



MultiRead2

**Read Compatibility Specifications
for
DVD-ROM and 2.6 GB DVD-RAM Devices**

Revision 1.0

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ABSTRACT

This specification defines the read-compatibility requirements for a MultiRead2 compliant device. The applicable clauses of the specification containing the word “**shall**” are the requirements to be MultiRead2 compliant. The Annexes are part of this document but are not required for compliance.

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Purpose

The purpose of this document is to specify the read- and/or play-compatibility requirements of a MultiRead2 compliant device working with computer operating systems. It is intended as a specification for CD and DVD drive manufacturers, personal computer manufacturers and operating system software developers. MultiRead2 defines the requirements that must be met for a drive to read all of the following types of media: DVD-Video, DVD-ROM, and DVD-RAM, as well as media defined under the MultiRead specification.

Developers of CD discs and drive products have Red, Yellow, and Orange Books and other related documents. Developers of DVD discs and drive products have separate books, too. However, PC manufacturers and software developers normally do not have these documents. This document is provided to help alleviate the need to purchase these specifications in order to specify MultiRead2 compatibility requirements. Additionally, many producers of CD-ROM and DVD-ROM devices have requested guidance and clarification of the MultiRead2 compatibility requirements as a summary of the many specifications available. These companies have provided their expert advice. A number of very important ideas resulting from that advice have been included within this specification.

This specification describes the complete device requirements of the MultiRead2 Specification. It covers logical and physical requirements for a MultiRead2 device.

Related Documents

Other industry standards and specifications were reviewed and consulted in the development of this specification. They are directly related to CD-DA, CD-ROM, CD-R, CD-RW, DVD-ROM, DVD-Video, DVD-Audio, and DVD-RAM devices as well as OSTA's MultiRead document. These documents include:

ANSI X3.304-1997	Information Technology – SCSI – 3 Multimedia Commands (MMC)
SFF 8020i	ATA Packet Interface for CD-ROMs, Version 2.6 or higher
SFF 8080	ATA Packet Interface for CD-R/RW Devices, Version 1.2 or higher
SFF 8090i	ATA Packet Interface for DVD-ROM, Version 1.00 or higher
IEC 60908 Ed.2.0 b.1999	Audio Recording – Compact disc digital audio system
ISO 9660:1988	Information Processing - Volume and File Structure of CD-ROM for Information Interchange
ISO/IEC 10149:1995	Information Technology - Data Interchange on read-only 120mm optical data discs (CD-ROM)
ISO/IEC 13346:1995	Information Technology: volume and file structure of write-Once and rewritable media using Non-Sequential Recording for Information Interchange (note: there are 5 parts)
Multisession Compact Disc	Multisession for CD-ROM and CD-R discs, Version 1.0 or higher
Orange Book Part-II	Recordable Compact Disc System Part-II, Philips and Sony Corp., Version 2.0 or higher
Orange Book Part-III	ReWritable Compact Disc System Part-III, Philips and Sony Corp., Version 1.0 or higher
OSTA UDF	OSTA Universal Disc Format, including support for CD-ROM, CD-R and CD-R/RW and DVD-ROM devices, Version 1.5 or higher. (note: OSTA UDF is also called UDF)
ECMA-267	120 mm DVD-Read-Only Disc
ECMA-268	80 mm DVD-Read-Only Disc
ECMA-272	120 mm DVD Rewritable Disc
ISO/IEC 16448:1999	120 mm DVD-Read-Only Disc
ISO/IEC 16449:1999	80 mm DVD-Read-Only Disc
ISO/IEC 16824:1999	120 mm DVD Rewritable Disc (DVD-RAM)
ISO/IEC 16825:1999	120 mm DVD Rewritable Disc Cartridge (DVD-RAM case)
MultiRead	OSTA MultiRead Specifications for CD-ROM, CD-R CD-R/RW and DVD-ROM Devices, Version 1.11 or higher

Note: Additional documents and information is available from www.ECMA.ch and www.JTC1.org and SFF (<ftp://fission.dt.wdc.com/pub/standards/sff/specs>).

Computer Terminology

Digital Versatile Disc (DVD) - Generic class of devices based on 120mm discs, using 8 to 16 Modulation, having a track pitch of 0.74 or 0.80 um, with a multiple gigabyte capacity.

Dolby Digital - A coding system for audio. It is the most common means of encoding audio for DVD-Video.

DVD-Video - A format for storing video on a disc. It is based on MPEG video, Dolby Digital and MPEG audio.

Moving Picture Expert Group (MPEG) - A committee that developed the MPEG family of audio and video compression systems.

MPEG audio - Audio compressed according to the MPEG perceptual encoding system. MPEG-2 audio adds data to provide discrete multi-channel audio.

MPEG video - Video compressed according to the MPEG perceptual encoding system. MPEG-2 video is used for higher-quality video.

MultiRead (MR) – The specification that defines the ability of any compliant drive to read all of the following types of media: CD-DA, CD-ROM, CD-R and CD-RW.

MultiRead2 – The specification that defines the ability of any compliant drive to read all of the following types of media: DVD-Video, DVD-Audio, DVD-ROM, DVD-RAM, as well as those specified by MultiRead.

Universal Disk Format (UDF) - File System developed by OSTA to provide file interchange among different operating systems for optical products.

Terms

May	Indicates an action or feature that is optional.
Optional	Describes a feature that may or may not be implemented. If implemented, the feature shall be implemented as described.
Shall	Indicates an action or feature that is mandatory and must be implemented in a device that is claimed to be in compliance with this specification.
<i>Should</i>	Indicates an action or feature that is optional but its implementation is strongly recommended.
Reserved	A reserved field is reserved for future use and shall be set to zero. A reserved value is reserved for future use and shall not be used.
or higher	Applies to version of standards, specification or documents that include a version number. It implicitly applies to any version number. New versions that conflict with older versions are exceptions that would require an update of this MultiRead2 Specification.
Drive/Device	For the purposes of this document the words “drive” and “device” are used interchangeably.
Versions	Indicates a change to the document that affects a change to the specification.
Revision	Indicates a change to the document that does not affect a change to the specification.
Number	When a number is being addressed as a number, it is written as a decimal. When a number has the letter ‘h’ next to it, it is written as a hexadecimal; the hexadecimal number is preceded by a leading ‘0’ for alignment purposes only. When a number has the letter ‘b’ next to it, it is written as a binary.

Definitions

Certain words and terms used in this specification have a specific meaning beyond their normal English meaning. These words and terms are defined either in this section, in Terms above, or in the text where they first appear. The first letter of such words is capitalized while lower case is used for words having their normal English meaning (unless they are proper nouns).

Blank Disc - A disc where only the embossed area is recorded.

Data Zone - A set of physical sectors of user data located after the Lead-in Zone and before the Lead-out Zone on DVD-Video, DVD-Audio, DVD-ROM, and DVD-RAM discs. A data area.

Defect Management - A method to replace ECC blocks or sectors that exceed a defined error threshold to be rewritten to a different (spare) area on a recordable disc that does not exceed this error threshold.

Drive - An active part of a computer system that contains the mechanisms for spinning a disc and moving a read or read-write head over the disc surface. A device.

DVD-ROM drive - A device that can read data on a pre-recorded disc according to the ECMA-267 format.

DVD-RAM drive - A device that can read and/or write and rewrite data on a formatted disc more than once according to the ECMA-272 format.

ECC Block - A set of 16 physical sectors on DVD-Video, DVD-ROM, and DVD-RAM media.

Lead-in Zone - On a DVD, a zone located in the Information Zone directly before the Data Zone. It contains control information.

Lead-out Zone - On a DVD, a zone located in the Information Zone directly after the Data Zone. It allows for a continuous smooth read-out for DVD-ROM.

Logical Sector Number (LSN) - The current or requested DVD-Video, DVD-ROM, or DVD-RAM Sector that is host addressable.

Physical Sector Number (PSN) - The current or requested DVD Sector that is device addressable.

Sector - The smallest addressable unit of information.

Start Position Shift (SPS) - A method used to reduce media wear caused by writing the same channel bit pattern to the same location. The start position is varied by randomly changing the number of bytes in the Guard 1 field.

Sync Frame - An area that consists of a sync code of 32 channel bits and 1456 channel bits of linking data.

Scope

This document defines the MultiRead2 Specification. MultiRead2 is the ability of any drive to read all of the following types of media: CD-DA, CD-ROM, CD-R, CD-RW, DVD-Video, DVD-Audio, DVD-ROM, and DVD-RAM.

A MultiRead2 drive **shall** support the OSTA MultiRead Specification 1.11 or higher. A MultiRead2 drive **shall** support different media reflectivities.

A MultiRead2 drive **shall** be capable of reading all User Data Blocks on CD-ROM, CD-R, and CD-RW media.

A MultiRead2 drive **shall** be capable of reading all sectors in the Data Zone on DVD-ROM and DVD-RAM media.

A MultiRead2 drive **shall** pass the contents of the User Data Blocks or sectors in the Data Zone unmodified to the drive interface.

A MultiRead2 drive **shall** conform to and pass the MultiRead2 Test Plan.

The scope of this document is:

- 1.) To specify requirements to achieve data interchange in a conforming MultiRead2 compliant drive.
- 2.) To define important parameters such that a conforming MultiRead2 compliant drive **shall** be capable of reading all User Data Blocks on CD-ROM, CD-R and CD-RW media.
- 3.) To define important parameters such that a conforming MultiRead2 compliant drive **shall** be capable of reading all sectors in the Data Zone on DVD-Video, DVD-Audio, DVD-ROM, and DVD-RAM media.
- 4.) To require that a conforming MultiRead2 compliant drive **shall** be able to read and play Audio Tracks and CD-DA discs, and DVD-Video discs.

Examples of MultiRead2 Compliance

	MultiRead2
CD-DA Disc	YES
CD-ROM Disc	YES
CD-R Disc	YES
CD-RW Disc	YES
DVD-ROM Disc	YES
DVD-Video Disc	YES
DVD-Audio Disc	YES
DVD-RAM Disc	YES

YES - A MultiRead2 compliant drive **shall** be able to read this media type.

DVD Specifications for MultiRead2 Compliant Devices

1.0 Read-Compatibility Specifications for 2.6 GB DVD-RAM

1.1 Disc-Category Requirement

The layout of the information zone of DVD-ROM and DVD-RAM discs is described in Annex A for reference. Bits 4 to 7 of Byte 0 of the Disc-Category and Version-Number byte, which is recorded in the physical-format information portion of the Control-Data Zone at physical-sector number 02F200h, **shall** be recognized as specified in Table 1.1. (The READ DVD STRUCTURE command (format 0) should be used to read this information. For additional information about the reference command set, refer to SFF8090i and ECMA-272.)

Table 1.1
Disc-Category

	DVD-ROM	DVD-RAM
Version-Number (bits 0 to 3)	0001b	0001b
Disc-Category (bits 4 to 7)	0000b	0001b

1.2 ECC Block Requirement

1.2.1 32 KB ECC Block for DVD-ROM

A MultiRead2 compliant drive **shall** be able to read all ECC Blocks in the Information Zone of DVD-ROM discs.

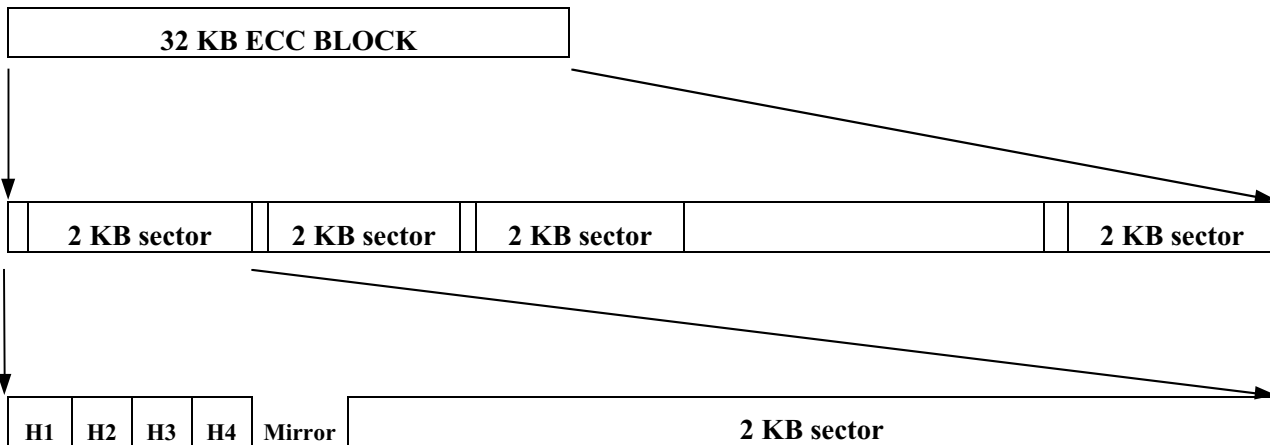
Table 1.2
32 KB ECC Block for DVD-ROM

32 KB ECC BLOCK

1.2.2 32KB ECC Block for DVD-RAM

A MultiRead2 compliant drive **shall** be able to read media written in the DVD-RAM format. Figure 1.1 shows that an ECC Block for DVD-RAM contains 16 sectors of 2KB each, and each sector is preceded by 4-physical Header Fields

Figure 1.1
32KB ECC Block for DVD-RAM



A sector begins with four Headers (H1, H2, H3, and H4, as shown in Figure 1.2). A Header is embossed and comprised of a Variable-Frequency Oscillator (VFO) field, an Address-Mark (AM) field, a Physical Identification Data (PID) field, a P(ID) Error-Detection (PED) field and a Postamble (PA) field. The numbers in the bottom row of Figure 1.2 give the number of bytes of the fields directly above. The first two PIDs are the same and show (for example) the sector number of a following groove sector. The latter two PIDs are the same and differ from the first two PIDs in that they show (for example) the sector number of a following land sector. A field shall have a nominal length of 32 channel bits. The mirror field shall have neither grooves nor embossed marks. There shall be no writing in this field. (ECMA-272; Clause 15.7)

Figure 1.2
Header field layout
(Note: Number of bytes is indicated in the bottom row of table)

Header 1					Header 2					Header 3					Header 4				
VFO 1	AM	PID1	PED 1	PA 1	VFO 2	AM	PID 2	PED 2	PA 2	VFO 1	AM	PID 3	PED 3	PA 1	VFO 2	AM	PID 4	PED 4	PA 2
36	3	4	2	1	8	3	4	2	1	36	3	4	2	1	8	3	4	2	1

The Recording field is shown in Table 1.3. It contains 8 fields and may be either unrecorded or recorded with up to 2,048 user bytes. The nominal length of the Recording field shall be 41 072 Channel bits. It shall consist of a Gap field, a Guard 1 field, a VFO 3 field, a PS field, the Data field, a PA 3 field, a Guard 2 field and a Buffer field. The numbers below the identifier or each field in Table 1.3 indicate the number of 16-Channel bit patterns in each field. The PS (pre-synchronous code) field is intended to allow the drive to achieve byte synchronization for the following Data field. It shall contain the 48-Channel bit pattern 0000 0100 0100 1000 0010 0001 0010 0000 1000 0010 0001 0000.

Table 1.3
Recording Field

Gap	Guard 1	VFO-3	PS	Data	PA3	Guard 2	Buffer
10-J/16	20+K	35	3	2,418	1	55-K	25-J/26

0ϕKϕ7

1.3 Start of User Data Requirement

A MultiRead2 compliant drive **shall** be able to read user data starting at the physical sector number specified in Table 1.4.

Table 1.4
Start of User Data

	DVD-ROM	DVD-RAM
Physical Sector Number	030000h	031000h

1.4 Defect-Management Read Requirement

A MultiRead2 compliant drive **shall** be able to use the Defect-Management Areas (DMAs) according to the methods described in Section 1.4.1 in order to read correct data.

1.4.1 DMA for DVD-RAM

A MultiRead2 compliant drive **shall** be able to read all four duplicate DMAs indicated in Table 1.5 and select the preferable DMA information from them. A MultiRead2 compliant drive **shall** also recognize all slipped and linear-replacement physical sectors in the Data Zone using information provided for these purposes in the DMAs. The Disc-Definition Structure (DDS) contains information that specifies the method by which the disc was formatted. The Primary Defect List (PDL) lists the sector number of defective sectors that were identified when the disc was formatted. The Secondary Defect List (SDL) lists the sector number of the first sector of defective ECC Blocks identified to be defective during use of the disc and the corresponding sector number of the first sector of the spare ECC Block that replace them.

Table 1.5

Locations of the DMAs

	Contents	Starting sector number	Ending sector number	Number of ECC Blocks
DMA 1	DDS PDL SDL	030F80h 030F81h 030F90h	030F80h 030F8Fh 030F9Fh	2
Reserved		030FA0h	030FBFh	2
DMA 2	DDS PDL SDL	030FC0h 030FC1h 030FD0h	030FC0h 030FCFh 030FDFh	2
Reserved		030FE0h	030FFFh	2
DMA 3	DDS PDL SDL	016B480h 016B481h 016B490h	016B480h 016B48Fh 016B49Fh	2
Reserved		016B4A0h	016B4BFh	2
DMA 4	DDS PDL SDL	016B4C0h 016B4C1h 016B4D0h	016B4C0h 016B4CFh 016B4DFh	2
Reserved		016B4E0h	016B4FFh	2

1.4.2 Disc Definition Structure (DDS)

The DDS contains information that specifies the method by which the disc was formatted as shown in the Table 1.6. The Disc-Certification flag and, if necessary, the Group-Certification flag shall be set during the certification process. The most significant bit (In-Progress bit) is set to 1 during certification and reset to 0 when certification is complete. This procedure allows the system to detect the occurrence of a failure during previous formatting involving the certification or other data-writing process.

Table 1.6
Byte assignment of the Disc Definition Structure

Byte position	Contents	Number of byte
0 to 1	DDS Identifier: 00A0Ah	2
2	Reserved	1
3	Disc Certification flag	1
4 to 7	DDS/PDL Update Count	4
8 to 9	Number of Groups	2
10 to 15	Reserved	6
16	Group Certification flag for Group 0	64
17	Group Certification flag for Group 1	
...	...	
39	Group Certification flag for Group 23	
40 to 79	Reserved	
80 to 2048	Reserved	1968

1.4.3 Primary Defect List (PDL)

The Primary Defect List (PDL) lists the sector number of defective sectors that are identified when the disc was formatted or reformatted. Table 1.7 lists information recorded in a PDL. A MultiRead2 compliant drive shall not read any listed sectors (slipped) in the Data Zone. A MultiRead2 compliant drive **shall** be able to read all four PDLs. The DDS/PDL update count can be used to decide which DMA is correct when the four DMAs do not completely agree. In such cases, the DMA that has the largest count is the correct one. Table 1.8 shows a typical PDL entry.

Table 1.7
Contents of the PDL

Byte position	Contents	Number of byte
0 and 1	PDL Identifier: 00001h	2
2 and 3	Number of entries in the PDL	2
4 to 7	The first PDL entry	4
8 to 11	The second PDL entry	4
---	---	---
n to $n+3$	The last PDL entry	4

When the data is read from the sectors of a Group, a defective sector listed in the PDL shall be skipped and the data shall be read from the next data sector according to the Slipping Algorithm. A PDL entry shall specify the Entry type and the Sector number of the corresponding defective sector as shown in Table 1.8. The sector numbers shall be listed in ascending order.

Table 1.8
PDL Entry

Bit 31	30	29	24	23	0
Entry type		Reserved		Defect Sector number	

Note: Entry type is only necessary at the time of a reformat.

1.4.4 Secondary Defect List (SDL)

The SDL lists the sector numbers of the first sectors of defective ECC Blocks that were identified to be defective during use of the disc and the corresponding sector number of the first sector of the spare ECC block that replaces them.

Table 1.9 lists information recorded in an SDL. Table 1.10 shows an SDL entry. A MultiRead2 compliant drive **shall** be able to read the replacement block instead of the defective block if any entry exists in the SDL and the sector number of the first sector in the replacement block is other than 00000h. A MultiRead2 compliant drive shall read all four SDLs. The DDS/PDL update count and SKC update count can be used to decide which SKC is correct when the four DMA do not completely coincide. In such cases, the SDL that has the largest SDL update count of which has the largest DDS/PDL update count is the correct one. The sector numbers of the first sector of the defective Blocks shall be listed in ascending order. FRM is a one-bit flag which shows, when 0, that a replacement block is assigned and that the replacement block is not defective. When FRM is 1, a replacement block is not assigned or the replacement block is defective. When a replacement block is assigned, it shall be used, even if defective. If a data block to be read is listed in the SDL with either an FRM set to ZERO or ONE, and the sector number of the first sector in the replacement block is other than 00000h, the data shall be read from a replacement block in the spare area pointed by the SDL according to the Linear Replacement Algorithm. If a data block to be read is listed in the SDL with Forced Reassignment Marking set to ONE, and the sector number of the first sector in the replacement block is 00000h, the data shall be read from the data block.

Table 1.9
Contents of the SDL

Byte position	Contents	Number of byte
0 and 1	SDL Identifier: 00002h	2
2 and 3	Reserved	2
4 to 7	SDL Update Count	4
8 to 15	Spare Area Full flags	8
16 to 19	DDS/PDL Update Count	4
20 and 21	Reserved	2
22 and 23	Number of entries in SDL	2
24 to 31	The first SDL entry	8
---	---	
m to $m+7$	The last SDL entry	8

Table 1.10
SDL Entry

Bit 63	62	56	55	32	31	24	23	0
FRM	Reserved		Physical-sector number of the first sector in the defective block			Reserved		Sector number of the first sector in the replacement ECC Block

1.5 Lead-in and Lead-out Initialization

1.5.1 Lead-in Initialization

A conforming MultiRead2 drive **shall** read control data zone and defect-management area and *should* read all ECC Blocks in the Lead-in Zone for DVD-ROM and DVD-RAM media.

1.5.2 Lead-out Initialization

A conforming MultiRead2 drive **shall** read defect-management area and *should* read all ECC Blocks in the Lead-out Zone for DVD-ROM and DVD-RAM media.

1.6 Requirements for Support of Use of Type 2 Cartridge

A MultiRead2 compliant drive **shall** be able to read bare DVD-RAM discs. Refer to Annex D for additional information.

1.7 MultiRead2 Test Requirements

The MultiRead2 test requirements for the MultiRead2 Specification are very precise. A separate document contains the MultiRead2 Test Plan. These test requirements apply only to the actions or features in the MultiRead2 Specification that is indicated by the word “**shall**”.

Annex A - Layout of the Information Zone of DVD-ROM disc and DVD-RAM disc

A.1 Layout of the Information Zone

	Starting Sector Number of DVD-ROM disc	Starting Sector Number of DVD-RAM disc
Lead-in Zone (Embossed Area)		
Initial Zone (22.6 mm)		027AB0h
Reference Code Zone	02F000h	02F000h
Buffer Zone 1	02F020h	02F010h
Control Data Zone	02F200h	02F200h
Buffer Zone 2	02FE00h	02FE00h
Connection Zone	NA	Mirror
Lead-in Zone (Rewritable Area)	NA	24.0 mm
Guard Track Zone 1	NA	030000h
Disc Test Zone	NA	030200h
Drive Test Zone	NA	030600h
Guard Track Zone 2	NA	000D00h
Reserved Zone	NA	030F00h
DMA 1 and DMA 2 Zone	NA	030F80h
Data Zone	030000h	031000h to 06B47Fh
Zone 0	NA	031000h to 037D5Fh
Zone 1	NA	037D60h to 04021Fh
-----	NA	-----
Zone 23	NA	0158D80h to 016B47Fh
Lead-out Zone (Rewritable)	See ISO/IEC-16448	57.5 mm
DMA 3 and DMA 4 Zone	NA	016B480h
Reserved Zone	NA	016B500h
Guard Track Zone 1	NA	016B580h
Drive Test Zone	NA	016B780h
Disc Test Zone	NA	016BE80h
Guard Track Zone 2	NA	016C580h

NA – Not applicable.

Annex B – Comparison of DVD-ROM and 2.6 GB DVD-RAM

Table B.1 – DVD-ROM compatibility

	2.6 GB DVD-RAM	DVD-ROM	Required change on ROM drive to read RAM disc	Remarks
Track	Land and Groove	Embossed pits	Tracking method (DPD → Push Pull)	No change on Optical Head
Mark	Phase Change	Embossed pits	Nothing	Same detection method
Track Pitch	0.74 μm			
Bit Pitch	0.41 – 0.43 μm	0.27 μm		
Sector Format	With Header	Continuous	Additional circuit (<3000 gates)	Header detection
Modulation	8 to 16 modulation		Nothing	Common
ECC	RS-PC			
Linear Velocity	About 6 m/s	3.5 m/s	Nothing	< 2x-ROM
Allocation	ZCLV	CLV	Firmware change	Access control
Defect Management	Equipped	Not Equipped	Firmware change	Read DMA

Annex C – Data Zone of 2.6 GB DVD-RAM

Table C.1 - Data Zone of 2.6 GB DVD-RAM

		Number of sectors per track	Sector numbers
Data Zone	Zone 0	17	031000h to 037D5Fh
	Zone 1	18	037D60h to 04021Fh
	Zone 2	19	040220h to 048E3Fh
	Zone 3	20	048E40h to 0521BFh
	Zone 4	21	0521C0h to 05BC9Fh
	Zone 5	22	05BCA0h to 065EDFh
	Zone 6	23	065EE0h to 07087Fh
	Zone 7	24	070880h to 07B97Fh
	Zone 8	25	07B980h to 0871DFh
	Zone 9	26	0871E0h to 09319Fh
	Zone 10	27	0931A0h to 09F8BFh
	Zone 11	28	09F8C0h to 0AC73Fh
	Zone 12	29	0AC740h to 0B9D1Fh
	Zone 13	30	0B9D20h to 0C7A5Fh
	Zone 14	31	0C7A60h to 0D5EFFh
	Zone 15	32	0D5F00h to 0E4AFFh
	Zone 16	33	0E4B00h to 0F3E5Fh
	Zone 17	34	0F3E60h to 010391Fh
	Zone 18	35	0103920h to 0113B30h
	Zone 19	36	0113B40h to 01244BFh
	Zone 20	37	01244C0h to 013559Fh
	Zone 21	38	01355A0h to 0146DDFh
	Zone 22	39	0146DE0h to 0158D7Fh
	Zone 23	40	0158D80h to 016B47Fh

Note: For information related to the logical sector number of the first sector, refer to the ISO/IEC 16824:1999.

Annex D – Additional Information to Support DVD-RAM Type 2 Cartridge

The DVD-RAM defect-management areas provide a fixed maximum number of spare sectors. Therefore careless or frequent handling of bare discs can increase the number of defective sectors beyond this limit. Once data has been written to a disc successfully, however, additional errors encountered by a drive when reading the disc can often be corrected at the ECC block level.

A Type 2 cartridge contains a single-sided disc that can be removed and a sensor hole that opens indicating that the cartridge has been opened. This open sensor hole then serves as a warning that the disc inside may have been handled and therefore the defect-management system could be compromised.