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Information technology — Digitally recorded media for information interchange and storage — Quality discrimination method ~~of~~for optical disks and operating method of storage systems for long-term data preservation

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 23, *Digitally Recorded Media for Information Interchange and Storage*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at ~~www.iso.org/members.html and www.iec.ch/national-committees~~www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

In the digital information society, there is no secure means for storing and accumulating rapidly growing digital information safely and on a permanent basis. There is therefore a concern that the world will face a critical situation and significant problem in the near future. Within this context, optical disks are increasingly being considered as a solution for archiving storage media with high capacity because of their unique features such as low cost, high compatibility and low energy consumption, and more specifically, their data storage capability without power consumption.

On the other hand, the data storage performance of an optical disk often depends on the initial recording quality and storage environment conditions. Therefore, when an optical disk is used for long-term data storage, it is desirable to check its estimated lifetime and initial recording quality by using a combination of a good quality optical disk and a good quality recording drive.

For this reason, this document specifies quality discrimination criteria using the initial quality of recordable optical disks as an index. It also specifies a quality judgement method for storage systems for long-term data preservation, including the consistency of the recordable optical disks and recording drives to ensure the quality of recorded digital data. In this document, recordable (write-once) disks among optical disks are adopted as long-term storage media to ensure the security of the stored digital data when giving greater importance to evidence, because physical overwriting and deletion by erroneous or intentional operation can be prevented.

This document is also applicable to read-only optical disks such as CD-ROM, DVD-ROM and BD-ROM, specifying the quality judgement method for long-term data preservation.

This document enables users to build data storage systems that use recordable and/or read-only optical disks for long-term data preservation. Optical disks with sufficient quality can be confirmed based on the results of the initial quality test. Through the periodic quality test described in this document, the possibility of data restoration from the optical disk can be continuously monitored. Using this document, manufacturers will be able to supply recordable and read-only optical disks incorporated with suitable recording and playback drives for building data storage systems for long-term data preservation.

In the future, it will be possible to build data storage systems using optical disks for storing and accumulating important digital information safely and on a permanent basis, fromfor consumer use toand professional use. The safe and secure progress of the digital information society towards greater sophistication can be expected.

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Information technology — Digitally recorded media for information interchange and storage — Quality discrimination method offor optical disks and operating method of storage systems for long-term data preservation

1 Scope

This document specifies a quality discrimination method for optical disks and the operating method of storage systems for long-term digital data preservation using optical disks and optical disk drives (hereinafter referred to as "drives").

It is applicable to recordable (write-once) optical disks which can prevent physical overwriting and deletion by erroneous or intentional operation when givingin contexts where greater importance is given to evidence. It is also applicable to read-only (ROM) optical disks.

This document specifies:

— ——combinations of recordable optical disks and drives used for long-term data preservation;

— ——quality discrimination criteria for recordable optical disks and the operation method forof long-term storage systems;

— ——a quality test for read-only optical disks and the operation method forof long-term storage systems;

— ——quality discrimination criteria for BD recordable disks when adopting the defect management.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 10149, *Information technology — Data interchange on read-only 120 mm optical data disks (CD-ROM)*

ISO/IEC 12862, *Information technology — 120 mm (8,54- Gbytes per side) and 80 mm (2,66- Gbytes per side) DVD recordable disk for dual layer (DVD-R for DL)*

ISO/IEC 16448, *Information technology — 120 mm DVD — Read-only disk*

ISO/IEC 16449, *Information technology — 80 mm DVD — Read-only disk*

ISO/IEC 16963, *Information technology — Digitally recorded media for information interchange and storage — Test method for the estimation of lifetime of optical disks for long-term data storage*

ISO/IEC 17344, *Information technology — Data interchange on 120 mm and 80 mm optical disk using +R format — Capacity: 4,7- Gbytes and 1,46- Gbytes per side (recording speed up to 16X)*

ISO/IEC 23912, *Information technology — 80 mm (1,46- Gbytes per side) and 120 mm (4,70- Gbytes per side) DVD Recordable Disk (DVD-R)*

ISO/IEC 25434, *Information technology — Data interchange on 120 mm and 80 mm optical disk using +R DL format — Capacity: 8,55- Gbytes and 2,66- Gbytes per side (recording speed up to 16X)*

ISO/IEC 30190, *Information technology — Digitally recorded media for information interchange and storage — 120 mm Single Layer (25,0- Gbytes per disk) and Dual Layer (50,0- Gbytes per disk) BD Recordable disk*

ISO/IEC 30191, *Information technology — Digitally recorded media for information interchange and storage — 120 mm Triple Layer (100,0- Gbytes single sided disk and 200,0- Gbytes double sided disk) and Quadruple Layer (128,0- Gbytes single sided disk) BD Recordable disk*

ECMA-394, *Recordable Compact Disk Systems CD-R Multi-Speed*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ~~—~~ISO Online browsing platform: available at ~~https://www.iso.org/obp~~https://www.iso.org/obp

— ~~—~~IEC Electropedia: available at ~~https://www.electropedia.org/~~https://www.electropedia.org/

3.1
maximum C1 error
Max C1
maximum number of C1 errors per second averaged over any 10 s in one of the relevant areas on a CD, measured at the input of error correction decoder under the standard data transfer rate

Note 1- to- entry:- See ISO/IEC 10149, ISO/IEC 16963, and ECMA 394.

3.2
maximum PI SUM 8
Max PI SUM 8
maximum parity of inner code (PI) error count at any consecutive 8 *error correction code* ~~(3.7)~~(3.7) blocks in one of the relevant areas on a DVD, measured at the first pass of the decoder before correction

Note 1- to- entry:- See ISO/IEC 12862, ISO/IEC 16448, ISO/IEC 16449, ISO/IEC 17344, ISO/IEC 23912, and ISO/IEC 25434.

3.3
maximum random symbol error rate
Max RSER
maximum value of random symbol error rate in one of the relevant areas on a BD excluding burst errors of 40 bytes or more, measured at the input of error-correction decoder

Note 1- to entry:- See ISO/IEC 30190, and ISO/IEC 30191.

Note 2- to entry:- Maximum random symbol error rate shall be measured by averaging over any *N* consecutive *long distance code* ~~(3.8)~~(3.8) blocks to reduce the impact of burst errors, with the condition that all blocks are recorded in a continuously written sequence, in a discontinuously written sequence excluding disk defects. In this document,

the number of *N* shall be 10 000, and when *defect management* ~~(3.18)~~(3.17) is applied, the number of *N* shall be 10 000 at maximum.

3.4
maximum burst error
Max BE
maximum sum of the lengths of burst errors with length greater than or equal to 40 bytes in one recording-unit block in one of the relevant areas on a BD

Note 1 to entry: See ISO/IEC 30190~~,~~ and ISO/IEC 30191.

Note 2 to entry: The number of burst errors is not covered in this document.

3.5
error rate
rate of data errors on the recorded disk measured before error correction is applied

3.6
uncorrectable error
error in the read-out data that ~~could not~~cannot be corrected by the error-correction decoders

[SOURCE: ISO/IEC 29121:2021, 3.18]

3.7
error correction code
ECC
mathematical computation yielding check bytes used for the detection and correction of errors in data

3.8
long distance code
LDC
error correction code ~~(3.7)~~(3.7) that increases the correction ability by increasing the code length and assigning more inspection symbols

Note 1 to entry: Long distance code is used in BD disks.

Note 2 to entry: See ISO/IEC 30190, and ISO/IEC 30191.

3.9
initial quality test
verification test of the data quality recorded on an optical disk before storing

3.10
periodic quality test
periodic test of the data quality recorded on an optical disk during preservation period

3.11
constant linear velocity
CLV
rotation control method of optical disk that keeps the linear velocity constant