF file.

1.3.8 CMF Set

Another term for a CMF File Set

1.3.9 CMF Support Files

A subset of the CMF File Set that includes all files in the CMF File Set except the HD DVD-ROM or 3X-SPEED DVD-ROM Image Files.

1.3.10 CMF Packets

Packets described by this document that are used to define the contents provided by an HD DVD Authoring system. There are two types of CMF Packets: CMFID Packets and CMFMS Packets.

1.3.11 CMFID Packet

The first packet in the CMF File. This packet describes the overall HD DVD-ROM or 3X-SPEED DVD-ROM disc.

1.3.12 CMFMS Packet

All other packets except the first packet in a CMF File. These packets point to another file and describe that file.

1.3.13 HD DVD-ROM

An optical disc that conforms to the HD DVD-ROM Specifications

1.3.14 3X-SPEED DVD-ROM

An optical disc that conforms to the 3X-SPEED DVD-ROM Specifications

1.3.15 Image File

A file containing the sector contents as they are to be placed on the HD DVD-ROM or 3X-SPEED DVD-ROM Disc. The first sector stored in the Image File is the first readable sector on the HD DVD-ROM or 3X-SPEED DVD-ROM Disc.

1.3.16 Layer

One surface of an HD DVD-ROM or 3X-SPEED DVD-ROM disc that contains information whereas a laser can be focused on the surface and reflected back and decoded.

1.3.17 Source Media

The media used as the source content that the CMF is describing.

1.3.18 File Based Media

This includes any media where the information is accessible via a file system. For a media to be file based, the computer system reading the media must possess and use the file system drivers to read the media.

1.3.19 Block Addressable Random Access

This includes any media that contains specific information blocks including error correction codes as part of the core infrastructure of the media and can be accessed in a random manner using addresses assigned to the blocks.

1.3.20 Non Streaming Sequential Access

This includes any media that contains specific information blocks including error correction codes as part of the core infrastructure of the media but can only be accessed in a sequential manner.

1.3.21 Streaming Sequential Access

This includes any media that is accessed only in a sequential manner and does not contain specific information blocks as part of its core infrastructure.

1.3.22 Volume Set

A collection of one or more physical media volumes that contain a complete CMF File Set.

1.3.23 Media Volume Set

Another term for Volume Set.

1.3.24 Media Volume

One piece of physical media that is part of a Media Volume Set. The Media Volume may contain part or all of a CMF File Set.

1.3.25 Volume

Another term for Media Volume.

1.3.26 HD DVD

An abbreviation for HD DVD-ROM and 3X-SPEED DVD-ROM.

1.3.27 Laser Beam Recorder

The piece of equipment used by the HD DVD Replication plant to create the physical master disc.

1.3.28 LBR

An abbreviation for Laser Beam Recorder.

1.3.29 HD DVD Replication Plant

A manufacturing company that manufactures HD DVD Discs

1.3.30 Physical Master Disc

The master disc created by an LBR that is the first instance of a disc that will be used to make HD DVD replicas.

1.3.31 HD DVD Replicas

The end product of the production of HD DVD.

1.4 Notations

1.4.1 Binary Numbers

All Binary numbers (base 2) in this specification shall be identified with a trailing lower case *b* (i.e. 0101b).

1.4.2 Decimal Numbers

All Decimal numbers in this specification shall be identified as base 10 digits.

1.4.3 Hexadecimal numbers

All Hexadecimal numbers (base 16) in this specification shall be identified with a trailing lower case *h* (i.e. F200ABh)

1.4.4 Character strings

All Character strings in this specification shall be identified by a leading and trailing single quote (i.e. 'CMF 2.00')

1.4.5 List of acronyms

CMF – Cutting Master Format

CMFID – Cutting Master Format ID Packet

CMFMS – Cutting Master Format Map Stream Packet

1.5 Data Types of Descriptor fields

'n' – ASCII text containing a numeric decimal value (base 10) right justified padded with either ASCII spaces (20h) or ASCII zero (30h).

'h' – ASCII text containing a numeric hexadecimal value (base 16) right justified padded with either ASCII spaces (20h) or ASCII zero (30h).

's' – ASCII text string of any printable characters (including spaces), left justified and padded with ASCII spaces (20h).

'b' – ASCII space or spaces (20h) filled to the size of the field

'a' – ASCII text containing an alphanumeric string formatted with up to 8 alphanumeric characters, followed by an optional decimal point (2Eh) and up to 3 alphanumeric characters (i.e. 8.3 file naming convention). The alphanumeric string is left justified and padded with spaces.

'd' – ASCII text containing a date string of the format 'yyyy/mm/dd'. This content is left justified and padded with spaces (20h).

't' – ASCII text containing a time string of the format 'hh:mm:ss" This content is left justified and padded with spaces (20h).

'f' – A field containing a fixed set of possible values.

'LB8' – Binary field containing 8 bits of data.

- 'LB16' – Binary field containing 16 bits of data with the most significant 8 bits stored first (at the lower memory address) and the least significant 8 bits stored last (at the higher memory address)
- 'LB24' – Binary field containing 24 bits of data with the most significant 8 bits stored first (at the lowest memory address) and the least significant 8 bits stored last (at the highest memory address)
- 'LB32' – Binary field containing 32 bits of data with the most significant 8 bits stored first (at the lowest memory address) and the least significant 8 bits stored last (at the highest memory address)
- 'LB64' – Binary field containing 64 bits of data with the most significant 8 bits stored first (at the lowest memory address) and the least significant 8 bits stored last (at the highest memory address)

2. Disc Layout

The HD DVD disc is composed such that the HD DVD information is sandwiched in the middle of the disc as shown in the cross section below.

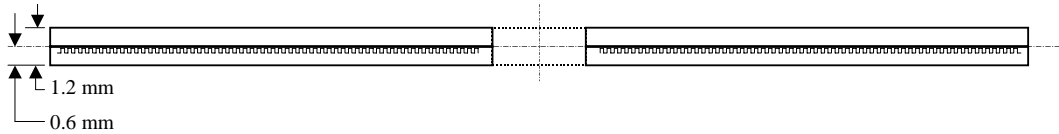


Figure 1 HD DVD Cross Section

The HD DVD disc can have three types of general formats: Single Layer, Dual Layer – Parallel Track Path, and Dual Layer – Opposite Track Path. The Single Layer HD DVD disc has one readable surface.

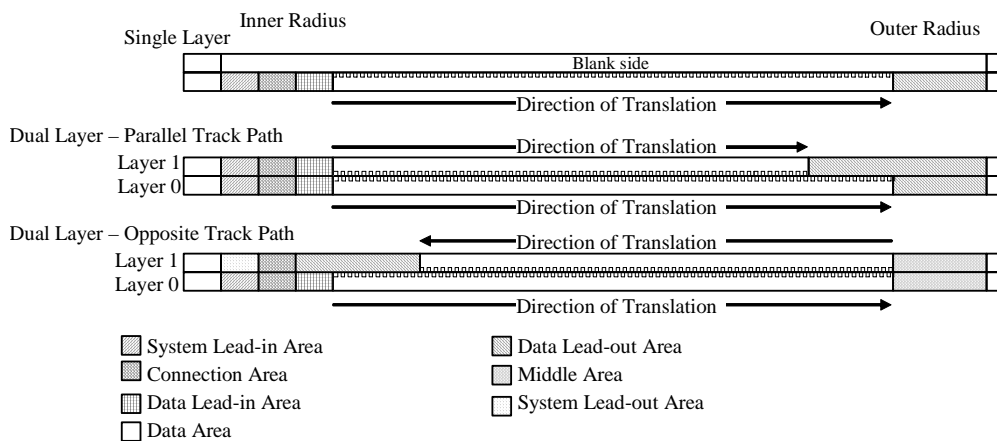


Figure 2 HD DVD-ROM Disc formats

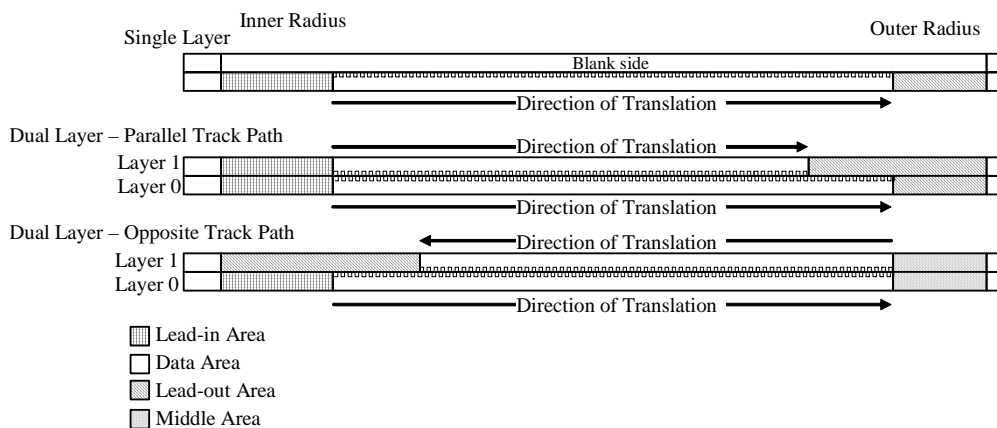


Figure 3 3X-SPEED DVD-ROM Disc formats

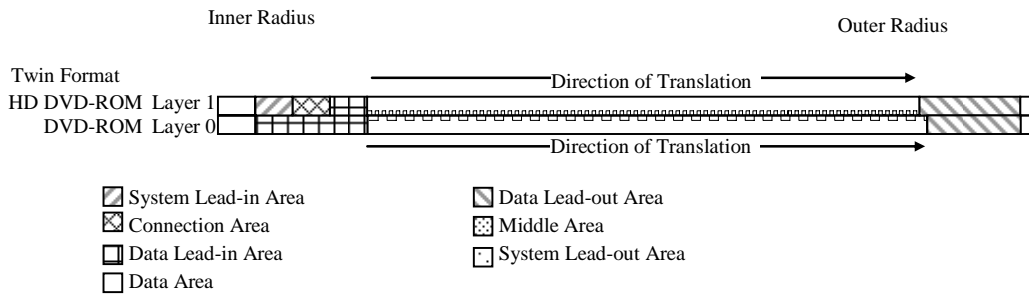


Figure 4 Twin Format Disc format

A Twin Format Disc is composed of Layer 0 containing DVD-ROM and Layer 1 containing HD DVD-ROM. For a Twin Format Disc the Layer 0 will be specified by another CMF Specification designed for DVD-ROM and only Layer 1 will be specified by this specification.

Each layer of the HD DVD disc is composed of a series of sectors. The format of the sector is shown below.

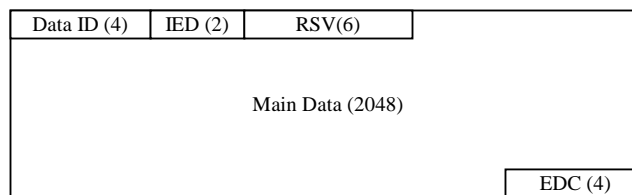


Figure 5 HD DVD Sector format

In addition the complete 2064 byte sector is scrambled prior to final HD DVD-ROM or 3X-SPEED DVD-ROM modulation.

3. CMF Layout

The layout for the HD DVD image will be generally the same when applied to the same type of media. Different media types have their own strengths and weaknesses. Therefore the layout, although similar, will be different between different media types.

The files on the media consist of one CMF file followed by at least three other files.

When an HD DVD is a dual layer disc, it is allowed that both layers are present on the media. However if AACS copy protection is to be applied to the HD DVD, then both layers **MUST** be present in the same CMF Set. Except as noted, a Twin Format Disc will be treated as a Single Layer Disc.

3.1 CMF File

The CMF file is the root file on the media. This file is used to point to all other files on the media. Therefore this file has specific limitations with respect to location and name on the media. This file is used to describe the contents of the rest of the media and to contain instructions that the physical formatter will use in creating the master HD DVD disc.

It contains the CMFID packet, and at least one CMFMS packet for each additional file on the media. The CMFMS packets are used to point to other files on the media. CMF is a derivative subset of the Disc Description Protocol developed by Doug Carson and Associates as a means of defining input media used for optical discs. The Cutting Master Format was developed by DCA and DVD Forum WG1/CMF voluntary members. The CMF file shall have the name CMFID.DAT.

3.2 CMF Packets

There are 2 types of CMF packets in the CMFID file: the CMFID packet and the CMFMS packet. The CMFID packet is used to give general information about the HD DVD title being described. The CMFMS packets are used to describe the rest of the files on the media. There are 4 types of CMFMS packets with each type of packet pointing to a different type of file. These packets are shown in Figure 6.

CMF Packet	CMF Packet Type	Description	Number of times packet can be present
CMFID	CMFID	General HD DVD Title Information	1 (mandatory)
T2	CMFMS	Free Format Text Data File	0 – n (optional)
D7	CMFMS	Disc Information File	1 (mandatory)
D2	CMFMS	Lead-in Control Data File	1 – 2 (mandatory)
D0	CMFMS	HD DVD Image File	1 – n (mandatory)

Figure 6 CMF Packets

3.3 CMF File and Packet Order

The packets can be in any order so long as the CMFID packet is the first packet and the CMFMS packet that describes the HD DVD Image File is the last packet. In the case of sequential access media, the files pointed to by the CMFMS packets must be in the same order as the CMFMS packets in the CMF file.

3.4 CMFID Packet Contents

The CMF File is composed of several packets of 128 bytes each. The first packet is the CMFID packet. It contains information that describes the overall HD DVD image. Figure 7 below shows the contents of the CMFID packet.

Byte	Length	Symbol	Name
0-7	8	CMFID	CMF level Identifier
8-37	30	-	Reserved
38-85	48	MID	Master ID
86	1	-	Reserved
87-88	2	TYPE	Type of disc
89	1	NSIDE	Number of disc Sides
90	1	SIDE	Side of current Surface
91	1	NLAYER	Number of disc Layers
92	1	LAYER	Layer of current Surface
93	1	DIR	Direction of Translation
94	1	DSIZE	Replica Disc Size (Diameter)
95-127	33	-	Reserved

Figure 7 CMFID Packet Contents

3.4.1 CMFID

Definition: This field is the CMF level Identifier. It contains both the CMF identifier and the CMF level number. The current CMF level is 2.00.

Byte: 0-7

Length: 8

Usage: 'f' type field containing 'CMF 2.00' (43h 4Dh 4Fh 20h 32h 2Eh 30h 30h)

3.4.2 Reserved

Definition: Reserved.

Byte: 8-37

Length: 30

Usage: 'f' type field
 ' ' (20h) = ASCII spaces

3.4.3 MID

Definition: The MID contains the Master ID, a unique character string used by mastering to identify jobs or clients. MID is filled with ASCII spaces (20h) when it is not used or when Master ID is not known.

Byte: 38-85

Length: 48

Usage: 's' type field

3.4.4 Reserved

Definition: Reserved.

Byte: 86

Length: 1

Usage: 'f' type field
 ' ' (20h) = ASCII spaces

3.4.5 TYPE

Definition: This field contains the type of the disc being described by the CMF File Set.

Byte: 87-88

Length: 2

Usage: 'f' type field

'HD' (48h 44h) = a disc conforming to HD DVD-ROM Specifications

'3X' (33h 58h) = a disc conforming to the 3X-SPEED DVD-ROM Specifications

'TW' (54h 57h) = a disc conforming to the HD DVD-ROM Twin Format

3.4.6 NSIDE

Definition: This field contains the total number of readable sides on the final disc.

Byte: 89

Length: 1

Usage: 'f' type field containing the number of sides being described by the CMF File Set

'1' (31h) = the final disc will have one readable side

'2' (32h) = the final disc will have two readable sides

3.4.7 SIDE

Definition: This field contains the current side of the image being described.

Byte: 90

Length: 1

Usage: 'f' type field containing the current side being described by the CMF File Set

'0' (30h) = side A

'1' (31h) = side B

3.4.8 NLAYER

Definition: This field contains the total number of layers on a side of the final disc.

Byte: 91

Length: 1

Usage: 'f' type field containing number of layers in the current side being described by the CMF File Set

'1' (31h) = the final disc will have one readable layers or the final disc is a Twin Format Disc

'2' (32h) = the final disc will have two readable layers

'3' (33h) = the final disc will have three readable layers (for future use)

'4' (34h) = the final disc will have four readable layers (for future use)

3.4.9 LAYER

Definition: This field contains the current layer of the image being described.

Byte: 92

Length: 1

Usage: 'f' type field containing the current layer being described by the CMF File Set

'0' (30h) = layer 0

'1' (31h) = layer 1 (Including HD DVD Layer of Twin Format Disc)

'2' (32h) = layer 2

'3' (33h) = layer 3

'A' (41h) = Both layers contained in CMF File Set

3.4.10 DIR

Definition: This field describes the direction of translation of Layer 1 of a dual layer HD DVD disc. It is valid only when there is more than one layer on the disc. Since there are unique sets of CMF for each layer, this field must contain the same value for the CMF used on both layers. That is, if Layer 1 is Opposite track path, then this field shall contain 'O' (hex 4F) for both layers.

Byte: 93

Length: 1

Usage: 'f' type field

'I' (49h) = if the side is single layer, dual layer parallel track path, or Twin Format Disc and therefore the translation of the layer 1 is from inner radius to outer radius

'O' (4Fh) = if the side is dual layer opposite track path and therefore the translation of the layer 1 is from outer radius to inner radius

3.4.11 DSIZE

Definition: This field specifies the physical size of the disc to be mastered.

Byte: 94

Length: 1

Usage: 'f' type field

'A' (41h) = The disc will have a diameter of 8 cm

'B' (42h) = The disc will have a diameter of 12 cm

3.4.12 Reserved

Definition: Reserved

Byte: 95-127

Length: 33

Usage: 'f' type field

' ' (20h) = ASCII spaces

3.5 CMFMS Packet Contents

After the CMFID packet are two or more CMFMS packets. The CMFMS packets are used to identify other files on the input media. Each CMFMS packet contains pointers and other information about data and other files. There is one CMFMS packet for each file present other than the CMF file. CMFMS packets are stored in the order in which the data is to be stored on the HD DVD disc. Figure 8 below shows the contents of the CMFMS packets.

Byte	Length	Symbol	Name
0-3	4	MPV	Map packet valid
4-5	2	DST	Data stream type
6-13	8	DSP	Data stream Pointer
14-21	8	DSL	Data stream length
22-29	8	DSS	Data stream start
30-37	8	RES1	Reserved
38-39	2	CDM	HD DVD mode
40	1	SSM	Source storage mode
41	1	SCR	Source materials scrambled
42	1	DSPVALUE	DSP Value
43	1	RES2	Reserved
44	1	LAYER	Layer
45-61	17	DSI	Data stream identifier
62-127	66	RES3	Reserved

Figure 8 CMFMS Packet Contents

3.5.1 MPV

Definition: This field is the Map Packet Valid field and is used to identify that the next 128 bytes in the file contain a valid CMFMS packet.

Byte: 0-3

Length: 4

Usage: 'f' type field containing 'VVVM' (56h 56h 56h 4Dh)

3.5.2 DST

Definition: This field is the Data Stream Type field and is used to identify the type of CMFMS packet and therefore the type of file being pointed to by the CMFMS packet.

Byte: 4-5

Length: 2

Usage: 'f' type field

- 'D0' (44h 30h) = DM (Main) — HD DVD Image file containing the actual HD DVD-ROM or 3X-SPEED DVD-ROM Image
- 'D2' (44h 32h) = DM (Main) — Lead-in data containing sectors that are to be placed in the Control Data Zone in the System Lead-in Area of the HD DVD-ROM or 3X-SPEED DVD-ROM disc
- 'D7' (44h 37h) = DM (Main) — Disc Information File containing information about the overall disc including any copy protection mechanism
- 'T2' (54h 32h) = TS (Text) — Free format text file containing customer information

3.5.3 DSP

Definition: This field is the Data Stream Pointer field and it is used only when the source media is a Block Addressable Random Access media. DSP is filled with ASCII spaces (20h) when it is not used. This field points to the sector on the source media that the information described by the CMFMS starts. The DSPFMT field in the current CMFMS indicates whether this field contains the logical block address or the physical sector number.

Byte: 6-13

Length: 8

Usage: 'n' type field

3.5.4 DSL

Definition: This field is the Data Stream Length field and it contains the amount of data in the file described by the map packet. In the case of D0 and D2 stream types, DSL contains the number of HD DVD sectors. The number of sectors for the Control Data Zone is 32. In the case of 'D7' type of streams, the DSL field contains ASCII spaces or the size of the input file. In the case of stream types other than 'D0', 'D2', and 'D7' the DSL contains the exact number of bytes in the input file.

Byte: 14-21

Length: 8

Usage: 'n' type field

3.5.5 DSS

Definition: This field is the Data Stream Start field and it contains the physical sector address on the HD DVD Disc where DM (Main) data are to be placed. The address is stored in this field in base 16 format. This field is required for all surfaces.

Byte: 22-29

Length: 8

Usage: 'h' type field

Examples:

- ' 01E400 (20h 20h 30h 31h 45h 34h 30h 30h) = The address of the physical start sector for Control Data Zone ('D2' type CMFMS packet) is 1E400h.
- ' 030000' (20h 20h 30h 33h 30h 30h 30h 30h) = The address of the physical start sector for the Data Zone ('D0' type CMFMS packet) is 030000h.
- ' FCEFF0' (20h 20h 46h 43h 45h 46h 46h 30h) = The address of the physical start sector for a Data Zone ('D0' type CMFMS packet) for a Layer 1 OTP that starting at FCEFF0h.
- ' ' (20h) = used only when DST is 'D7' or 'T2'

3.5.6 RES1

Definition: Reserved

Byte: 30-37

Length: 8

Usage: 'f' type field

' ' (20h) = ASCII spaces

3.5.7 CDM

Definition: This field is the HD DVD Disc Mode field and is used to describe what mode of data is to be recorded on the HD DVD Disc for this particular map packet. This is independent of how data is stored on the source media.

Byte: 38-39

Length: 2

Usage: 'f' type field

'DV' (44h 56h) = HD DVD-ROM or 3X-SPEED DVD-ROM Sector

' ' (20h) = used only when DST is 'D7' or 'T2'

3.5.8 SSM

Definition: This field is the Source Storage Mode field and it is used to describe the format of the data on the source media. It is used in conjunction with the CDM field.

Byte: 40

Length: 1

Usage: 'f' type field

'0' (30h) = User data only, 2048 bytes

'1' (31h) = Complete 2054

'6' (36h) = Incomplete, 2064 bytes

'7' (37h) = Complete, 2064 bytes

' ' (20h) = used only when DST is 'D7' or 'T2'

See sections 6 Lead-in Control Data File and 7 Image File on how the parts of the sector stored for each value and the processing performed.

3.5.9 SCR

Definition: This field is the Source Material Scrambled field and it contains information whether the data on input media has already been scrambled. An SCR of 1 is used only when SSM = 6 or 7.

Byte: 41

Length: 1

Usage: 'f' type field

'0' (30h) = indicates data on input media does not contain HD DVD sector scrambling

'1' (31h) = indicates data on input media does contain HD DVD sector scrambling

' ' (20h) = used only when DST is 'D7' or 'T2'

3.5.10 DSPVALUE

Definition: This field is the Data Stream Pointer Format (DSPFMT) field and contains information whether the value of the DSP field contains a Logical Block Address or a Physical Sector Address.

Byte: 42

Length: 1

Usage: 'f' type field

'0' (30h) = indicates that the DSP field contains a Logical Block Address

'1' (31h) = indicates that the DSP field contains a Physical Sector Address

‘ ‘ (20h) = used only when DSP field is not used

3.5.11 Res2

Definition: Reserved

Byte: 43

Length: 1

Usage: ‘f’ type field

‘ ’ (20h) = ASCII spaces

3.5.12 LAYER

Definition: This field identifies the layer that the file being described by the current CMFMS is to be placed.

Byte: 44

Length: 1

Usage: ‘f’ type field

‘0’ (30h) = indicates that the file should be placed on Layer 0

‘1’ (31h) = indicates that the file should be placed on Layer 1 (Including HD DVD Layer of Twin Format Disc)

‘ ‘ (20h) = used only when DST is ‘D7’ or ‘T2’

3.5.13 DSI

Definition: This field is the Data Stream Identifier (DSI) field. This field is used with File Based Media to indicate the name of the file being defined by the current CMFMS packet. For other types of media, this field may be filled in with the name that the file would normally have. The file name needs to conform to an 8.3 file name convention and all alphabetic characters must be upper case.

Byte: 45-61

Length: 17

Usage: ‘a’ type field

3.5.14 RES3

Definition: Reserved

Byte: 62-127

Length: 66

Usage: ‘f’ type field

‘ ’ (20h) = ASCII spaces

3.6 File Names

The CMF file must have the file name **CMFID.DAT**. The names of the files that the CMFMS packets reference are suggested to be those described in Figure 9.

File Type	File Name
T2 Text File	T2TEXTn.DAT – where n is a number when more than one T2 Text file is present
Disc Information File	DISCINFO.XML
Lead-in Control File	CONTROL.DAT
HD DVD Image File	IMAGE.DAT

Figure 9 Recommended File Names

When there are more than one HD DVD Image file, then each HD DVD Image file must have a unique name.

The file names must follow the conventional 8.3 naming sequence. All alphabetic characters must be upper case. The file names in the CMFMS packets need to match with the actual file names on the media. Therefore any alphabetic characters used in the file names in the CMFMS packets must also be upper case. Figure 10 identifies the valid characters for file names¹.

ASCII	hex	ASCII	hex	ASCII	Hex	ASCII	hex	ASCII	Hex	ASCII	hex
0	30	7	37	E	45	J	4C	S	53	Z	5A
1	31	8	38	F	46	M	4D	T	54	-	2D
2	32	9	39	G	47	N	4E	U	55	_	5F
3	33	A	41	H	48	O	4F	V	56		
4	34	B	42	I	49	P	50	W	57		
5	35	C	43	J	4A	Q	51	X	58		
6	36	D	44	K	4B	R	52	Y	59		

Figure 10 Valid Characters for File Names

3.7 Required Files

There are four files required for all types of HD DVD layers. These files are the CMF file, the DISCINFO.XML file, the CONTROL.DAT file, and at least one IMAGE.DAT file. Figure 11 shows the required files.

CMFID.DAT	Required
T2TEXTn.DAT	Optional
DISCINFO.XML	Required
CONTROL.DAT	Required
IMAGE.DAT	Required

Figure 11 Required Files: HD DVD-ROM and 3X-SPEED DVD-ROM Disc

4. Free Format Text File

The free format text file is a file that contains ASCII text of any format. Lines can be terminated in any of the acceptable line termination methods


```

    <Section Type="Segment Key File">OPEN</Section>
    <Section Type="Directory Key File">OPEN</Section>
    <CHT1>EMPTY</CHT1>
    <CHT2>EMPTY</CHT2>
    <CC>EMPTY</CC>
</Status>
<Key Type="VolumeID">112233445566778899AABBCCDDEEFF</Key>
<Key Type="TitleKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="TitleKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="TitleKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="TitleKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
<Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
<PMSN Type="DiscUniqueStart">00000000000000000000000000000001</PMSN>
<PMSN Type="DiscUniqueEnd">55555555555555555555555555555555</PMSN>
<ReplacementFile>
    <SourcePath/>
    <DiscImagePath>/AACS/CONTENT_REVOCATION_LIST.AACS
    </DiscImagePath>
</ReplacementFile>
<ReplacementFile>
    <SourcePath/>
    <DiscImagePath>/AACS_BAK/CONTENT_REVOCATION_LIST.AACS
    </DiscImagePath>
</ReplacementFile>
<ReplacementFile>
    <SourcePath/>
    <DiscImagePath>/AACS/MKBROM.AACS</DiscImagePath>
</ReplacementFile>
<ReplacementFile>
    <SourcePath/>
    <DiscImagePath>/AACS_BAK/MKBROM.AACS</DiscImagePath>
</ReplacementFile>
<ReplacementFile>
    <SourcePath/>
    <DiscImagePath>/AACS/ SKB.AACS </DiscImagePath>
</ReplacementFile>
<ReplacementFile>
    <SourcePath/>
    <DiscImagePath>/AACS_BAK/ SKB.AACS </DiscImagePath>
</ReplacementFile>
<ReplacementFile>
    <SourcePath/>
    <DiscImagePath>/AACS/ MKBRECORDABLE.AACS </DiscImagePath>
</ReplacementFile>
<x-data>
    <Extension>XML</Extension>
</x-data>
<x-data>
    <Extension>TXT</Extension>
</x-data>

```

```

</CopyProtectionInformation>
</DiscInformationFile>

```

An example of the Disc Information File after AACS Encryption and AACS signing and ready to be sent to the HD DVD-ROM Physical Formatter is shown below.

```

<?xml version="1.0" encoding="UTF-8" ?>
<DiscInformationFile xmlns="http://www.dvdforum.org/2006/HDDVDCMF/DISINFO">
  <DiscInformation>
    <DateTime Type="Created">2005-01-01T09:44:35Z</DateTime>
    <DateTime Type="Modified">2005-01-02T00:00:00Z </DateTime>
    <NumberLayers>2</NumberLayers>
    <LayerType>OTP</LayerType>
    <Layer Type="0">
      <StartAddress>0</StartAddress>
      <Length>4334752</Length>
    </Layer>
    <Layer Type="1">
      <StartAddress>4334752</StartAddress>
      <Length>4220832</Length>
    </Layer>
    <BCA>1001110448120000100210084000112233445566000000000000000000000000000000
      0000000000000000000000000000000000000000000000000000000000000000000000
      000000000000000000</BCA>
    <Title>HDDVDVIDEO</Title>
    <Author>HDDVDVIDEOAUTHOR</Author>
    <CopyrightNotice>HDDVDVIDEOCOPYRIGHTNOTICE</CopyrightNotice>
    <Abstract>HDDVDVIDEOABSTRACT</Abstract>
  </DiscInformation>
  <CopyProtectionInformation Type="AACS">
    <Status>
      <ProtectionStatus>COMPLETE</ProtectionStatus>
      <Section Type="Advanced Resources">AACS PROTECTED</Section>
      <Section Type="Enhanced Video Object">AACS PROTECTED</Section>
      <Section Type="Segment Key File">AACS PROTECTED</Section>
      <Section Type="Title Key Files">AACS PROTECTED</Section>
      <Section Type="Title Usage Files">AACS PROTECTED</Section>
      <Section Type="Directory Key File">AACS PROTECTED</Section>
      <CHT1>COMPLETE</CHT1>
      <CHT2>COMPLETE</CHT2>
      <CC>AFTER AACS SIGNED</CC>
    </Status>
    <Key Type="VolumeID">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="TitleKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="TitleKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="TitleKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="TitleKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF</Key>
    <Key Type="KCD">112233445566778899AABBCCDDEEFF </Key>
  </CopyProtectionInformation>
</DiscInformationFile>

```

```
<PMSN Type="DiscUniqueStart">000000000000000000000000000001</PMSN >  
<PMSN Type="DiscUniqueEnd">55555555555555555555555555555555</PMSN >  
<PartialMediaKeyBlock>/Other/PartialMKB.bin</PartialMediaKeyBlock>  
</CopyProtectionInformation>  
</DiscInformationFile>
```

6. Lead-in Control Data File

The Lead-in Control Data (sometimes referred to as the CONTROL.DAT) file shall contain one ECC block of sectors of the Control data section that is to be placed in the Control Data Zone in the Lead-in Area on the HD DVD disc. Although the file on the media contains only one ECC Block of sectors, these sectors are repeated as required on the HD DVD disc. The Lead-in Control Data file consists of one Physical Format Information Sector, one Disc Manufacturing Information Sector, one Copyright Protection Information Sector, and twenty nine Reserved Sectors. The contents of these sectors should be in accordance to the *HD DVD Specifications for Read-Only Disc, Part 1 Physical Specification*.

The Lead-in Control Data file can be stored in 2048, 2054, or 2064 byte HD DVD sectors.

Note: HD DVD discs contain 2064 bytes of information per sector, divided as follows: ID (4 bytes), IED (2 bytes), RSV (6 bytes), Main Data (2048 bytes) and error detection code (EDC) (4 bytes).

When SSM = 0, ID, IED, and EDC is generated, the RSV bytes are set to zero, and the user data is sent without modification.

When SSM = 1, ID, IED, and EDC is generated, and the RSV bytes and user data are sent without modification.

When SSM = 6, ID, IED, and EDC are ignored and regenerated, and the RSV bytes and user data are sent without modification.

When SSM=7, the entire sector is sent without modification.

On D2 (Lead-in Control) map packets with '0', '1', or '6' are the only values that are valid for this field.

7. Image File

The HD DVD Image file (sometimes referred to as the IMAGE.DAT file) contains the HD DVD image that is to be placed in the Data Area on the HD DVD disc. The HD DVD Image file can be stored in 2048 byte, 2054 byte, or 2064 byte HD DVD sectors.

When $SSM = 0$, ID, IED, and EDC is generated, the RSV bytes are set to zero, and the user data is sent without modification.

When $SSM = 1$, ID, IED, and EDC is generated, and the RSV bytes and user data are sent without modification.

When $SSM = 6$, ID, IED, and EDC are ignored and regenerated, and the RSV bytes and user data are sent without modification.

When $SSM=7$, the entire sector is sent without modification.

There may be more than one HD DVD Image file. Each HD DVD Image file must have a corresponding CMFMS Packet describing it. The order of the CMFMS packets must be in the same order as their corresponding HD DVD Image Files will occur on the HD DVD Disc.

8. Appendix A – XML Elements in Disc Information File

8.1 *DisclInformationFile*

Type: Complex

Attributes:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Children: *DisclInformation*, *CopyProtectionInformation*

Annotation: This element holds all of the Disc Information File content

8.1.1 *DisclInformationFile/DisclInformation*

Type: Complex

Attributes:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children: *DateTime*, *NumberLayers*, *LayerType*, *Layer*, *BCA*, *Title*, *Author*,
CopyrightNotice, *Abstract*

Annotation: This element holds all of the physical disc properties

8.1.1.1 *DisclInformationFile/DisclInformation/DateTime*

Type: *xs:dateTime*

Attributes: *Type=*

Created – Date Time the CMF Set was created

Modified – Date Time the CMF Set was modified

Properties:

Minimum Occurrences: 1 – *Type=Created*

Maximum Occurrences: $n > 0$ including one with *Type=Created* and any number with
Type=Modified

Facets:

Children:

Annotation: This element the date and time that the CMF Set was created or modified depending on the type attribute

8.1.1.2 DiscInformationFile/DiscInformation/NumberLayers

Type: xs:integer

Attribute:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets: enumeration

1 – single layer (Including HD DVD Layer of Twin Format Disc)

2 – dual layer

3 – 3 layers (for future use)

4 – 4 layers (for future use)

Children:

Annotation: This element defines the number of layers present on the media. The HD DVD-ROM disc can currently have 2 and may eventually contain more layers

8.1.1.3 DiscInformationFile/DiscInformation/LayerType

Type: xs:string

Attribute:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets: enumeration

PTP – Parallel Track Path (Including single layer disc and HD DVD Layer of Twin Format Disc)

OTP – Opposite Track Path

Children:

Annotation: This element defines the type of layers

8.1.1.4 DiscInformationFile/DiscInformation/Layer

Type: Complex

Attribute : Type =

0 – Defines Layer 0 Information

1 – Defines Layer 1 Information (Including HD DVD Layer of Twin Format Disc)

2 – Defines Layer 2 Information (reserved for 3 layer HD DVD-ROM)

3 – Defines Layer 3 Information (reserved for 4 layer HD DVD-ROM)

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 4

Facets:

Children: StartAddress, Length

Annotation: This element defines length and start location of each layer

8.1.1.4.1 DiscInformationFile/DiscInformation/Layer/StartAddress

Type: xs:integer

Attribute :

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element defines the start Logical Block Address that the Data Area of the Layer being defined starts

8.1.1.4.2 DiscInformationFile/DiscInformation/Layer/Length

Type: xs:integer

Attribute :

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element defines the length (in number of blocks (i.e. sectors)) of the Data Area being defined

8.1.1.5 DiscInformationFile/DiscInformation/BCA

Type: xs:hexBinary

Attribute :

Properties:

Minimum Occurrences: 0

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element contains content to be placed in the BCA. This element should contain the total number of BCA characters that are to be placed on the disc. For example, for HD DVD-ROM, this element should contain 152 characters for 76 bytes BCA Information. In case of 3X-SPEED DVD-ROM with AACS or HD DVD-ROM, this element shall be present. In case of 3X-SPEED DVD-ROM without AACS, this element may not be present.

8.1.1.6 DiscInformationFile/DiscInformation/Title

Type: xs:string

Attribute :

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element contains the title of the disc image contents or application. It contains all characters valid for a normal XML string. It is recommended that the maximum length of this element be 4096 characters.

8.1.1.7 DiscInformationFile/DiscInformation/Author

Type: xs:string

Attribute :

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element contains the Name and Software Version of the Authoring System Product used to create the disc image. It contains all characters valid for a normal XML string. It is recommended that the maximum length of this element be 4096 characters.

8.1.1.8 DiscInformationFile/DiscInformation/CopyrightNotice

Type: xs:string

Attribute :

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element contains the copyright notice for the disc image contents. It contains all characters valid for a normal XML string. It is recommended that the maximum length of this element be 4096 characters.

8.1.1.9 DiscInformationFile/DiscInformation/Abstract

Type: xs:string

Attribute:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element contains a description of the disc image contents. It can be used for identifying different versions of a disc image. It contains all characters valid for a normal XML string. It is recommended that the maximum length of this element be 4096 characters.

8.1.2 DiscInformationFile/CopyProtectionInformation

Type: Complex

Attribute: Type=

AACS – AACS Copy protection applies to the content

Properties:

Minimum Occurrences: 0

Maximum Occurrences: one for each type of copy protection to be present on the media

Facets:

Children: Status, Key, PMSN, PartialMediaKeyBlock, ReplacementFile, x-data

Annotation: This element holds all of the information specific to the copy protection system to be placed on the disc

8.1.2.1 DiscInformationFile/CopyProtectionInformation/Status

Type: Complex

Attribute:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children: ProtectionStatus, Section, CHT1, CHT2, CC

Annotation: This element defines the status of the copy protection. It can identify different parts of the Disc Image and their copy protection status. This allows different parts of the Disc Image to have different copy protection statuses.

8.1.2.1.1 DiscInformationFile/CopyProtectionInformation/Status/ProtectionStatus

Type: xs:string

Attribute:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

INCOMPLETE – Copy protection is incomplete. Check the children for more details

COMPLETE – Copy protection is complete and ready for the Physical Formatter

Children:

Annotation: This element defines the status of the copy protection with regard to a piece of the disc content.

8.1.2.1.2 DiscInformationFile/CopyProtectionInformation/Status/Section

Type: xs:string

Attribute: Type =

Title Key Files – Indicates that this element defines the status of the AACS Title Key File(s) within the Disc Image file(s). Elements with this type of attribute can have a value of PARTIAL, OPEN or AACS PROTECTED enumerations. See Appendix C – AACS Considerations for the detailed requirements of Title Key handling.

Title Usage Files – Indicates that this element defines the status of the AACS Title Usage File(s) within the Disc Image file(s). Elements with this type of attribute can have a value of OPEN or AACS PROTECTED enumerations. Description for this type can be omitted when the Disc Image file does not include Title Usage Files.

Advanced Resources – Indicates that this element defines the status of the Advanced Resource File(s) such as Advanced Navigation and Advanced Element within the Disc Image file(s). Elements with this type of attribute can have a value of OPEN or AACS PROTECTED enumerations. If the element has a value of OPEN, Advanced Resources which are necessary to be protected shall be AACS encapsulated without AACS encryption and calculation of MAC and Hash value. Advanced Resources which are stored in archiving file (*.aca) or multiplexed in P-EVOB as Advanced Stream also obey this enumeration. Description for this type can be omitted when the Disc Image file does not include any Advanced Resources.

Enhanced Video Object – Indicates that this element defines the status of the Enhanced Video Object File(s) such as EVOBs (both Standard and Advanced Content) within the Disc Image file(s). Elements with this type of attribute can have a value of OPEN or AACS PROTECTED enumerations. CPI of EVOBs shall be filled with valid value for any enumerations. PES_scrambling_control of the packs which need to be encrypted shall be also filled with valid value for any enumerations. S-EVOBs which are stored in archiving file (*.aca) or multiplexed in P-EVOB as Advanced Stream also obey this enumeration.

Directory Key File – Indicates that this element defines the status of the AACS Directory Key File within the Disc Image file(s). Elements with this type of attribute can have a value of OPEN or AACS PROTECTED enumerations.

Segment Key File – Indicates that this element defines the status of the AACS Segment Key File within the Disc Image file(s). Elements with this type of attribute can have a value of OPEN or AACS PROTECTED enumerations. Description for this type can be omitted when the Disc Image file does not include Segment Key File.

Properties:

Minimum Occurrences: 3

Maximum Occurrences: 6

Facets:

PARTIAL – Indicates that the file(s) are partially filled in and not encrypted.

OPEN – Indicates that the file(s) are not encrypted.

AACS PROTECTED – Indicates that the file(s) are encrypted using AACS.

Children:

Annotation: This element defines the status of the copy protection with regard to a piece of the disc content. The piece of the disc content is identified by the Type attribute. There are six types of pieces. The file indicated by PARTIAL shall be partially filled with valid value and is not cryptographically calculated such as encryption and/or calculation of MAC/Hash. The file indicated by OPEN shall be filled with valid value, except for the file is not cryptographically calculated such as encryption and/or calculation of MAC/Hash. The file indicated by AACS PROTECTED is complete and/or does not need any cryptographic calculations. See Appendix D – AACS Processing Status.

8.1.2.1.2.1 *Required Attributes*

The following lists the minimum required *Section* elements with attributes that must be present for different types of HD DVD-Video discs. The elements with Title Key Files, Enhanced Video Object and Directory Key File attribute are required for any Category discs. The element with Advanced Resources attribute is required for Category 2 disc. The element with Title Usage Files attribute is required if the Disc Image file contains one or more Title Usage Files. The element with Segment Key File attribute is required if Sequence Key is used and the Disc Image file contains Segment Key File.

Category 1 HD DVD-Video discs without Title Usage Files and use of Sequence Key

```
<Section Type="Title Key Files">
<Section Type="Enhanced Video Object">
<Section Type="Directory Key File">
```

Category 1 HD DVD-Video discs without use of Sequence Key

```
<Section Type="Title Key Files">
<Section Type="Title Usage Files">
<Section Type="Enhanced Video Object">
<Section Type="Directory Key File">
```

Category 1 HD DVD-Video discs with use of Sequence Key

```
<Section Type="Title Key Files">
<Section Type="Title Usage Files">
<Section Type="Enhanced Video Object">
<Section Type="Directory Key File">
<Section Type="Segment Key File">
```

Category 2 HD DVD-Video discs without Title Usage Files and use of Sequence Key

```
<Section Type="Title Key Files">
<Section Type="Advanced Resources">
<Section Type="Enhanced Video Object">
<Section Type="Directory Key File">
```

Category 2 HD DVD-Video discs without use of Sequence Key

```

<Section Type="Title Key Files">
<Section Type="Title Usage Files">
<Section Type="Advanced Resources">
<Section Type="Enhanced Video Object">
<Section Type="Directory Key File">

```

Category 2 HD DVD-Video discs with use of Sequence Key

```

<Section Type="Title Key Files">
<Section Type="Title Usage Files">
<Section Type="Advanced Resources">
<Section Type="Enhanced Video Object">
<Section Type="Directory Key File">
<Section Type="Segment Key File">

```

8.1.2.1.3 DiscInformationFile/CopyProtectionInformation/Status/CHT1

Type: xs:string

Attribute: none

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

COMPLETE – CHT1 is complete

EMPTY – CHT1 is empty (filled with 00h)

Children:

Annotation: This element defines the status of the AACS Content Hash Table 1 file. .

When the status of CHT1 is COMPLETE, the status of Enhanced Video Object shall be AACS PROTECTED and vice versa. See Appendix D – AACS Processing Status.

8.1.2.1.4 DiscInformationFile/CopyProtectionInformation/Status/CHT2

Type: xs:string

Attribute: none

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

COMPLETE - CHT2 is complete

PARTIAL - CHT2 is partially filled in with the entry for the hash value of Advanced Resources.

EMPTY - CHT2 is empty (filled with 00h)

Children:

Annotation: This element defines the status of the AACS Content Hash Table 2 file. When the status of CHT2 is COMPLETE or PARTIAL, the status of Advanced Resources shall be AACS PROTECTED and vice versa. When the status of CHT2 is COMPLETE, the statuses of Title Usage Files and Directory Key File shall be AACS PROTECTED and vice versa. See Appendix D – AACS Processing Status.

8.1.2.1.5 DiscInformationFile/CopyProtectionInformation/Status/CC

Type: xs:string

Attribute: none

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

AFTER AACS SIGNED - CC is complete with AACS signature.

BEFORE AACS SIGNED - CC is complete except AACS signature.

EMPTY - CC is empty (filled with 00h).

Children:

Annotation: This element defines the status of the AACS Content Certificate file. When the status of CC is AFTER AACS SIGNED or BEFORE AACS SIGNED, the status of CHT1 and CHT2 shall be COMPLETE and vice versa. See Appendix D – AACS Processing Status.

8.1.2.2 DiscInformationFile/CopyProtectionInformation/Key

Type: xs:hexBinary

Attribute: Type=

VolumeID – The element contains the Volume ID. The occurrence of the element with this attribute shall be one time.

TitleKey – The element contains a Title Key. The occurrences of the element with this attribute shall be equal to or more than 0 and less than 65 times. The order which this element is described in corresponds to the entry number of Title Key. The entry number is the value which is indicated by TITLE_KEY_PTR. The Title Keys in this element may be different from the Title Keys in Title Key Files, and AACS protection shall be performed with not Title Keys in Title Key Files but those in this element. See Appendix C – AACS Considerations for the detailed usages and requirements of this element.

SegmentKey – The element contain a Segment Key. The occurrences of the element with this attribute shall be equal to or more than 0 and less than 1537 times. The number 1536 corresponds to the product of the maximum of SEG_NO (8) and that of SEG_KEY_PTR (192). The order which this element is described in corresponds to the entry number of Segment Key. The entry number is the value which is indicated by SEG_NO and SEG_KEY_PTR. The entry number equals to $SEG_NO + SEG_KEY_PTR * 8$, where SEG_NO runs from 1 to 8 and SEG_KEY_PTR runs from 1 to 192.

KCD – The element contains a Key Conversion Data. The occurrence of the element with this attribute shall be zero or one time.

Properties:

Minimum Occurrences: 2 – when CMF is describing the content as generated by Authoring.

3 – when CMF is describing the content that has AACS processing complete and is ready to be sent to the LBR.

Maximum Occurrences: 1602

Facets:

Children:

Annotation: This element holds a key used for AACS encryption. The type of key is specified by the attribute. The value for this element is stored as a hexadecimal value. The value is stored as a ASCII representation of the hexadecimal numbers. For example the 16 byte value 01h 02h 03h 04h 05h 06h 07h 08h 09h 1Ah 1Bh 2Ch 3Dh 4Eh F6h 00h would be represented with the ASCII codes 30h 31h 30h 32h 30h 33h 30h 34h 30h 35h 30h 36h 30h 37h 30h 38h 30h 39h 31h 41h 30h 42h 32h 43h 33h 44h 34h 45h 4Fh 36h 30h 30h which in a text processor would look like “0102030405060708091A1B2C3D4EF600”.

8.1.2.2.1 Required Attributes

The following lists the minimum required *Key* elements with attributes that must be present for different types of HD DVD-Video discs. The elements with VolumeID and TitleKey attribute are created by Authoring system and required for both CMF file sets out of Authoring and ready to be sent to LBR. The element with SegmentKey attribute is created by Authoring system and required for both CMF file sets if Sequence Key is used. The element with KCD attribute is required for CMF file set ready to be sent to LBR.

Out of Authoring

HD DVD-Video discs without use of Sequence Key and 'Section' element with 'Title Key Files' attribute is PARTIAL

<Key Type="VolumeID">

HD DVD-Video discs with use of Sequence Key and 'Section' element with 'Title Key Files' attribute is PARTIAL

<Key Type="VolumeID">

<Key Type="SegmentKey">

HD DVD-Video discs without use of Sequence Key and 'Section' element with 'Title Key Files' attribute is OPEN or AACS PROTECTED

<Key Type="VolumeID">

<Key Type="TitleKey">

HD DVD-Video discs with use of Sequence Key and 'Section' element with 'Title Key Files' attribute is OPEN or AACS PROTECTED

<Key Type="VolumeID">

<Key Type="TitleKey">

<Key Type="SegmentKey">

Ready to be sent to LBR

HD DVD-Video discs without use of Sequence Key

<Key Type="VolumeID">

<Key Type="TitleKey">

<Key Type="KCD">

HD DVD-Video discs with use of Sequence Key

<Key Type="VolumeID">

<Key Type="TitleKey">

<Key Type="KCD">

<Key Type="SegmentKey">

8.1.2.3 DiscInformationFile/CopyProtectionInformation/PMSN

Type: xs:hexBinary

Attribute: Type=

TitleUnique – The element contains the title unique, i.e. CMF master unique, Prerecorded Media Serial Number. When this attribute is used, then only one DiscInformationFile/CopyProtectionInformation/PMSN element can be present.

DiscUniqueStart – The element contains the start number of disc unique Prerecorded Media Serial Number. When this attribute is used, a second DiscInformationFile/CopyProtectionInformation/PMSN element must be present with the attribute DiscUniqueEnd.

DiscUniqueEnd – The element contains the end number of disc unique Prerecorded Media Serial Number. When this attribute is used, a second DiscInformationFile/CopyProtectionInformation/PMSN element must be present with the attribute DiscUniqueStart.

Properties:

Minimum Occurrences: 0

Maximum Occurrences: 2

Facets:

Children:

Annotation: This element holds a PMSN used for AACS protection. The type of PMSN is specified by the attribute. The PMSN can be specified as one of two ways according to the attribute.

- 1) The TitleUnique attribute specifies that the PMSN will be placed in the BCA for all replicas of the Title. In this case the PMSN will be placed in the BCA by the HD DVD Physical Formatter at the LBR or after the replica is created. When the attribute is TitleUnique, only one DiscInformationFile/CopyProtectionInformation/PMSN element can exist in the file.
- 2) The DiscUniqueStart and DiscUniqueEnd attributes work in conjunction to specify the range of PMSNs that will be placed in the BCA with each HD DVD Replica containing a unique PMSN. In this case the PMSN will be placed in the BCA after each replica is created. The DiscUniqueStart and DiscUniqueEnd attributes must be present together. The value for the DiscUniqueEnd must be larger than the value for DiscUniqueStart. Furthermore the DiscInformationFile/DiscInformation/BCA should not have the record for the PMSN stored.

The value for this element is stored as a hexadecimal value. The value is stored as an ASCII representation of the hexadecimal numbers. For example the 16 byte value 01h 02h 03h 04h 05h 06h 07h 08h 09h 1Ah 1Bh 2Ch 3Dh 4Eh F6h 00h would be represented with the ASCII codes 30h 31h 30h 32h 30h 33h 30h 34h 30h

35h 30h 36h 30h 37h 30h 38h 30h 39h 31h 41h 30h 42h 32h 43h 33h 44h 34h 45h
4Fh 36h 30h 30h which in a text processor would look like
“0102030405060708091A1B2C3D4EF600”.

8.1.2.4 DiscInformationFile/CopyProtectionInformation/ PartialMediaKeyBlock

Type: xs:string

Attribute:

Properties:

Minimum Occurrences: 0 – when CMF is describing the content as generated by
Authoring.

1 – when CMF is describing the content that has AACS
processing complete and is ready to be sent to the LBR.

Facets:

Children:

Annotation: This element specifies the path to a file that contains the Partial Media Key
Block (P-MKB). The path specified by this element is relative to the folder that the
CMFID file is found.

8.1.2.5 DiscInformationFile/CopyProtectionInformation/ReplacementFile

Type: Complex

Attribute:

Properties:

Minimum Occurrences: 0

Maximum Occurrences: n

Facets:

Children: SourcePath, DiscImagePath

Annotation: This element is used to replace a file listed in the UDF File System within the
Disc Image File with a new file. The element has two children. One child contains
the full path in the UDF File System within the Disc Image of the file to replace.
The other child contains the path to the file that will be used as the source content.
The source content file must be the same size or smaller than the file listed in the
UDF File System within the Disc Image. When the source file is smaller, the
remaining sectors in the file in the Disc Image will be filled with 00h. In practical
use, this element will exist only when a new replacement source file exists. This
element is used for MKBROM.AACS, MKBRECORDABLE.AACS,
CONTENT_REVOCATION_LIST.AACS and SKB.AACS.

8.1.2.5.1 DiscInformationFile/CopyProtectionInformation/ReplacementFile/SourcePath

Type: xs:string

Attribute:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element specifies the path to a file that is to be placed into the Disc Image. The path specified by this element is relative to the folder that the CMFID file is found.

8.1.2.5.2 DiscInformationFile/CopyProtectionInformation/ReplacementFile/DiscImagePath

Type: xs:string

Attribute:

Properties:

Minimum Occurrences: 1

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element specifies the full path to a file in the Disc Image UDF structure that the file is to replace.

8.1.2.6 DiscInformationFile/CopyProtectionInformation/x-data

Type: Complex

Attribute:

Properties:

Minimum Occurrences: 0

Maximum Occurrences: n

Facets:

Children: Extension

Annotation: In the HD-Video specification, there may be the file whose extension and content is not specified. The MIME type of such file is defined as application/x-data (See DVD Specifications for High Definition VIDEO (HD DVD-Video) Volume 1, Chapters 1 to 4, Table 3.3.5-1 File Extension and MIME Type). This element is used to indicate and protect such files.

8.1.2.6.1 DiscInformationFile/CopyProtectionInformation/x-data/Extension

Type: xs:string

Attribute:

Properties:

Minimum Occurrences: 0

Maximum Occurrences: 1

Facets:

Children:

Annotation: This element specifies the extension name of the file whose MIME type is application/x-data, and which is protected by AACS. Note that all the files indicated by this element are protected by AACS encapsulation. Note that the characters in upper case shall be regarded as different from the characters in lower case and vice versa. (e.g. XML and xml are not regarded as same extension)

9. Appendix B - Media Specific Requirements

This section describes the requirements for placing a CMF File Set on different media.

9.1 File Based Media

File Based Media applies to any media type in which its content is accessed via a file system. This media type includes networked drives, etc. This type of media, the DSI field in the CMFMS packets must be filled in with the correct name of the file that the CMFMS packet is describing.

9.2 Block Addressable Random Access Media

Block Addressable Random Access Media applies to any media in which its content can be randomly accessed using addresses assigned to its blocks. It is not accessed via a file system. This type of media each file must be stored in a continuous sequence of blocks. The DSP field in the CMFMS packet is used to point to the first block on the media of the file being described by the CMFMS packet.

9.3 Non Streaming Sequential Access Media

Non Streaming Sequential Access media is basically computer accessible tape media.

9.4 Streaming Sequential Access Media

Streaming Sequential Access media is not a usable type of media for storing CMF 2.00 image.

10. Appendix C – AACS Considerations

Regarding applying AACS, the Title Keys can be generated by the Authoring Studio (sometimes it means Content Provider) or the HD DVD Replicator. The decision for where the Title Keys to be generated depends on certain criteria.

10.1 Title Key Generation Requirements

1. If the HD DVD-Video content is to be encrypted by the Title Keys, but not all of them are present in the Title Key Files on the physical HD DVD-ROM disc such as Online-Enabling case, then the Authoring Studio must generate the Title Keys.
2. If the specific Title Keys are to be used for the HD DVD-Video content, e.g. if the same Title Keys are to be used across different physical HD DVD-ROM disc, then the Authoring Studio must generate the Title Keys.
3. Otherwise the Authoring Studio may require the Replicator to generate the Title Keys. This is accomplished by the Disc Information File which does not include any 'Key' elements with 'TitleKey' attribute. In this case, the 'Section' element with 'Title Key Files' attribute must be PARTIAL.

NOTE: The condition 1 and 2 are not mutually exclusive and it is possible that an HD DVD-Video disc may contain both conditions.

10.2 Title Key Transport Requirements

1. If the Authoring Studio is to generate the Title Keys to encrypt the HD DVD-Video content on the physical HD DVD-ROM disc, and all of them are present in the Title Key Files on the physical HD DVD-ROM disc, then the Authoring Studio must place the Title Keys in the Title Key Files and in the Disc Information File. The Replicator shall read the Title Keys from the Disc Information File when performing AACS encryption. In this case, the 'Section' element with 'Title Key Files' attribute must be OPEN or AACS PROTECTED.
2. If the Authoring Studio is to generate the Title Keys to encrypt the HD DVD-Video content on the physical HD DVD-ROM disc, but not all of them are present in the Title Key Files on the physical HD DVD-ROM disc such as Online-Enabling case, then the Authoring Studio must place the Title Keys, which are necessary to encrypt the HD DVD-Video content on the physical HD DVD-ROM disc, in the Disc Information File. The Replicator shall read the Title Keys from the Disc Information File when performing AACS encryption. In this case, the 'Section' element with 'Title Key Files' attribute must be OPEN or AACS PROTECTED.
3. If the Replicator generates Title Keys, then the Authoring Studio must still generate the Title Key Files, but fill the Title Key fields in with 00h. The Authoring Studio must not place any 'Key' elements with 'TitleKey' attribute in the Disc Information File. The Replicator uses a random number generator to generate the Title Keys and places them in the Title Key fields in the Title Key Files on the

physical HD DVD-ROM disc. In this case, the 'Section' element with 'Title Key Files' attribute must be PARTIAL.

10.3 Title Key Security Requirements

When the HD DVD-Video content is to be protected by AACS, the AACS Keys in the Disc Information File must be secure and it is recommended to protect them. The method of protecting the AACS Keys shall be up to an agreement between the HD DVD-Video Authoring House to the HD DVD-ROM Disc Manufacturing plant.

11. Appendix D – AACS Processing Status

This section describes the detailed conditions of AACS processing status. Basically, Authoring Studio performs AACS pre-processing such that the HD DVD and AACS components are ready to be encrypted, and Replicator performs AACS post-processing such that the components are completely encrypted and the dummy files are replaced with the specific data provided by AACS.

Status		PARTIAL (TK are generated by Replicator)	OPEN (TKs are generated by Authoring Studio)	AACS PROTECTED	
Title Key File	Header	TKF_ID	Completed	Completed	Completed
		HD_VTKF_SIZE			
		PLAYLIST_NAME			
		Reserved			
		VERN			
	Title Key Entry #1 - # 64	Reserved	Filled with 00h	Filled with un-encrypted Title Key	
		BIFO for Title Key			
		Reserved			
		Encrypted Title Key			
	Binding MAC		Completed	Completed	
Reserved		Completed	Completed		
TKF MAC		Filled with 00h	Filled with 00h		

Figure 12 Field conditions of Title Key File

Status		OPEN	AACS PROTECTED		
Title Usage File	Header	URF_ID	Completed	Completed	
		HD_VURF_SIZE			
		URS_NUM (N)			
		HASH_SIZE			
		VERN			
		PLAYLIST_NAME			
		Reserved			
		Reserved			
	Usage Rule Set #1 - #N	URS_VERSION			
		URS_SIZE			
		UR_NUM (M)			
		Usage Rule #1 - #M			UR_ID
					UR_TYPE
	UR_SIZE				
	BURS #1 - #N	UR_BODY			
BIFO					
Binding MAC		Filled with 00h			
TUF MAC					

Figure 13 Field conditions of Title Usage File

Status		EMPTY	BEFORE AACS SIGNED	AFTER AACS SIGNED
Content Certificate	Certificate Type	Filled with 00h	Completed	Completed
	Reserved			
	Total_Number_of_HashUnits			
	Total_Number_of_Layers		Filled with 00h	
	Layer_Number			
	Reserved			
	Number_of_Digests		Completed	
	Applicant ID			
	Content Sequence Number			
	Minimum CRL Version		Filled with 00h	
	Reserved			
	Length_Format_Specific_Section			
	Reserved		Completed	
	Content Hash Table Digest #1			
	Content Hash Table Digest #2			
Signature Data				

Figure 14 Field conditions of Content Certificate

Status		EMPTY	COMPLETE
Content Hash Table #1	Number of Hash Values (NHV)	Filled with 00h	Completed
	Reserved		
	Hash Value of EVOBU #1 - #NHV		

Figure 15 Field conditions of Content Hash Table #1

Status		EMPTY	PARTIAL	COMPLETE
Content Hash Table #2	Hash of DISCID.DAT	Filled with 00h	Filled with 00h	Completed
	Hash of Directory Key File			
	Hash of MNGCPY_MANIFEST			
	Hash of VTUF.AACS			
	Hash of VTUF000.AACS - VTUF999.AACS			
	Hash of ATUF000.AACS - ATUF999.AACS			
	Number of Hashes of ANFs (NHA)		Completed	
Hash of ANF #1 - #NHA				

Figure 16 Field conditions of Content Hash Table #2

Status		OPEN	AACS PROTECTED
Directory Key File	DKF_ID	Completed	Completed
	HD_VDKF_SIZE		
	Reserved		
	VERN		
	Reserved		
Encrypted Directory Key	Filled with un-encrypted Directory Key		

Figure 17 Field conditions of Directory Key File

Status				OPEN	AACS PROTECTED	
Segment Key File	Header	SKF_ID		Completed	Completed	
		HDV_SKF_SIZE				
		Reserved				
		VERN				
		Reserved				
	SKG #1 - #6	SKU #0 - #1023	Verification Data			Filled with un-encrypted Segment Key
			SEG_NO for Segment Key #1 - #32			
			Encrypted Segment Key #1 - #32			
Reserved				Completed		

Figure 18 Field conditions of Segment Key File

Status				OPEN	AACS PROTECTED
Enhanced Video Object	P-EVOB of Standard Content	CPI		Completed	Completed
		PES_scrambling_control			
		Pack encryption		Undone	
		Hash calculation			
	P-EVOB of Advanced Content	CPI		Completed	
		PES_scrambling_control			
		Pack encryption		Undone	
		Hash calculation			
		ARF in Advanced Stream			
	S-EVOB in Advanced Stream		Same as the condition of S-EVOB of Advanced Content		
	S-EVOB of Advanced Content	CPI		Completed	
		PES_scrambling_control			
		Pack encryption		Undone	
Hash calculation					

Figure 19 Field conditions of Enhanced Video Object

Status				OPEN	AACS PROTECTED
Advanced Resources	ARF (excluding Archiving Data)	Encapsulation for Encryption	FILE_ID	Completed	Completed
			Protection Type		
			Reserved		
			TITLE_KEY_PTR		
			Resource File Size		
			Encrypted Data		
		Encapsulation for Encryption and Hash	FILE_ID	Completed	
			Protection Type		
			Reserved		
			TITLE_KEY_PTR		
			Resource File Size		
			Encrypted Data		
Hash Pointer		Completed			

		Encapsulation for MAC	FILE_ID	Completed
			Protection Type	
			Reserved	
			TITLE_KEY_PTR	
			Resource File Size	
			Resource File Name	
			Resource Data	
		MAC of Resource Data	Filled with 00h	
		Encapsulation for Hash	FILE_ID	Completed
			Protection Type	
			Reserved	
			Resource File Size	
			Resource File Name	
			Resource Data	
		Encapsulation for Non-Protected Advanced Element	FILE_ID	Completed
			Protection Type	
			Reserved	
			TITLE_KEY_PTR	
	Resource File Size			
	Encrypted File Name field		Filled with un-encrypted Resource File Name	
	Resource Data	Completed		
Archiving Data	ARF in Archiving Data		Same as the condition of ARF	
	S-EVOB in Archiving Data		Same as the condition of S-EVOB of Advanced Content	

Figure 20 Field conditions of Advanced Resources

MKBROM.AACS	If this file is described as Replacement element, the file is filled with the dummy data. The size of dummy data must be enough to store the specific data provided by AACS.
MKBRECORDABLE.AACS	
CONTENT_REVOCATION_LIST.AACS	
SKB.AACS	Otherwise, the file is filled with the specific data provided by AACS and remaining fields are filled with 00h. Note that Authoring Studio should get the information of the file size from AACS, and Replicator must not change the file system for replacing.
MNGCPY_MANIFEST.XML	This file shall be completed by Authoring Studio. Replicator calculates the hash value of the file if the processing status of Content Hash Table #2 is not COMPLETE.

Figure 21 Conditions of other components

WG-1/CMF Voluntary Members of the DVD Forum who participated in making this format

Doug Carson and Associates Inc., Oklahoma, USA
Eclipse Data Technologies, California, USA
Memory Tech Corporation, Japan
Microsoft Corporation, Washington, USA
Sonic Solutions, California, USA
Thomson, France
Toshiba Corporation, Japan
Zoo Tech, United Kingdom

End Notes

ⁱ The character ‘.’ (2Eh) can be used only to separate the 8 character file name from the 3 character extension.