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Information technology — 80 mm (1,46 Gbytes per side) and 120 mm (4,70 Gbytes per side) DVD Recordable Disk (DVD-R)

Technologies de l'information — Disque enregistrable DVD (DVD-R) de 80 mm (1,46 GB par face) et 120 mm (4,7 GB par face) de diamètre

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 23912 was prepared by ECMA (as ECMA-359) and was adopted, under a special “fast-track procedure”, by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, in parallel with its approval by national bodies of ISO and IEC.

This corrected version of ISO/IEC 23912:2005 incorporates the following corrections:

— description of Figure 20 corrected in 14.5.1;

— data for Table 26 corrected in 28.3.2.1;

— label for Figure F.3 corrected in F.4;

— Figure J.1 in J.2 corrected;

— on the third line of page 128 (M.3.1), the words "see Table M.2" replaced by "see Table M.3";

— the text of the last line of page 130 (M.3.1) corrected.

Introduction

In June 2001 eleven members proposed to ECMA TC31 to develop a standard for 120 mm and 80 mm DVD Recordable optical disks using Organic Dye recording technology and TC31 adopted this project. In April 2004 ten members proposed to TC31 to restart this project and TC31 re-activated the work that has resulted in this International Standard.

This International Standard specifies two Types of Recordable optical disks, one (Type 1S) making use of recording on only a single side of the disk and yielding a nominal capacity of 4,70 Gbytes for a 120 mm disk and 1,46 Gbytes for an 80 mm disk, the other (Type 2S) making use of recording on both sides of the disk and yielding a nominal capacity of 9,4 Gbytes for a 120 mm disk and 2,92 Gbytes for an 80 mm disk.

Information technology — 80 mm (1,46 Gbytes per side) and 120 mm (4,70 Gbytes per side) DVD Recordable Disk (DVD-R)

Section 1 - General

1 Scope

This International Standard specifies the mechanical, physical and optical characteristics of an 80 mm and a 120 mm DVD Recordable disk to enable the interchange of such disks. It specifies the quality of the pre-recorded, unrecorded and the recorded signals, the format of the data, the format of the information zone, the format of the unrecorded zone, and the recording method, thereby allowing for information interchange by means of such disks. This disk is identified as a DVD Recordable (DVD-R) disk.

This International Standard specifies

- 80 mm and 120 mm nominal diameter disks that may be either single or double sided,
- the conditions for conformance,
- the environments in which the disk is to be operated and stored,
- the mechanical and physical characteristics of the disk, so as to provide mechanical interchange between data processing systems,
- the format of the pre-recorded information on an unrecorded disk, including the physical disposition of the tracks and sectors, the error correcting codes and the coding method used,
- the format of the data and the recorded information on the disk, including the physical disposition of the tracks and sectors, the error correcting codes and the coding method used,
- the characteristics of the signals from pre-recorded and unrecorded areas on the disk, enabling data processing systems to read the pre-recorded information and to write to the disks,
- the characteristics of the signals recorded on the disk, enabling data processing systems to read the data from the disk.

This International Standard provides for interchange of disks between disk drives. Together with a standard for volume and file structure, it provides for full data interchange between data processing systems.

2 Conformance

2.1 Optical Disk

A claim of conformance shall specify the type of the disk, i.e. its size and whether it is single-sided or double sided. An optical disk shall be in conformance with this International Standard if it meets the mandatory requirements specified for this type.

2.2 Generating system

A generating system shall be in conformance with this International Standard if the optical disk it generates is in accordance with 2.1.

2.3 Receiving system

A receiving system shall be in conformance with this International Standard if it is able to handle an optical disk according to 2.1.

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 8859-1, *Information technology — 8-bit single-byte coded graphic character sets — Part 1: Latin alphabet No. 1*

ISO/IEC 8859-2, *Information technology — 8-bit single-byte coded graphic character sets — Part 2: Latin alphabet No. 2*

ISO/IEC 8859-3, *Information technology — 8-bit single-byte coded graphic character sets — Part 3: Latin alphabet No. 3*

ISO/IEC 8859-4, *Information technology — 8-bit single-byte coded graphic character sets — Part 4: Latin alphabet No. 4*

ECMA-287, *Safety of electronic equipment* – 2nd edition (December 2002)

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
Block SYNC Guard Area
The recorded area in the first ECC block of the contiguous area of which recording is started from the unrecorded area by using 32K-Link.

4.2
Border Zone
The linking region that prevents the pick-up head from over running on an unrecorded area when a disk is played back in a partially recorded state.

4.3
Channel bit
The elements by which, after modulation, the binary values ZERO and ONE are represented on the disk by marks.

4.4
Clamping Zone
The annular part of the disk within which a clamping force is applied by a clamping device.

4.5
Data Zone
The zone between the Lead-in Zone and the Lead-out Zone in which user data is recorded. In Border recording mode, Border Zone is included in Data Zone.

4.6
Data Recordable Zone
The zone that is available to record user data.

4.7
Digital Sum Value (DSV)
The arithmetic sum obtained from a bit stream by allocating the decimal value 1 to bits set to ONE and the decimal value –1 to bits set to Zero.

4.8
Disk at once recording
A recording mode in which the Lead-in Zone, the user data and the Lead-out Zone are recorded sequentially.

4.9
Disk Reference Plane
A plane defined by the perfectly flat annular surface of an ideal spindle onto which the Clamping Zone of the disk is clamped, and which is normal to the axis of rotation.

4.10
ECC Block address
The address embossed on the land as the Pre-pit Information, which represents the absolute physical address of the track used to define the recording position of each area. The address is equal to the bit-inverted numbers from b_{23} to b_4 of the Physical Sector Number recorded in the groove.

NOTE The "ECC Block address" definition is specific to this Standard.

4.11
Error Correction Code (ECC)
A mathematical computation yielding check bytes used for the detection and correction of errors in data.

4.12
Error Detection Code (EDC)
A code designed to detect certain kinds of errors in data.

Error Detection Code consists of data and the error detection parity.

4.13
Finalization
The action in which the Lead-in Zone and the Lead-out Zone are recorded.

4.14
Groove
The wobbled guidance track.

4.15
Incremental recording
A recording mode in which the disk is recorded in several distinct recording operations (for example at different times and using different recording drives). In this recording mode, the specified linking scheme shall be used.

4.16
Information Zone
The zone comprising the Lead-in Zone, the Data Zone and the Lead-out Zone.

4.17
Land
The area between the grooves.

4.18
Land Pre-Pit (LPP)
Pits embossed on the land during the manufacture of the disk substrate, which contain address information.

4.19
Lead-in Zone
The zone comprising Physical sectors adjacent to the inside of the Data Zone.

4.20
Lead-out Zone
The zone comprising Physical sectors adjacent to the outside of the Data Zone.

4.21
Recording Management Area (RMA)
The area containing the Recording Management Data (RMD), situated adjacent to the inside of the Lead-in Zone.

4.22
Recording Management Data (RMD)
The information about the recording on the disk, including information on each recording mode.

4.23
R-Information Zone
The zone comprising the Power Calibration Area (PCA) and the Recording Management Area (RMA).

4.24
RZone
Continuous ECC blocks assigned to user data during Incremental recording mode and Restricted Overwrite mode.

4.25
Sector
The smallest addressable part of a track in the information zone of a disk that can be accessed independently of other addressable parts.

4.26
Substrate
A transparent layer of the disk, provided for mechanical support of the recording or recorded layer, through which the optical beam accesses the recordable / recorded layer.

4.27
Track
A 360° turn of a continuous spiral of recorded marks or groove.

4.28
Track pitch
The distance between adjacent average physical track centrelines of the wobbled grooves for the unrecorded disk, or between adjacent physical track centrelines of the successive recorded marks for the recorded disk, measured in the radial direction.

4.29
Zone
An annular area of the disk.

5 Conventions and notations

5.1 Representation of numbers

A measured value is rounded off to the least significant digit of the corresponding specified value. For instance, it implies that a specified value of 1,26 with a positive tolerance of + 0,01 and a negative tolerance of - 0,02 allows a range of measured values from 1,235 to 1,275.

Numbers in decimal notations are represented by the digits 0 to 9.

Numbers in hexadecimal notation are represented by the hexadecimal digits 0 to 9 and A to F in parentheses.

The setting of bits is denoted by ZERO and ONE.

Numbers in binary notations and bit patterns are represented by strings of digits 0 and 1, with the most significant bit shown to the left.

Negative values of numbers in binary notation are given as Two's complement.

In each field the data is recorded so that the most significant byte (MSB), identified as Byte 0, is recorded first and the least significant byte (LSB) last. In a field of 8*n* bits, bit $b_{(8n-1)}$ shall be the most significant bit (msb) and bit b_0 the least significant bit (lsb). Bit $b_{(8n-1)}$ is recorded first.

5.2 Names

The names of entities, e.g. specific tracks, fields, areas, zones, etc. are given a capital initial.

6 Acronyms

AP	Amplitude of the land Pre-Pit signal (without wobble amplitude)
AR	Aperture Ratio (of the Land Pre-Pit after recording)
BP	Byte Position
BPF	Band Pass Filter
CLV	Constant Linear Velocity
CNR	Carrier to Noise Ratio
DCC	DC Component suppress control
DSV	Digital Sum Value
ECC	Error Correction Code
EDC	Error Detection Code
HF	High Frequency
ID	Identification Data
LA	Lead-out Attribute
IED	ID Error Detection (code)
LPF	Low-Pass Filter
LPP	Land Pre-Pit
LSB	Least Significant Byte
lsb	least significant bit
MSB	Most Significant Byte
msb	most significant bit
NBCA	Narrow Burst Cutting Area
NRZI	Non Return to Zero Inverted
OPC	Optimum Power Control

PBS	Polarizing Beam Splitter
PCA	Power Calibration Area
PI	Parity (of the) Inner (code)
PLL	Phase Locked Loop
PO	Parity (of the) Outer (code)
PSN	Physical Sector Number
PUH	Pick-Up Head
RBP	Relative Byte Position
RBW	Resolution Bandwidth
RESYNC	Re-Synchronization
RMA	Recording Management Area
RMD	Recording Management Data
RS	Reed-Solomon (code)
SYNC	Synchronization

7 General description of a disk

The 80 mm and 120 mm optical disks that are the subject of this International Standard consist of two substrates bonded together by an adhesive layer, so that the recording layer (single-sided disk) or recording layers (double-sided disk) are on the inside. The centring of the disk is performed on the edge of the centre hole of the assembled disk on the side currently read. Clamping is performed in the Clamping Zone. The DVD Recordable Disk (DVD-R) may be either double-sided or single-sided with respect to the number of recording layers. A double-sided disk has a recording layer on the inside of each substrate. A single-sided disk has one substrate with the recording layer on the inside and a dummy substrate without a recording layer. A recorded disk provides for the data to be read many times by an optical beam of a drive. Figure 1 shows schematically a double-sided (Type 2S) and a single-sided (Type 1S) disk.

Type 1S consists of a substrate, a single recording layer, an adhesive layer, and a dummy substrate. The recording layer can be accessed from one side only. The nominal capacity is 1,46 Gbytes for an 80 mm disk and 4,70 Gbytes for a 120 mm disk.

Type 2S consists of two substrates, two recording layers, and an adhesive layer. From one side of the disk only one recording layer can be accessed. The nominal total capacity is 2,92 Gbytes for an 80 mm disk and 9,40 Gbytes for a 120 mm disk.

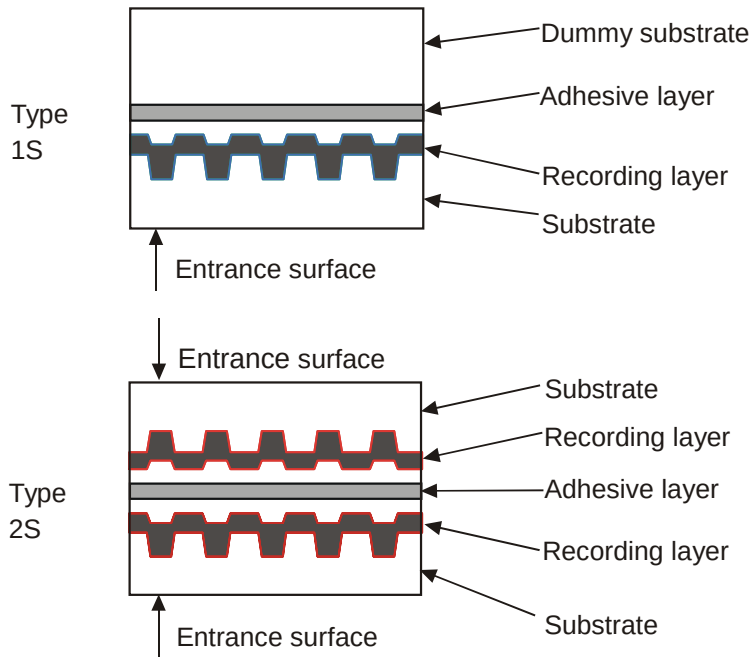

Figure 1 - Disk outline

8 General requirement

8.1 Environments

8.1.1 Test environment

The test environment is the environment where the air immediately surrounding the disk has the following properties.

	a) For dimensional measurements	b) For other measurements
temperature :	23 °C ± 2 °C	15 °C to 35 °C
relative humidity :	45 % to 55 %	45 % to 75 %
atmospheric pressure :	86 kPa to 106 kPa	86 kPa to 106 kPa

Unless otherwise stated, all tests and measurements shall be made in this test environment.

8.1.2 Operating environment

This International Standard requires that an optical disk which meets all mandatory requirements of this International Standard in the specified test environment provides data interchange over the specified ranges of environmental parameters in the operating environment.

Disks used for data interchange shall be operated under the following conditions, when mounted in the drive supplied with voltage and measured on the outside surface of the disk.