INTERNATIONAL STANDARD

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Information technology — Office equipment — Print quality attributes for machine readable Digital Postage Marks

Technologies de l'information — Équipement de bureau — Attributs d'impression qualité pour les timbres postaux numériques lisibles par machine

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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 18050 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 28, *Office equipment*.

Introduction

Digital Postage Marks (or franking marks), sometimes abbreviated to DPM, are used to evidence the payment of postage and/or other fees related to services requested by mailers. Digital Postage Marks are represented by symbols imprinted on the envelope, the label or the insert. Digital Postage Marks produced by different vendors' systems are generated with a variety of symbols and graphical images. The symbologies used for these images are primarily two-dimensional bar codes of both multi-row (PDF417) and matrix types (e.g. Data Matrix), as specified in UPU standard S 28. However, postal operators may also use other symbologies, e.g. OCR or 4-state codes for these purposes. The two-dimensional bar code symbologies offer advantages for the machine-readable representation of data strings of the order of 80 or more bytes in length, due to their high information density characteristics.

Public postal operators and private carriers have a high interest in automatically reading and validating these marks, preferably at high speed. These symbols must be read reliably by postal processing equipment. The highest practicable read rate is desired by users of such equipment in order to ensure efficient automation of this process, and any shortfall in the read rate may have as its consequence a loss of revenue to the operator.

This International Standard has been designed to customize the generic method of measuring the print quality of two-dimensional bar code symbols to the needs of the postal application and to recommend appropriate print quality levels that should contribute to the achievement of the read rates desired by the authorities responsible for validation of the Digital Postage Marks and by postal operators; it is also intended to provide guidelines for printing machine readable Digital Postage Marks on mail items. This International Standard will provide mailers, postal operators and their suppliers with a practical, quantitative and objective way to measure and communicate to each other basic print quality parameters of machine readable Digital Postage Marks. Since all attributes do not contribute uniformly to the readability of a Digital Postage Mark, this International Standard identifies five levels of criticality for an attribute (graded 0 to 4, in ascending order of quality), and a grading scheme that assesses the overall symbol quality based on averaging the results of multiple scans.

The International Standard may be used in the following ways:

- It allows an estimate to be made of the readability of a Digital Postage Mark without actually submitting it to any postal validation and the qualification of said symbol as acceptable or not acceptable for readability purposes.
- It allows an estimate to be made of the quality levels potentially achievable by a printing system with particular substrates.
- It provides a tool for process control in the operation of Digital Postage Mark printing systems.

This International Standard applies the measurement methodology defined in ISO/IEC 15415 for print quality attributes that tend to influence the readability of two-dimensional bar codes. This methodology is derived from a view of the current state-of-the-art in two-dimensional bar code scanning technologies.

Yet, such a state-of-the-art is not a perfectly defined concept. First, it is likely to evolve with time towards improved recognition capabilities. Second, an automatic identification and data capture system is always the result of a compromise between recognition power and cost. This is why this International Standard is expressed in the form of guidelines rather than prescriptions. However, it is not technically possible to define guidelines concerning solely the printing of Digital Postage Marks without taking into account the manufacturing of the mail item as a whole. The readability of the Digital Postage Mark is a function not only of the inherent quality of printing, i.e. the interaction of the ink, substrate and printing mechanism together with the effects of the shape of the mail-piece and its transport through the printing system on the production of the mark, but also of the effects of environmental and handling factors in transit between the production point and the point at which it is to be read. For example, the symbol contrast of Digital Postage Marks is not only that provided by the printer/paper combination under defined illumination conditions. It also results from a variety

of other factors among which the covering of the mail item or the material of the transparent window through which the Digital Postage Mark may be seen. As a consequence, the guidelines described in this International Standard apply to the Digital Postage Mark blocks of fully assembled mail items. It is the responsibility of the users of this International Standard to achieve compliance with the guidelines by controlling the effects of the physical elements resulting in the relevant attributes.

The guidelines are primarily a tool for predicting the level of Digital Postage Mark readability with respect to current scanning technologies, and compliance with them should result in a high level of Digital Postage Mark readability. The guidelines are aimed at facilitating the relations between postal operators and customers, vendors of mail generation and printing equipment and suppliers of mail reading and sorting equipment. In particular, equipment vendors need firm and precise guidance in designing print systems and formats for machine readability. Therefore, a quantitative specification of print quality is critical to the development of products that meet the needs of mailers and postal operators.

Information technology — Office equipment — Print quality attributes for machine readable Digital Postage Marks

1 Scope

This International Standard:

— specifies a methodology for the measurement of defined print quality attributes of Digital Postage Marks in the form of two-dimensional bar code symbols on mail-pieces,

— defines methods for grading the results of these measurements and deriving an overall symbol quality grade as a guide to estimating the readability of the Digital Postage Marks,

— provides guidelines for printing and gives information on possible causes of deviation from high grades to assist users in taking appropriate corrective action,

— defines a test procedure for the assessment of printing systems for the production of Digital Postage Marks.

These provisions apply to the Digital Postage Mark blocks as they appear on fully produced mail items when remitted to postal operators, including the characteristics resulting from operations other than printing per se that affect their appearance to a mail processing system (covering, inserts into transparent window envelopes, affixed Digital Postage Mark labels).

This International Standard does not define the qualification tests or sampling requirements necessary to determine the practical feasibility of any specific read rate.

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 15415:2004, *Information technology – Automatic identification and data capture techniques – Bar code print quality test specification – Two-dimensional symbols*

ISO/IEC 15416:2000, *Information technology – Automatic identification and data capture techniques – Bar code print quality test specification – Linear symbols*

ISO/IEC 15419:2001, *Information technology – Automatic identification and data capture techniques – Bar code digital imaging and printing performance testing*

ISO/IEC 15426-2:2005, *Information technology – Automatic identification and data capture techniques – Bar code verifier conformance specification – Part 2: Two-dimensional symbols.*

EN 1556:1996, *Bar coding – Terminology.*

Universal Postal Union (UPU) standard S-28, *Communication of Postal Information using Two-dimensional Symbols*

UPU standard S-36, *Digital Postage Marks: Applications, Security and Design*

UPU standard S-44-1, *Colour and Durability Attributes of Franking Marks*

3 Terms and definitions

For the purposes of this International Standard, the terms and definitions given in ISO/IEC 15415, ISO/IEC 15416, EN 1556 and the following apply:

3.1
broad-band
descriptive of illumination in which the spectral distribution of the light is wide, with a bandwidth in excess of 200 nm at the 50% power level.

3.2
mail format
form taken by a finished mail-piece or other carrier of a Digital Postage Mark, e.g. envelope with or without contents, or flat sheet of paper

3.3
narrow-band
descriptive of illumination in which the spectral power distribution is concentrated in a narrow band of wavelengths, with a bandwidth of less than 200 nm at the 50% power level.

3.4
overall symbol grade
measure of symbol quality calculated as arithmetic mean of scan grades from a number of individual scans of the symbol

3.5
read rate
percentage representing the number of items carrying digital postage marks that have been successfully read, out of all such items attempted to be read in a given period.

3.6
scan grade
result of the assessment of a single scan of a symbol, derived by taking the lowest grade achieved for any measured parameter in that scan.

3.7
spectral response characteristic
integral response of the reading system, a function of wavelength across the spectral region of interest and calculated for each wavelength as the product of the intensity of light emitted, the transmission characteristic of any filters or coatings used, and the response of the sensor element at that wavelength.

3.8
validation
technical process by which the authenticity, data integrity and uniqueness of a Digital Postage Mark are confirmed or denied.

3.9
verification
technical process by which a bar code symbol is measured to determine its conformance with the specification for that symbol.

3.10
verifier
device used to measure and analyse quality attributes of a bar code symbol such as element and quiet zone dimensions, reflectances, and other aspects against a standard to which the bar code symbol should conform

4 Symbols and abbreviations

dpi dots per inch (25.4 mm)

dpmm dots per millimetre

°K degrees Kelvin

UEC Unused Error Correction

X nominal width of a narrow element (bar code) or of a module (matrix code)

Y nominal height of an element (bar code)

5 Requirements

The print quality requirement for a Digital Postage Mark, when measured in accordance with ISO/IEC 15415 and the following clauses, is expressed in the form:

grade/aperture/light/angle, where:

— "*grade*" is the overall symbol grade, i.e. the arithmetic mean to one decimal place of the scan reflectance profile or scan grades,

NOTE where the value is followed by an asterisk it indicates that there are extremes of reflectance in the symbol surroundings which may potentially interfere with reading

— *"aperture"* is the aperture reference number (from ISO/IEC 15416 for linear scanning techniques, or the diameter in thousandths of an inch (to the nearest thousandth) of the synthetic aperture defined in ISO/IEC 15415),

— "*light*" defines the illumination: a numeric value indicates the peak light wavelength in nanometres (for narrow-band illumination); the alphabetic character W indicates that the symbol has been measured with broad-band illumination (sometimes referred to as "white light" although the terms are not directly equivalent) the spectral response characteristics of which must imperatively be defined or have their source specification clearly referenced.

— *"angle"* is an additional parameter defining the angle of incidence (relative to the plane of the symbol) of the illumination. It shall be included in the reporting of the overall symbol grade when the angle of incidence is other than 45°. Its absence indicates that the angle of incidence is 45°.

In view of the close correlation between print quality and reading performance, where maximum reading performance is critical, a Digital Postage Mark represented by a two-dimensional bar code symbol should achieve a minimum overall symbol grade of 2,8 under the following measurement conditions:

— aperture diameter 0,25 mm (reference number 10), in the case of a Digital Postage Mark in the form of a two-dimensional multi-row bar code symbol, or

— aperture diameter 0,40 mm (reference number 16), in the case of a Digital Postage Mark in the form of a two-dimensional matrix symbol,

and

— peak wavelength of 660 nm in the case of a Digital Postage Mark intended to be read under narrow-band illumination, or

— light reference W, together with the specification of the spectral response characteristics used or a reference to a source of this specification, in the case of a Digital Postage Mark intended to be read under broad-band illumination.

NOTE The aperture reference number represents the nominal diameter, in thousandths of an inch, of the measuring aperture. For multi-row symbologies, ISO/IEC 15415 specifies that its diameter is to be determined by the application specification; see 7.4.1. For matrix symbols, the measuring aperture diameter is a function of the symbol X dimension; see 7.4.2.

In either case the angle of incidence of the light shall be 45°.

These would be expressed as, for example,

2,8/16/W (with the spectral response specification, or an appropriate reference) for a Digital Postage Mark in the form of a two-dimensional matrix symbol intended for reading in broad-band light, or

2,8/10/660 for a Digital Postage Mark in the form of a multi-row bar code symbol intended to be read in narrow-band (visible red) light with a peak wavelength of 660 nm.

The illumination conditions used for verification shall imperatively be specified or clearly referenced with the verification results.

In order to allow for the effect of less easily controllable substrates, where a somewhat lower read rate may result (for example with Digital Postage Mark symbols printed on relatively low-reflectance substrates that are unable to meet the preferred symbol contrast requirements), the overall symbol grade requirement may be reduced to 1,8 provided that all measured parameters except Symbol Contrast are consistent with the requirements of the higher grade of 2,8. A minimum overall symbol grade of 1,8 governed by any of the measured parameters would probably lead to a further reduction in read rate performance. See clause 8 for details, and Annex C for a description of the measurement parameters.

While the above grades are recommended as the minima to ensure an adequate read rate, postal operators may determine their minimum recommended grades corresponding to the particular reading requirements of their environment or to the read rate which they require.

6 Basic measurement methodology

Digital Postage Marks shall be measured according to the methodology defined in ISO/IEC 15415 for the type of symbology concerned, either two-dimensional multi-row symbologies (e.g. PDF417 as defined in ISO/IEC 15438) or two-dimensional matrix symbologies (e.g. DataMatrix as defined in ISO/IEC 16022). The print quality requirements specified in ISO/IEC 15438 and ISO/IEC 16022, and in similar symbology standards, which were published prior to the development of the generic methodologies defined in ISO/IEC 15415 shall not be applied to the evaluation of Digital Postage Marks.

NOTE For two-dimensional multi-row symbols, ISO/IEC 15415 adapts (and supplements) the methodology for the print quality assessment of linear bar code symbols defined in ISO/IEC 15416. For matrix symbols, the methodology of ISO/IEC 15415 requires the capture of a two-dimensional grey-scale image of the symbol to be verified, under defined and controlled illumination conditions, and the processing of the image to analyse its specified parameters. ISO/IEC 15415 defines the reference optical arrangement to be used for measurement, and the symbol attributes to be measured (see Annex C for a list of the measured parameters for each type of symbol). ISO/IEC 15415 requires to be read in conjunction with the International Standard or other equivalent formal specification of the symbology concerned and in particular makes use of the reference decode algorithm defined in that specification as a common, standard basis for evaluation. It assigns grades on a five-step scale to each of the parameters; there are four passing grades, from 4 to 1 in descending order of quality, and one failing grade of 0. It provides for multiple scans of the symbol in different positions in order to derive an average assessment of the symbol, and defines an overall grading scheme that takes account of the individual

