DDP® 3.00 for HD DVD-ROM and 3X Speed DVD-ROM
Draft Notes

Revision	Notes	Author	Date
0.80	Original Draft	Hbk	2004/03/26
0.81	Updated Lead-in Control Data file for update disc specification	hbk	2004/07/28
0.82	Completed information on Disc Information File	hbk	2005/01/22
0.83	Added ability for DDP File Set to span multiple media volumes	hbk	2005/02/15
"	Changed copyright date to 2005	hbk	2005/03/25
0.84	Added text for 3X-SPEED DVD-ROM, corrected naming of HD-DVD to HD DVD-ROM	hbk	2005/06/30
0.85	First draft of completed AACS documentation	hbk	2005/08/04
0.86	Added DID to Disc Information file	hbk	2005/09/13
0.90	Completed Disc Information file for AACS and corrected example of DSS value for D2 type DDPMS packets to reflect HD DVD-ROM Version 1.1 and beyond	hbk	2005/10/21
0.91 - draft	Added Layer value of 'A' for DDPMS layer field to describe a file that spans all layers. Added CHT1 and CHT2 elements to CopyProtectionInformation/Status element to describe status of AACS CHT1 and CHT2 Added TKF, TUF, CC, and SKF attributes to CopyProtectionInformation/Status/Section element to define status of these AACS components Added CC, CRL, CHT1, CHT2, MNKBROM, SKB, MKBRECORDABLE, VTK(s), and SKF to CopyProtectionInformation/ReplacementFile element to define location of these AACS components Cleaned up Disc Information File examples	hbk	2005/11/01
0.92 - candidate	Added OFS to DDPMS, and required existence of a DDPMS packet for each layer. Added more details for AACS including creating new PMSN element. Removed Attributes from ReplacementFile	hbk	2005/12/02
0.93	Added some more corrections based on Toshiba input. Noteworthy, changed attribute type for DiscInformationFile/CopyProtectionInformation/Status/Section from "Streaming Content" to "Enhanced Video Content" Added information for Twin Disc Format Made several typographical changes Added some new elements in DiscInformation file pertaining to AACS copy protection	hbk	2006/1/06
0.93a	Changed requirement in DDPMS Packet DSL field where DSL field can contain ASCII blanks when DST equals 'D7' (Disc Information File)	hbk	2006/1/09
0.93b	Removed 'A' value in the DDPMS Packet Layer field. 'A' is obsolete since two DDPMS packets are required when one file spans layers.	hbk	2006/1/10
0.93c	Added text clarifying Twin Format Disc for various fields, clarified DSL usage for D7 DDPMS packet	hbk	2006/1/17
0.94	Changed file extension of Disc Information file to XML Clarified the length and format of the Lead-in Control file for HD DVD-ROM and 3X-SPEED DVD-ROM.	hbk	2006/1/25
0.95	Corrected XML formatting of Disc Information file regarding to Copy protection status element and corrected DiscInformation file examples	hbk	2006/02/01

0.96	Corrected some typographical errors	hbk	2006/02/15
0.97	Corrected error in minimum occurrences for BCA for 3X-SPEED DVD-ROM Added details of the required elements and attributes for the Section and Key elements in the Disc Information file.	hbk	2006/03/13
0.98	Added Title Keys requirements for providing Title Keys at Authoring or Replication stages and protecting the Title Keys	hbk	2006/07/12
1.00	Added final commentary text to bring equivalent to CMF 2.00 revision 1.00	hbk	2006/10/11

DDP 3.00 for HD DVD-ROM and 3X-SPEED DVD-ROM

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1. General

The Disc Description Protocol is a standardized way of transferring content for HD DVD-ROM and 3X-SPEED DVD-ROM discs between the content authoring systems and manufacturing and verification equipment used by HD DVD-ROM and 3X-SPEED DVD-ROM disc manufacturing plants.

1.1 Scope

This is document describes the Disc Description Protocol (DDP ®) in its use for transferring content from HD DVD-ROM or 3X-SPEED DVD-ROM content authoring systems. The DDP® 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.

DDP 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.

1.1.1 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

1.2 Definitions

1.2.1 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.

1.2.2 Physical Disc Formatter

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

1.2.3 Copy Protection Processing

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

1.2.4 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.

1.2.5 DDP File

A file named DDPID. This file contains the DDP packets and serves as the catalog of all other files in the DDP system.

1.2.6 DDP File Set

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

1.2.7 DDP Set

Another term for a DDP File Set

1.2.8 DDP Support Files

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

1.2.9 DDP 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 DDP Packets: DDPID Packets and DDPMS Packets.

1.2.10 DDPID Packet

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

1.2.11 DDPMS Packet

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

1.2.12 HD DVD-ROM

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

1.2.13 3X-SPEED DVD-ROM

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

1.2.14 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.

1.2.15 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.

1.2.16 Source Media

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

1.2.17 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.

1.2.18 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.

1.2.19 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. Examples of this type of media includes tape media such as DLT, LTO Ultrium, etc.

1.2.20 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.

1.2.21 Volume Set

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

1.2.22 Media Volume Set

Another term for Volume Set.

1.2.23 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 DDP File Set.

1.2.24 Volume

Another term for Media Volume.

1.2.25 HD DVD

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

1.2.26 Laser Beam Recorder

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

1.2.27 LBR

An abbreviation for Laser Beam Recorder.

1.2.28 HD DVD Replication Plant

A manufacturing company that manufactures HD DVD Discs

1.2.29 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.

1.2.30 HD DVD Replicas

The end product of the production of HD DVD.

1.2.31 HD DVD Physical Formatter

The piece of equipment used by the HD DVD Replication Plant to create the modulated signal of the HD DVD Disc.

1.3 Notations

1.3.1 Binary Numbers

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

1.3.2 Decimal Numbers

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

1.3.3 Hexadecimal numbers

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

1.3.4 Character strings

All Character strings in this specification shall be identified by a leading and trailing single quote (i.e. 'DDP 3.00')

1.3.5 List of acronyms

DDP – Disc Description Protocol
DDPID – DDP ID Packet
DDPMS – DDP Map Stream Packet
HD DVD-ROM – High Density DVD-ROM (or possibly High Definition DVD-ROM)
3X-SPEED DVD-ROM -
HD DVD – Abbreviation for HD DVD-ROM and 3X SPEED DVD-ROM.
LBR – Laser Beam Recorder

1.4 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)

'b64' – ASCII text containing a base64 representation of a hexadecimal number. Right justified and padded with ASCII zeros (30h). If the field does not contain a value, then it should be filled in with ASCII spaces (20h).

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.

1.2 mm
0.6 mm
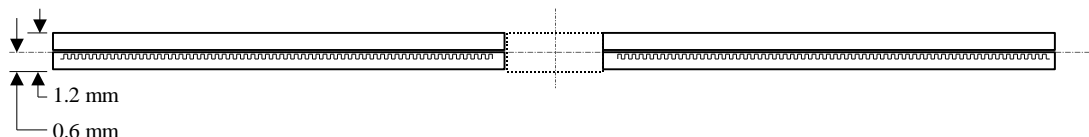
Figure 1 HD DVD Cross Section

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.
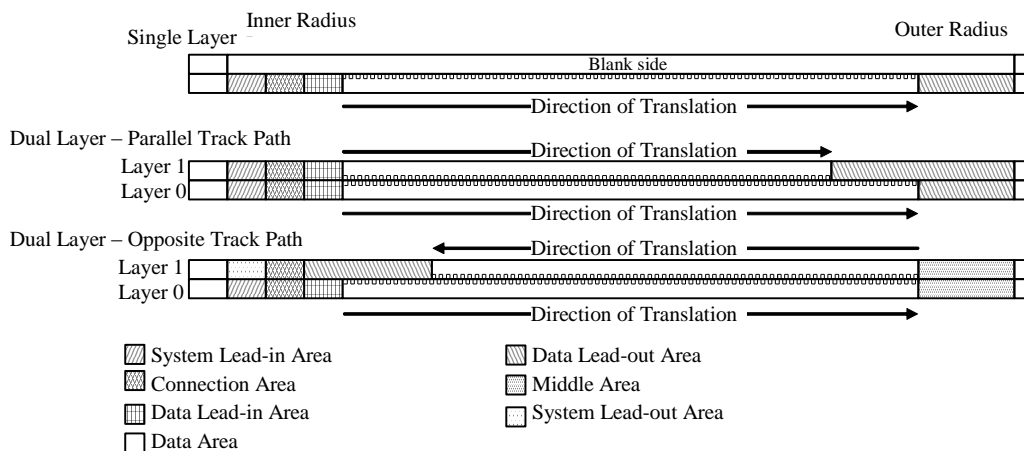
Figure 2 HD DVD-ROM Disc formats
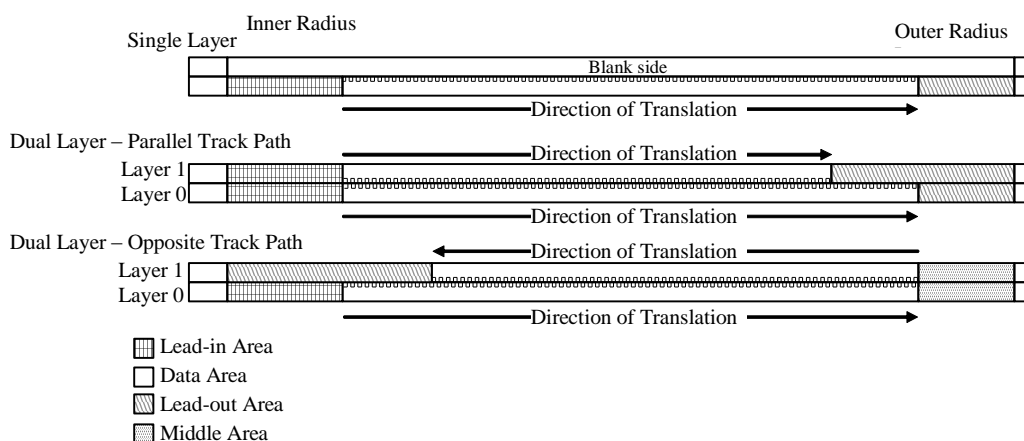
Figure 3 3X-SPEED DVD-ROM Disc formats
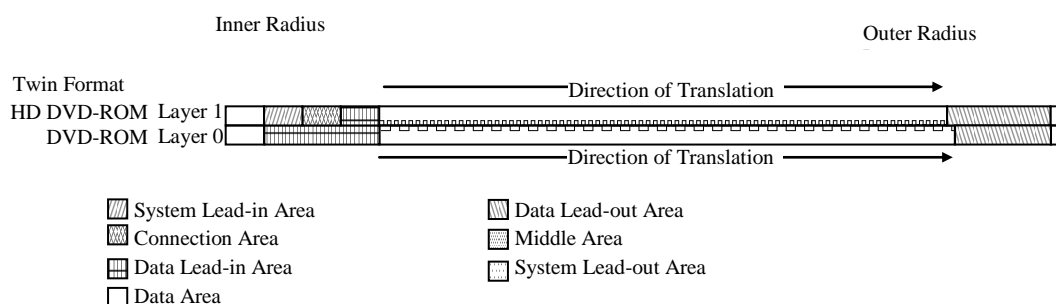
Figure 4 Twin Format Disc format

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 DDP 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.
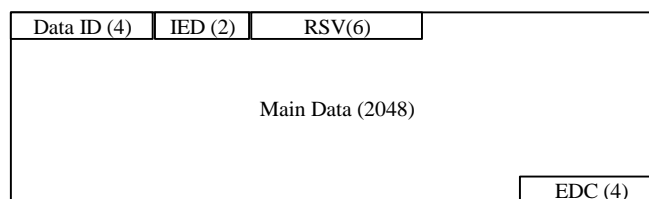
Figure 5 HD DVD Sector format

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

3. DDP 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 DDP 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. If both layers are present it is allowed that they be placed in the same file and referenced by two DDPMS packets. However if AACS copy protection is to be applied to the HD DVD, then both layers MUST be present in the same DDP Set Except as noted, a Twin Format Disc will be treated as a Single Layer Disc.

3.1 DDP File

The DDP 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 DDPID packet, and at least one DDPMS packet for each additional file on the media. The DDPMS packets are used to point to other files on the media. DDP stands for the Disc Description Protocol developed by Doug Carson and Associates as a means of defining input media used for optical discs[i]. The DDP file shall have the name DDPID.

3.2 DDP Packets

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

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

Figure 6 DDP Packets

3.3 DDP File and Packet Order

The packets can be in any order so long as the DDPID packet is the first packet and the DDPMS packet that describes the HD DVD Image File is the last packet. In the case of sequential access media such as DLT tape, the files pointed to by the DDPMS packets must be in the same order as the DDPMS packets in the DDP file. An example of correct order is shown in Figure 7.
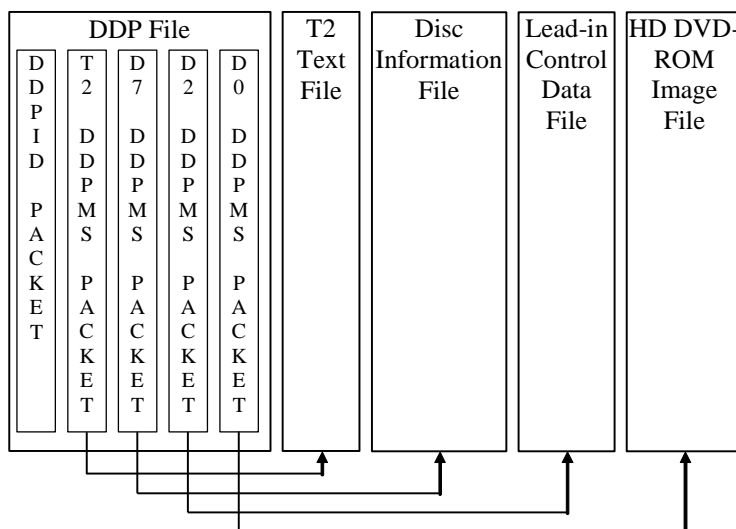
Figure 7 An Example of Correct File Order

An example of incorrect file order is shown in Figure 8.
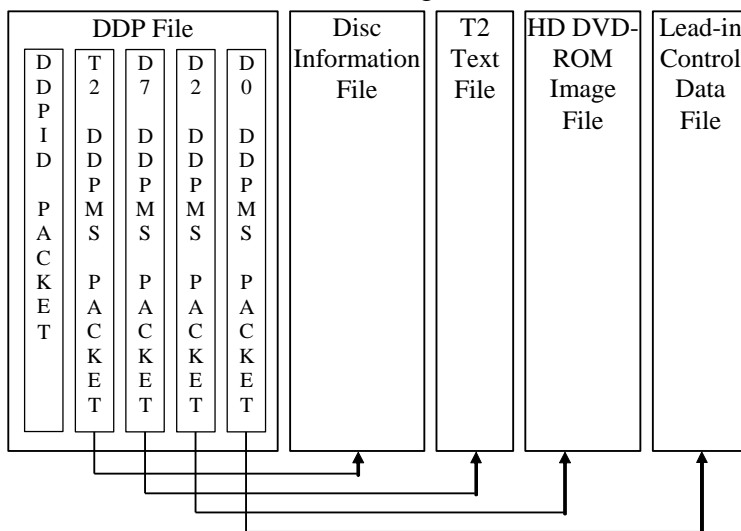
Figure 8 An Example of Incorrect File Order

In Figure 8, the DDPMS packets are in the correct order. However the files that they reference are not in the same order. While this is acceptable on disk file system oriented media such as a network, it is not correct when the data is stored on sequential access media such as tape.

An example of incorrect DDPMS packet order is shown in Figure 9.
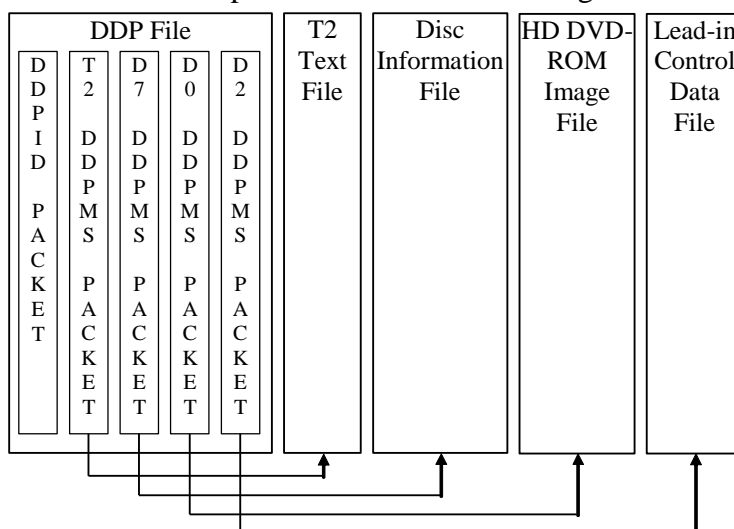
Figure 9 An Example of Incorrect Packet Order

In Figure 9, the DDPMS packets are in the same order as the files in which they reference. However in this case the HD DVD Image File DDPMS packet is not the last packet and the files are not in the correct order. In this example, if the media is sequential access, the Lead-in Control Data File cannot be accessed without first having the tape drive read or skip past the very large HD DVD Image File.

3.4 DDPID Packet Contents

The DDP File is composed of several packets of 128 bytes each. The first packet is the DDPID packet. It contains information that describes the overall HD DVD image. Figure 10 below shows the contents of the DDPID packet.

Byte	Length	Symbol	Name
0-7	8	DDPID	DDP level Identifier
8-36	29	-	Reserved
37	1	MED	Media Number
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 10 DDPID Packet Contents

3.4.1 DDPID

Definition: This field is the DDP level Identifier. It contains both the DDP identifier and
          the DDP level number. The current DDP level is 3.00.
Byte: 0-7
Length: 8
Usage: 'f' type field containing 'DDP 3.00' (44h 44h 50h 20h 33h 2Eh 30h 30h)

3.4.2 Reserved

Definition: Reserved.
Byte: 8-36
Length: 29
Usage: 'f' type field
          ' ' (20h) = ASCII spaces

3.4.3 MED

Definition: This field is used when the DDP File Set spans multiple Volumes. It identifies
          which volume of the volume set that the current DDPID file is located.
Byte: 37
Length: 1
Usage: 'h' type field or ASCII space if DDP File Set is placed on a single media.

3.4.4 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

3.4.5 Reserved

Definition: Reserved.
Byte: 86
Length: 1
Usage: 'f' type field
          ' ' (20h) = ASCII spaces

3.4.6 TYPE

Definition: This field contains the type of the disc being described by the DDP 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

3.4.7 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 DDP File Set
      '1' (31h) = the final disc will have one readable side
      '2' (32h) = the final disc will have two readable sides

3.4.8 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 DDP File Set
      '0' (30h) = side A
      '1' (31h) = side B

3.4.9 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
        DDP 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
      '4' (34h) = the final disc will have four readable layers

3.4.10 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 DDP 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 DDP File Set

3.4.11 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 DDP for each layer, this field must contain the same value
for the DDP 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

3.4.12 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

3.4.13 Reserved

Definition: Reserved
Byte: 95-127
Length: 33
Usage: 'f' type field
   ' ' (20h) = ASCII spaces

3.5 DDPMS Packet Contents

After the DDPID packet are two or more DDPMS packets. The DDPMS packets are used to identify other files on the input media. Each DDPMS packet contains pointers and other information about data and other files. There is one DDPMS packet for each file present other than the DDP file. DDPMS packets are stored in the order in which the data is to be stored on the HD DVD disc. Figure 11 below shows the contents of the DDPMS 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	MED	Media Number
44	1	LAYER	Layer
45-61	17	DSI	Data stream identifier
62-73	12	OFS	Offset
74-101	28	CHK	Hash Checks Sum
102-127	26	RES3	Reserved

Figure 11 DDPMS 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 DDPMS 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 DDPMS packet and therefore the type of file being pointed to by the DDPMS 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 DDPMS starts. The DSPFMT field in the
current DDPMS 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. For HD DVD-ROM and the HD DVD
Layer of Twin Disc Format, the number of sectors for the Control Data Zone is 32.
For 3X-SPEED DVD-ROM, the number of sectors for the Control Data Zone is 16.
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 DDPMS 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 DDPMS 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 DDPMS packet) for a Layer 1 OTP that
starting at FCEFF0h.
' ' (20h) = used only when DST is 'D7' or 'T2'

3.5.6 RES2

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 MED

Definition: This field is used when the DDP File Set spans multiple Volumes. It identifies
    which Volume of a Volume Set that the file being defined by the current DDPMS
    packet.

Byte: 43

Length: 1

Usage: 'h' type field or ASCII space if DDP File Set is placed on a single media.

3.5.12 LAYER

Definition: This field identifies the layer that the file being described by the current
    DDPMS 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 DDPMS
    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 OFS

Definition: This field is the Offset Field (OFS). This field is used to specify the byte offset
    in the file being defined by the current DDPMS packet that the data actually starts.

Byte: 62-73

Length: 12

Usage: 'n' type field

3.5.15 CHK

Definition: Hash Checksum of the file contents. This checksum is computed with a SHA1 Hash and then encoded in a base64 notation before being placed in this field. The use of this field is optional. If this field is not used, then it should be filled in with ASCII spaces (20h).
Byte: 74-101
Length: 28
Usage: 'b64' type field
      ' ' (20h) = ASCII spaces

3.5.16 RES3

Definition: Reserved
Byte: 102-127
Length: 26
Usage: 'f' type field
      ' ' (20h) = ASCII spaces

3.6 File Names

The DDP file must have the file name ***DDPID***. The names of the files that the DDPMS packets reference are suggested to be those described in Figure 12.

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 12 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 DDPMS packets need to match with the actual file names on the media. Therefore any alphabetic characters used in the file names in the DDPMS packets must also be upper case. Figure 13 identifies the valid characters for file names[ii].

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 13 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 DDP file, the DISCINFO.XML file, the CONTROL.DAT file, and at least one IMAGE.DAT file. Figure 14 shows the required files.

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

Figure 14 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

5. Disc Information File

The Disc Information file is an XML file used for processing the disc image. It is composed of one Disc Parameter Information Section followed by zero or more Copy Protection Information Sections.

The layout of the Disc Information File is shown in Appendix A − XML Elements in Disc Information File.

For AACS copy protection the Copy Protection Encryption System will parse the UDF 2.50 File System and parse the High Definition Video System to pick up on what will be encrypted, and how it is to be encrypted. For example, for Standard Content, the EVOBUs will be referenced to find the Usage Rule that describes how the EVOBU is to be protected. Furthermore the EVOBUs will be referenced to find the Title Key in the Title Key File to use. When AACS is to be applied to the Disc Image, the entire information regarding AACS will be placed in the Disc Information file in the CopyProtectionInformation section.

An example of the Disc Information File that would be output from an HD DVD Video Authoring system is shown below.

```
<?xml version="1.0" encoding="UTF-8" ?>
<DiscInformationFile>
        <Revision>DDP 3.00 Revision 1.00</Revision>
        <DiscInformation>
                <DateTime Type="Created">2005-01-01T09:44:35Z</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>100111044812000010021008400011223344556600000000000000000000000000000
                        000000000000000000000000000000000000000000000000000000000000000000000000
                        0000000000000000000</BCA>
                <Title>HDDVDVIDEO</Title>
                <Author>HDDVDVIDEOAUTHOR</Author>
                <CopyrightNotice>VIDOEOWNER</CopyrightNotice>
                <Abstract>EXAPMLE</Abstract>
                <DID>00000001-0001-0001-0001-000000000001</DID>
        </DiscInformation>
        <CopyProtectionInformation Type="AACS">
                <Status>
                        <ProtectionStatus>INCOMPLETE</ProtectionStatus>
                        <Section Type="Advanced Resources">AACS PROTECTED</Section>
                        <Section Type="Enhanced Video Object">OPEN</Section>
                        <Section Type="Title Key Files">OPEN</Section>
```

```
                <Section Type="Title Usage Files">OPEN</Section>
                <Section Type="Segment Key File">OPEN</Section>
                <Section Type="Directory Key File">OPEN</Section>
                <CHT1>EMPTY</CHT1>
                <CHT2>PARTIAL</CHT2>
                <CC>EMPTY</CC>
        </Status>
        <Key Type="VolumeID">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
        <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
        <PMSN Type="DiscUniqueStart">000000000000000000000000000001</PMSN >
        <PMSN Type="DiscUniqueEnd">555555555555555555555555555555</PMSN >
        <ReplacementFile>
                <SourcePath/>
                <DiscImagePath>/AACS/CONTENT_REVOCATION_LIST.AACS
                </DiscImagePath>
        </ReplacementFile>
        <ReplacementFile>
                <SourcePath/>
                <DiscImagePath>/AACS/MKBROM.AACS</DiscImagePath>
        </ReplacementFile>
        <ReplacementFile>
                <SourcePath/>
                <DiscImagePath>/AACS/ 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 but before the CRL and CC have been signed is shown below.

```
<?xml version="1.0" encoding="UTF-8" ?>
<DiscInformationFile>
        <Revision>DDP 3.00 Revision 1.00</Revision>
        <DiscInformation>
```

```
                    <DateTime Type=Created>2005-01-01T09:44:35Z</DateTime>
                    <DateTime Type=Modifed>2005-01-01T10:44:35Z</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
                            00000000000000000000000000000000000000000000000000000000000000000000000
                            0000000000000000000</BCA>
                    <Title>HDDVDVIDEO</Title>
                    <Author>HDDVDVIDEOAUTHOR</Author>
                    <CopyrightNotice>VIDOEOWNER</CopyrightNotice>
                    <Abstract>EXAPMLE</Abstract>
                    <DID>00000001-0001-0001-0001-000000000001</DID>
            </DiscInformation>
            <CopyProtectionInformation Type="AACS">
                    <Status>
                            <ProtectionStatus>INCOMPLETE</ProtectionStatus>
                            <Section Type="Advanced Resources">AACS PROTECTED</Section>
                            <Section Type="Enhanced Video Object"> AACS PROTECTED </Section>
                            <Section Type="Title Key Files">AACS PROTECTED </Section>
                            <Section Type="Title Usage Files"> AACS PROTECTED Section>
                            <Section Type="Segment Key File">AACS PROTECTED</Section>
                            <Section Type="Directory Key File"> AACS PROTECTED </Section>
                            <CHT1>COMPLETE</CHT1>
                            <CHT2>COMPLETE</CHT2>
                            <CC> BEFORE AACS SIGNED </CC>
                    </Status>
                    <Key Type="VolumeID">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                    <Key Type="KCD">112233445566778899AABBCCDDEEFF00</Key>
                    <PMSN Type="DiscUniqueStart">000000000000000000000000000000001</PMSN >
                    <PMSN Type="DiscUniqueEnd">5555555555555555555555555555555</PMSN >
                    <PartialMediaKeyBlock>/Other/PartialMKB.bin</ PartialMediaKeyBlock>
                    <ReplacementFile>
                            <SourcePath/>
                            <DiscImagePath>/AACS/CONTENT_CERT.AACS</DiscImagePath>
                    </ReplacementFile>
                    <ReplacementFile>
                            <SourcePath/>
```

```
                    <DiscImagePath>/AACS/CONTENT_REVOCATION_LIST.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 CC and CRL signing and ready to be sent to the HD DVD-ROM Physical Formatter is shown below.

```
<?xml version="1.0" encoding="UTF-8" ?>
<DiscInformationFile>
        <Revision>DDP 3.00 Revision 1.00</Revision>
        <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>10011104481200001002100840001122334455660000000000000000000000000000000
                        000000000000000000000000000000000000000000000000000000000000000000000000
                        0000000000000000000</BCA>
                <Title>HDDVDVIDEO</Title>
                <Author>HDDVDVIDEOAUTHOR</Author>
                <CopyrightNotice>VIDOEOWNER</CopyrightNotice>
                <Abstract>EXAPMLE</Abstract>
                <DID>00000001-0001-0001-0001-000000000001</DID>
        </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">112233445566778899AABBCCDDEEFF00</Key>
```

```
                <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="TitleKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                <Key Type="SegmentKey">112233445566778899AABBCCDDEEFF00</Key>
                <PMSN Type="DiscUniqueStart">000000000000000000000000000001</PMSN >
                <PMSN Type="DiscUniqueEnd">555555555555555555555555555555</PMSN >
                <PartialMediaKeyBlock>/Other/PartialMKB.bin</PartialMediaKeyBlock>
            </CopyProtectionInformation>
    </DiscInformationFile>
```

Note: When the CC and CRL are not to be signed, then the status should be set to COMPLETE, even when the Section Key for Content Certificate and/or Content Revocation List still is set to OPEN.

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 discffffff. 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 either the *HD-DVD Specifications for Read-Only Disc, Part 1 Physical Specification* or *DVD Specifications for Read-Only Disc (DVD-ROM) Part 1 Optional Specifications (3X-SPEED DVD-ROM)*.

The Lead-in Control Data file can be stored in 2048, 2054, or 2064 byte HD-DVD sectors. Figure 15 identifies the parts of the HD-DVD sectors that are included in these byte sizes.

DDP Source Storage Mode = 0 (2048)

DDP Source Storage Mode = 1 (2054)

DDP Source Storage Mode = 6 (2064 Incomplete)

☐ Data on media, copied onto HD-DVD

☐ Data not on media, will be generated

▨ Data on media, but will be ignored and other data generated in its place

Figure 15 Lead-in Control Data File Sector Sizes

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 '0', '1', and '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. Figure 16 identifies the parts of the HD-DVD that are included in these byte sizes.
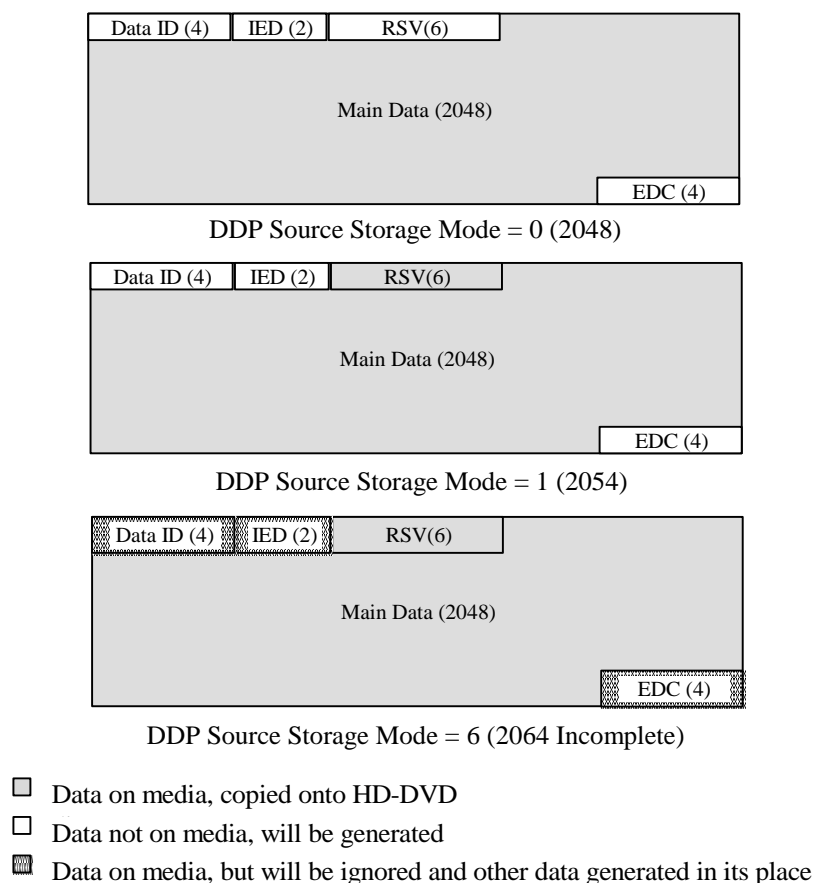
```
┌──────────────────────────────────────────┐
│ Data ID (4) │ IED (2) │  RSV(6)  │        │
│                                           │
│                                           │
│              Main Data (2048)             │
│                                           │
│                              ┌──────────┐ │
│                              │ EDC (4)  │ │
└──────────────────────────────────────────┘
       DDP Source Storage Mode = 0 (2048)
```

```
┌──────────────────────────────────────────┐
│ Data ID (4) │ IED (2) │  RSV(6)  │        │
│                                           │
│                                           │
│              Main Data (2048)             │
│                                           │
│                              ┌──────────┐ │
│                              │ EDC (4)  │ │
└──────────────────────────────────────────┘
       DDP Source Storage Mode = 1 (2054)
```

```
┌──────────────────────────────────────────┐
│ Data ID (4) │ IED (2) │  RSV(6)  │        │
│                                           │
│                                           │
│              Main Data (2048)             │
│                                           │
│                              ┌──────────┐ │
│                              │ EDC (4)  │ │
└──────────────────────────────────────────┘
   DDP Source Storage Mode = 6 (2064 Incomplete)
```

```
┌──────────────────────────────────────────┐
│ Data ID (4) │ IED (2) │  RSV(6)  │        │
│                                           │
│                                           │
│              Main Data (2048)             │
│                                           │
│                              ┌──────────┐ │
│                              │ EDC (4)  │ │
└──────────────────────────────────────────┘
   DDP Source Storage Mode = 7 (2064 Complete)
```

☐ Data on media, copied onto DVD disc

☐ Data not on media, will be generated

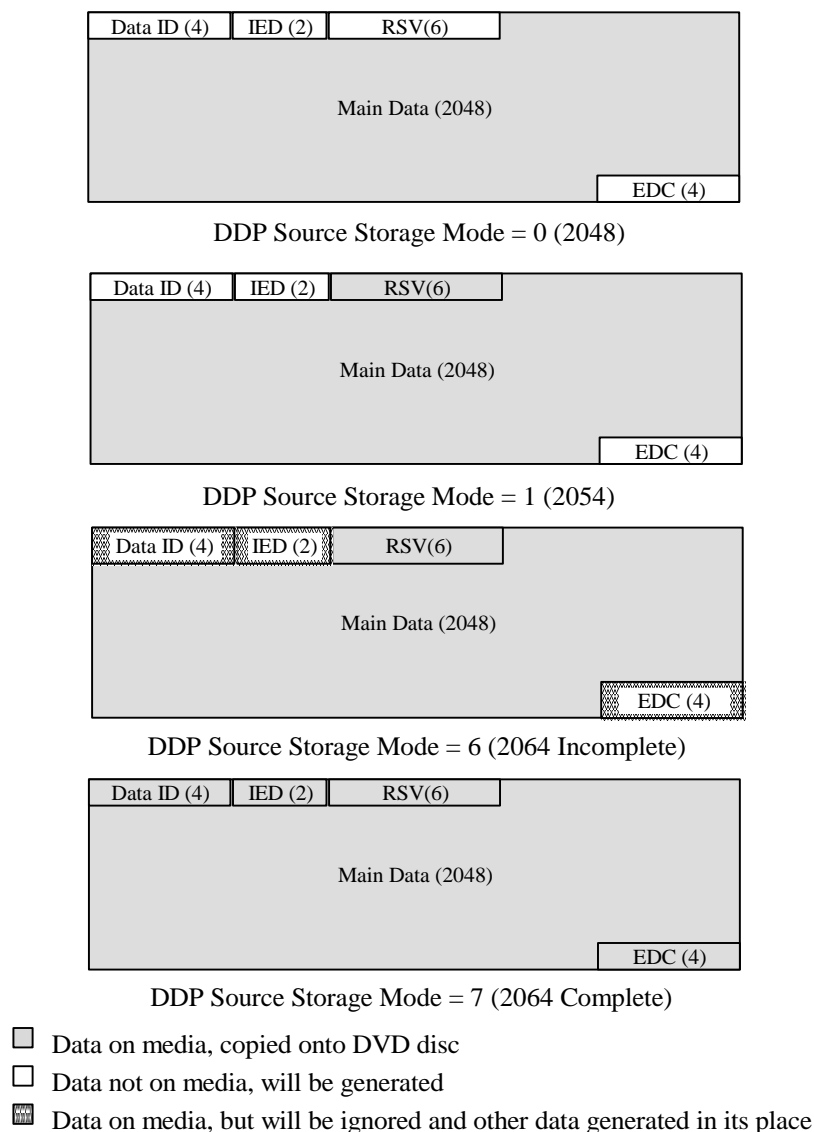▦ Data on media, but will be ignored and other data generated in its place

Figure 16 IMAGE.DAT Sector Sizes

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 '0' and '1' are the only values that are valid for this field.

There may be more than one HD-DVD Image file. Each HD-DVD Image file must have a corresponding DDPMS Packet describing it. The order of the DDPMS 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

ToDO Add complete XML Schema describing Disc Information File.

8.1 DiscInformationFile

Type: Complex
Attributes:
Properties:
Minimum Occurrences: 1
Maximum Occurrences: 1
Children: Revision, DiscInformation, CopyProtectionInformation
Annotation: This element holds all of the Disc Information File content

8.1.1 DiscInformationFile/DiscInformation

Type: Complex
Attributes:
Properties:
Minimum Occurrences: 1
Maximum Occurrences: 1
Facets:
Children: DateTime, NumberLayers, LayerType, Layer, BCA, Title, Author,
        CopyrightNotice, Abstract, DID
Annotation: This element holds all of the physical disc properties

8.1.1.1 DiscInformationFile/DiscInformation/DateTime

Type: xs:dateTime
Attributes: Type=
        Created – Date Time the DDP Set was created
        Modified – Date Time the DDP 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 DDP 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 have 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 only for 3X-Speed DVD-ROM
                                    1 only for HD DVD-ROM
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 of BCA information.

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.

8.1.1.10   DiscInformationFile/DiscInformation/DID

Type: xs:string
Attribute:
Properties:

Minimum Occurrences: 1
Maximum Occurrences: 1
Facets:
Children:
Annotation: This element contains the Disc ID.

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: xs: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, DDP PROTECTED, or AACS PROTECTED enumerations. See Appendix E – 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, DDP PROTECTED, 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 Resources 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, DDP PROTECTED, or AACS PROTECTED enumerations. 'If the element has a value of OPEN or DDP PROTECTED, 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, DDP PROTECTED, 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, DDP PROTECTED, 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, DDP PROTECTED, 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 nor signed
> DDP PROTECTED – Indicates that the file(s) are encrypted using DDP Protocol. This encryption is only used for transport to the Disc Manufacturer.
> AACS PROTECTED – Indicates that the file(s) are encrypted (or signed) 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 F – 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
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 F – 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
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 F – 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.

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 F – 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 E – AACS Considerations for the detailed 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 DDP is describing the content as generated by Authoring.
> 3 – when DDP 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 DDP
     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 DDP
     file sets if Sequence Key is used. The element with KCD attribute is required for
     DDP 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, DDP PROTECTED, 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, DDP PROTECTED, 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. DDP 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 DDP is describing the content as generated by
                         Authoring.
                      1 – when DDP 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
          DDPID file is found.

8.1.2.5 DiscInformationFile/CopyProtectionInformation/ReplacementFile

Type: xs: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 DDPID 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 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)

8.1.3 DiscInformationFile/Revision

Type: xs:string
Attribute:
Properties:
Minimum Occurrences: 1
Maximum Occurrences: 1
Facets:
Children:
Annotation: This element specifies the DDP spec and revision that the Disc Information XML file complies. The contents of this element are

DDP *v.vv* Revision *r.rrs*

Where
        v.vv is the DDP Specification Level as found in the Level field of the
                DDPID file
        r.rr is the Revsion number of the DDP Specification
        s is a suffix (if needed) to the Revision number.

For this draft of the DDP specification, the value should be

DDP 3.00 Revision 1.00

9. Appendix B - Media Specific Requirements

This section describes the requirements for placing a DDP 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 DDPMS packets must be filled in with the correct name of the file that the DDPMS 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 DDPMS packet is used to point to the first block on the media of the file being described by the DDPMS packet.

9.3 Non Streaming Sequential Access Media

Non Streaming Sequential Access media is basically computer accessible tape media such as DLT, etc. This media will not be used for DDP 3.00 for HD DVD.

9.4 Streaming Sequential Access Media

Streaming Sequential Access media is not a usable type of media for storing DDP 3.00 images.

9.5 Images that Span Multiple Volumes

When the media being used is a File Based Media and the DDP File Set is too large to fit onto one Media Volume, it may span multiple volumes. However, the rules and limitations defined below must be followed.

1. Each Volume must contain a complete DDPID file that describes the entire Volume Set.
2. The MED field in the DDPID packet in each DDP File must identify the Volume sequence in the Volume Set of the Media Volume that the DDPID file is located.
3. The MED field in each DDPMS packet in the DDPID file must identify the Volume in the Volume Set that the file being described is located.
4. Files that are too large to fit on a single volume must be broken up into smaller files with each file being described by its own DDPMS packet in the DDP file.
5. The number sequence of the two MED fields shall be hexadecimal numbering from '0' (30h) to 'F' (46h).

9.5.1 Examples

For example, suppose an HD DVD Disc image of 30GB DL/OTP will be stored in a DDP Set.

If the Disc Image is stored in two files on an HDD the DDP Set would look like

        DDPID File
                DDPID Packet
                DDPMS Packet (describes LiControl File)
                DDPMS Packet (describes DiscInformation File)
                DDPMS Packet (describes first DiscImage File)
                DDPMS Packet (describes second DiscImage File)
      LiControl File (32 sectors)
      DiscInformationFile
      First Disc Image File containing Layer 0 (5,824,224 sectors)
      Second Disc Image File containing Layer 1 (5,824,213 sectors)

When copied to a series of 4 Dual Layer DVD-Rs the Disc Image file (IMAGE.DAT) would be broken up into 4 files.

The resulting the DDP Set would look like

      DVD–R 1st MEDIA
            DDPID File
                DDPID Packet (MED=0)
                DDPMS Packet (describes LiControl File (MED=0))
                DDPMS Packet (describes DiscInformation File (MED=0))
                DDPMS Packet (describes first DiscImage File (MED=0))
                DDPMS Packet (describes second DiscImage File(MED=1))
                DDPMS Packet (describes third DiscImage File(MED=2))
                DDPMS Packet (describes fourth DiscImage File(MED=3))
            LiControl File
            DiscInformationFile
            First Disc Image File containing first half Layer 0 (2,912,112 sectors)

      DVD–R 2nd MEDIA
            DDPID File
                DDPID Packet (MED=1)
                DDPMS Packet (describes LiControl File (MED=0))
                DDPMS Packet (describes DiscInformation File (MED=0))
                DDPMS Packet (describes first DiscImage File (MED=0))
                DDPMS Packet (describes second DiscImage File(MED=1))
                DDPMS Packet (describes third DiscImage File(MED=2))
                DDPMS Packet (describes fourth DiscImage File(MED=3))
            Second Disc Image File containing second half Layer 0 (2,912,112 sectors)

      DVD–R 3rd MEDIA
            DDPID File
                DDPID Packet (MED=2)
                DDPMS Packet (describes LiControl File (MED=0))

         DDPMS Packet (describes DiscInformation File (MED=0))
         DDPMS Packet (describes first DiscImage File (MED=0))
         DDPMS Packet (describes second DiscImage File(MED=1))
         DDPMS Packet (describes third DiscImage File(MED=2))
         DDPMS Packet (describes fourth DiscImage File(MED=3))
   Third Disc Image File containing first half Layer 1 (2,912,112 sectors)

 DVD–R 4th MEDIA
     DDPID File
         DDPID Packet (MED=3)
         DDPMS Packet (describes LiControl File (MED=0))
         DDPMS Packet (describes DiscInformation File (MED=0))
         DDPMS Packet (describes first DiscImage File (MED=0))
         DDPMS Packet (describes second DiscImage File(MED=1))
         DDPMS Packet (describes third DiscImage File(MED=2))
         DDPMS Packet (describes fourth DiscImage File(MED=3))
   Fourth Disc Image File containing second half Layer 1 (2,912,101
       sectors)

10. Appendix C – Dual Layer Images

When Dual Layer images are stored in one DDP Set, the HD DVD Image can be stored in one or more files. Each file will be described by one DDPMS packet. However when one file contains sectors of more than one layer, then that file will have a DDPMS packet that describes the location of the first sector in the file of each layer. For example, when a file contains sectors of two layers, there will be one DDPMS packet that points to the first sector in the file and a second DDPMS packet that points to the first sector of the second layer in the file.

For example, assume that the HD DVD Disc Image file contains a Dual Layer (Opposite Track Path) image of 11,648,437 sectors (2048 byte sector format) with 5,824,224 sectors in Layer 0 and 5,824,213 sectors in Layer 1. There will be two DDPMS packets that describe the file. The significant information in each DDPMS packet is shown below.

Symbol	Name
MPV	VVVM
DST	D0
DSP	
DSL	5824224
DSS	030000
RES1	
CDM	DV
SSM	0
SCR	0
DSPVALUE	
MED	
LAYER	0
DSI	IMAGE.DAT
OFS	0
RES3	

Figure 17 DDPMS contents for Layer 0

Figure 17 shows a DDPMS packet that describes Layer 0 when a Dual Layer OTP HD DVD Image is stored in one file.

The DSL field contains only the number of sectors of Layer 0 stored in the file.
The DSS field contains the Physical Sector Number of the on the HD DVD Disc that the first sector of Layer 0 is stored.

Symbol	Name
MPV	Map packet valid
DST	D0
DSP	
DSL	5824213
DSS	A4211F
RES1	
CDM	DV
SSM	0
SCR	0
DSPVALUE	
MED	
LAYER	1
DSI	IMAGE.DAT
OFS	11928010752
RES3	

Figure 18 DDPMS contents for Layer 1

Figure 18 shows a DDPMS packet that describes Layer 1 when a Dual Layer OTP HD DVD Image is stored in one file.

The DSL field contains only the number of sectors of Layer 1 stored in the file.
The DSS field contains the Physical Sector Number of the on the HD DVD Disc that the first sector of Layer 1 is stored.

11. Appendix D – Twin Format

A Twin Format disc consists of Layer 0 contain Standard Density DVD and Layer 1 containing High Density DVD. In the case of a Twin Format disc, the contents of the Standard Density Layer will be specified by another DDP Specification (e.g. DDP 2.xx) while the contents of the High Density Layer will be specified by this specification.

12. Appendix E – 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 .

12.1 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 not 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 discs, 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 creating the Disc Information File without any Key elements with the Title Key attribute. In this case the Section element with the Title Key Files attribute must be PARTIAL.

NOTE: Conditions 1 and 2 are not mutually exclusively and it is possible that an HD DVD-Video may contain all both conditions.

12.2 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.

12.3 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 recommend 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.

13. Appendix F – 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			
		Reserved			
	Title Key Entry (#1 - #64)	BIFO for Title Key			
		Reserved			
		Encrypted Title Key	Filled with 00h	Filled with unencrypted Title Key	
		Binding MAC	Completed	Completed	
	Reserved				
	TKF MAC		Filled with 00h	Filled with 00h	

Figure 19 Field conditions for 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		
	Usage Rule Set (#1 - #N)	URS_VERSION		
		URS_SIZE		
		UR_NUM (M)		
		Usage Rule #1 - #M	UR_ID		
			UR_TYPE		
			UR_SIZE		
			UR_BODY		
	BURS #1- #N	BIDO		
		Binding MAC		
	TUF MAC		Filled with 00h	

Figure 20 Field conditions for Title Usage File

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

Figure 21 Field conditions for Content Certificate

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

Figure 22 Field conditions for Content Hash Table #1

	Status	EMPTY	PARTIAL	COMPLETE
Content Hash Table #2	Hash of DISCID.DAT	Filled with 00h	Filled with 00h	Complete
	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)		Complete	
	Hash if ANF #1 - #NHA			

Figure 23 Field conditions for Content Hash Table #2

	Status	OPEN	AACS PROTECTED
Directory Key File	DKF_ID	Completed	Complete
	HD_VDKF_SIZE		
	Reserved		
	VERN		
	Reserved		
	Encrypted Directory Key	Filled with unencrypted Directory Key	

Figure 24 Field conditions for Directory Key File

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

Figure 25 Field conditions for Segment Key File

Status			OPEN	AACS PROTECTED
Enhanced Video Object	P-EVOB of Standard Content	CPI	Completed	Complete
		PES scrambling control		
		Pac Encryption	Undone	
		Hash calculation		
	P-EVOB of Advanced Content	CPI	Completed	
		PES scrambling control		
		Pac Encryption	Undone	
		Hash calculation		
		ARF in Advanced Stream	Same as condition of ARF	
		S-EVOB in Advanced Stream	Same as condition of S-EVOB of Advanced Content	
	S-EVOB of Advanced Content	CPI	Completed	
		PES scrambling control		
		Pac Encryption	Undone	
		Hash calculation		

Figure 26 Field conditions for Enhanced Video Object

Status				OPEN	AACS PROTECTED
Advanced Resources	ARF excluding Archiving Data	Encapsulation for Encryption	FILE_ID	Completed	Complete
			Protection Type		
			Reserved		
			TITLE_KEY_PTR		
			Resource File Size		
			Encrypted Data	Filled with unencrypted Resource Data	
		Encapsulation for Encryption and Hash	FILE_ID	Completed	
			Protection Type		
			Reserved		
			TITLE_KEY_PTR		
			Resource File Size		
			Encrypted Data	Filled with unencrypted Resource 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 Resource of Data	Filled with 00h	
		Encapsulation for Hash	FILE_ID	Completed	
			Protection Type		
			Reserved		
			Resource File Size		
			Resource File Name		
			Resource Data		
			Hash Pointer		
		Encapsulation for Non Protected Advanced Element	FILE_ID	Completed	
			Protection Type		
			Reserved		
			TITLE_KEY_PTR		
			Resource File Size		
			Resource File Name	Filled with unencrypted 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 27 Field conditions for Advanced Resources

| MKBROM.AACS
MKBRECORDABLE.AACS
CONTENT_REVOCATION_LIST.AACS
SKB.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. Otherwise, the file is filled with the specific data provided by AACS and remaining fields are filled with 00h. Note that 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 28 Field conditions of other components

End Notes

[i] DDP® Available from Doug Carson and Associates, 1515 E Pine St, Cushing, OK. 74023, USA

[ii] The character '.' (2Eh) can be used only to separate the 8 character file name from the 3 character extension.