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Information technology — Automatic identification and data capture techniques — Quality test specification for rewritable hybrid media data carriers

Technologies de l'information — Techniques automatiques d'identification et de capture des données — Spécification d'essai qualitatif pour porteurs de données de milieux hybrides

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Contents

Page

Foreword

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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 shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 29133 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

Introduction

Traditionally, linear bar codes and two-dimensional symbols have been considered as write once/read many times (WORM) technologies. The advent of Rewritable Media, which can completely change the displayed information, provides applications with an opportunity to erase previously encoded data carriers and human readable data and to overwrite this with new data. There is a requirement to ensure that Rewritable Media can be fully integrated with pre-existing WORM applications.

Additionally, Rewritable Media can be combined with rewritable RFID (radio frequency identification) technologies to create what is called a Rewritable Hybrid Media product. In this form, the characteristics of the optical data carrier and RFID data carrier can be used in an integrated manner in business applications. Because the rewriting procedure for each technology is different, there is a requirement to ensure that this data is synchronised, not necessarily to be identical, on each rewriting cycle.

Because the Rewritable Media and RFID tags can be re-used for a number of cycles, they can contribute to environmental improvement as they produce a smaller carbon footprint over their lifetime than current systems that use paper and card-based products. Also, by combining Rewritable Media with RFID, the number of single-use RFID labels can be reduced.

Manufacturers of bar code equipment and RFID equipment, and the users of both these data capture technologies, require publicly available standard test specifications for the objective assessment of the quality of Rewritable Hybrid Media and its component parts. Such standards can be referred to when developing equipment and application standards, or determining the quality of the data carriers. Such test specifications form the basis for development of measuring equipment for process control and quality assurance purposes during the rewriting process as well as afterwards. This International Standard provides requirements and guidelines to achieve a specified quality requirement for applications making use of Rewritable Hybrid Media. These requirements also address the fact that any batch of Rewritable Hybrid Media is heterogeneous, with some items that are relatively new being intermixed with other items that have been erased and re-written many times. Procedures outlined in this International Standard ensure, irrespective of the age and number of cycles achieved by an item of Rewritable Hybrid Media, that the minimum required quality output is maintained.

The bar code symbol needs to be produced in such a way as to be reliably decoded at the point of use, if it is to fulfil its basic objective as a machine-readable data carrier. Similarly, the RFID tag needs to be encoded in a correct manner to be reliably read at the point of use.

This International Standard specifies the overall quality process and associated methodology for Rewritable Hybrid Media. This International Standard determines quality characteristics to ensure that various types of product combination and integrated Rewritable Hybrid Media system can be implemented in a reliable and robust manner.

This International Standard contributes to the interoperability of data carriers and devices that support this technology. In addition, as the Rewritable Media technology develops, this International Standard will provide a benchmark to assess whether the new developments are capable of being applied in a manner compatible with existing data carriers.

Information technology — Automatic identification and data capture techniques — Quality test specification for rewritable hybrid media data carriers

1 Scope

This International Standard specifies methodologies to be used for the conformance of rewritable hybrid media data carriers, which combine RFID tag technology with linear and/or two-dimensional bar code symbologies that are written to an erasable substrate. Three main product configuration types are addressed within this International Standard:

— Rewritable Media, which supports the rewriting of linear or two-dimensional symbols;

— Rewritable Hybrid Media, which integrates the Rewritable Media with an RFID tag;

— Rewritable Media combined with RFID technology that are physically separate data carriers but still require their data encoding processes to be integrated as part of a Rewritable Hybrid Media system.

In particular, this International Standard

— defines the base requirements for Rewritable Media and Rewritable Media devices (see 6.2),

— defines additional methods for process control of the Rewritable Media over multiple erasure and rewrite cycles (see 6.4),

— defines reference standards for evaluating the RFID tag component (see 7.2 and 7.3),

— defines additional methods for process control of the RFID component over multiple erasure and rewrite cycles (see 7.4),

— provides information to ensure that the data encoded in the bar code symbology and RFID data carrier are synchronous, i.e. are derived from the same source data set (see Clause 8).

NOTE Depending on the application, the encoded data can be identical or different (e.g. one data carrier could provide additional data).

Because of the interdependency between the Rewritable Hybrid Media and the rewrite device used to create the optical image, the entire Rewritable Hybrid Media system needs to be taken into account to define conformance. Therefore, there is a requirement to define the capability of achieving a given print quality grade as defined in relevant standards. This Rewritable Hybrid Media system approach has the additional advantage of not being prescriptive on the types of media and "print" technologies that may be used now or developed in future. As long as a print technology/media combination meets the print quality grades, it can be considered conformant with this International Standard.

2 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 15415 *Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Two-dimensional symbols*

ISO/IEC 15416 *Information technology — Automatic identification and data capture techniques — Bar code print quality test specification — Linear symbols*

ISO/IEC 15419, *Information technology — Automatic identification and data capture techniques — Bar code digital imaging and printing performance testing*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*

ISO/IEC 19762-2, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 2: Optically readable media (ORM)*

ISO/IEC 19762-3, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 3: Radio frequency identification (RFID)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762-1, ISO/IEC 19762-2, ISO/IEC 19762-3 and the following apply.

3.1
Rewritable Hybrid Media
combination of Rewritable Media and an RFID tag in an integrated product

3.2
Rewritable Media
substrate, consisting of a protective layer, optical imaging layer and base material, that enables repeated writing and erasing of optical data including bar code symbologies and eye readable data

3.3
Rewritable Hybrid Media system
system comprising the Rewritable Hybrid Media data carriers, the process control to achieve verifiable data carrier conformance, and the data integrity between the bar code and RFID components, whether these are integrated or separate data carriers

4 Symbols and abbreviations

nm nanometre

R_{max} Maximum reflectance value

R_{min} Minimum reflectance value

5 Hybrid media functions and process description

Rewritable Media is a substrate that enables repeated writing and erasing of optical data including bar code symbologies and eye readable data. This is achieved by incorporating an optical imaging layer in the media substrate. The process of erasing and then rewriting is normally achieved in a device that combines the functions, or in separate devices addressing each process.

Other than the system meeting the basic conformance requirements specified in Clause 6, this International Standard places no constraints on the type of media substrate nor the "printing" process. Example technologies are described in Annex A.

The Rewritable Hybrid Media allows applications to exploit the benefits of optical and radio frequency technologies in innovative ways. A key advantage is that the media device can be reused for multiple cycles.

6 Conformance tests for the Rewritable Media system

6.1 General

This clause applies equally to Rewritable Media when used alone or as a component of Rewritable Hybrid Media.

A Rewritable Media system shall consist of Rewritable Media products and a device capable of erasing the media and rewriting this with a new set of barcode(s) and eye readable data. The following sub-clause specifies procedures for making conformance claims for the Rewritable Media product and capabilities of the Rewritable Media device. Additional sub-clauses define factors that need to be taken into account for process control purposes; and finally a range of process control methods are defined, increasing in sophistication.

6.2 Product conformance

Manufacturers of Rewritable Media products and of Rewritable Media devices are expected to carry out type testing of their product to enable application designers and users to select appropriate products. Any conformance claims shall be expressed as an overall minimum print quality grade:

— using the procedures specified in ISO/IEC 15419

— declared using the procedures of ISO/IEC 15416 for linear bar codes and identifying the symbology and X dimension used for testing purposes,

— declared using the procedures of ISO/IEC 15415 for two-dimensional symbols and identifying the symbology and X dimension used for testing purposes,

— based on the initial (first) print impression on the Rewritable Media product, i.e. using previously blank stock,

— based on a stated number of erase and re-print cycles, where the number of cycles is declared by the manufacturer of the Rewritable Media product,

— declaring the wavelength(s) of light at which the grade was determined,

— declaring the scanning aperture used in the test.

6.2.1 Tests and declarations by the Rewritable Media manufacturer

The Rewritable Media manufacturer may select any Rewritable Media device for the product tests. This device should be identified by brand and model code in the test report. The test report shall address all the points listed in 6.2 and otherwise be in compliance with ISO/IEC 15419.

6.2.2 Tests and declarations by the Rewritable Media device manufacturer

The Rewritable Media device manufacturer may select any Rewritable Media for the device tests. This media should be identified by brand and product code in the test report. The test report shall address all the points listed in 6.2 and otherwise be in compliance with ISO/IEC 15419.

6.3 Process control factors

Because of the nature of Rewritable Media, considerations other than the methodology defined in ISO/IEC 15416 for linear bar code and ISO/IEC 15415 for two-dimensional bar codes need to be taken into account. These are defined in the following sub-clauses.

6.3.1 Minimum overall grade

When the methodology defined in ISO/IEC 15416 is used to evaluate linear bar codes or ISO/IEC 15415 is used to evaluate two-dimensional symbols, the minimum overall print quality grade for successive print cycle images shall be as specified by the application.

6.3.2 Symbol Contrast grading and application standards

Some Rewritable Media may not achieve the highest Symbol Contrast (SC) grades. Therefore, if the application requires a grade level of 3 (B) or higher, additional advice should be provided in application standards to specify an acceptable grade for SC separate from but in addition to an overall symbol grade without SC included in the calculation of Symbol Grade.

6.3.3 Modulation grading and application standards

Some Rewritable Media may not achieve the highest Modulation grades. Therefore, if the application requires a grade level of 3 (B) or higher, additional advice should be provided in application standards to specify an acceptable grade for Modulation separate from but in addition to an overall symbol grade without Modulation included in the calculation of Symbol Grade.

6.3.4 Minimum reflectance requirements

To enable the use of the process control method defined in 6.4, a minimum reflectance value of the substrate (R_{max}) shall be specified by the application (see 6.4.2). This is to ensure that Symbol Contrast and Modulation requirements can be achieved.

6.3.5 Wavelength of light

Because of the nature of the make-up of the Rewritable Media, reflectance measures can vary significantly, depending on the wavelength of light at which the scanner operates. Given that this varies between brands and models of scanner and the technology used for the optical systems, applications should give some consideration to the wavelength of light that is suitable for scanning purposes.

ISO/IEC 15415 provides detailed advice that applies in this International Standard equally to linear and two-dimensional symbols that are printed on Rewritable Media. ISO/IEC 15415 advises that measurements to be made using light of the same characteristics as those in the intended scanning environment.

The process control testing (see 6.4) should be undertaken at a wavelength of light specified by the application. If the application does not specify the wavelength, the default value is 660 nm.

6.4 Process control methods

6.4.1 Process control considerations

6.4.1.1 ISO/IEC 15416 process control

ISO/IEC 15416 has an informative annex addressing process control requirements. The procedures defined in that annex are not appropriate for Rewritable Media, because they apply to a situation where successive symbols are being produced using a substrate that is reasonably consistent between impressions (i.e. they form a homogeneous set). The ISO/IEC 15416 process control methods are designed to monitor and control drift in a homogeneous set. In contrast, the process used to erase and rewrite Rewritable Media can have successive media components that might have been recycled many or few times in a completely random mix (i.e. they form a heterogeneous set). In addition, Rewritable Media is affected not only by the number of erase and re-write cycles but also unexpected damage and the usage conditions, etc.

A more appropriate process control methodology for Rewritable Media is defined in 6.4.1.2.

6.4.1.2 Heterogeneity

The nature of Rewritable Media is that it will deteriorate over time based on a complex set of causes. A basic cause is the number of rewrite cycles, but deterioration can be accelerated due to adverse environmental conditions to which the media is exposed when in use as a data carrier during the application cycle (e.g. if it is exposed to higher than average heat). Because batches of Rewritable Media that are being processed for rewriting are likely to be heterogeneous with each item of Rewritable Media presenting a different state of quality, it is difficult to predict the presence of items that might no longer be suitable for rewriting.

6.4.1.3 Sample size considerations

Whereas with a homogenous set it is possible to apply sophisticated tests to a small sample, for Rewritable Hybrid Media it is more appropriate to apply simple tests on a larger sample or on all items. The following sub-clauses identify a range of tests of increasing sophistication. Therefore, the extent that they can be applied will range from the possibility of testing a small sample size to a full inspection.

6.4.2 Reflectance test

A simple test that can be applied is a reflectance test of the background colour of the substrate.

A basic test should be applied to each item of Rewritable Media as it is presented to the erase and rewrite cycle, based on the reflectance of the substrate (R_{max}). The application should set the threshold relative to the reflectance of new media. The default threshold is a decrease of 10% for the reflectance of the substrate (R_{max}) (e.g. for new media with Rmax equal to 0,83 the reflectance test threshold is ≥ 0,75 for each rewrite cycle).

Any item of Rewritable Media that fails this reflectance test should be subjected to the requirements defined in ISO/IEC 15416 and/or ISO/IEC 15415.

6.4.3 Symbol contrast test

A better assessment of the suitability of Rewritable Media for re-use can be achieved by incorporating a Symbol Contrast calculation based on the highest and lowest reflectance value of any scan line through the Rewritable Media. This test could be applied to an item of Rewritable Media prior to erasure. If the calculated Symbol Contrast is below that defined for the application, the item of Rewritable Media should be subjected to the requirements defined in ISO/IEC 15416 and/or ISO/IEC 15415.

Instead of measuring the Symbol Contrast on a random selection of graphical images (some of which might, or might not, be bar codes) an alternative procedure can be considered. If the application standard provides sufficient label area, a set of special marks can be printed on each rewrite of the cycle. Annex B shows a

