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Information technology – Automatic identification and data capture techniques – Bar code printer and bar code reader performance testing specification

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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

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.

Introduction

Bar code printers and bar code readers are key equipment in auto-ID systems. However, manufacturers of this equipment evaluate their products' performance by their own test methods and measures, specifying this performance in their catalogues. As a result, actual performance varies, although there are some performance values that are the same across catalogues. Therefore, users are forced to test the equipment in order to find the most suitable solutions for their applications, at their own cost.

This document was developed to provide standard test and ranking methods giving users a **common ruler** to be able to evaluate performance values in selecting equipment to meet their needs.

Furthermore, this document is expected to be used in avoiding using poor quality products.

NOTE There are ISO/IEC 15419 and ISO/IEC 15423. ISO/IEC 15419 mainly specifies how to print a barcode as a digital image, so that the contents focus on software development and look like a technical suggestion with no details on how to evaluate performances of a bar code printer in total.

This document specifies more details how to test and evaluate complete printer performances including durability of printed labels.

ISO/IEC 15423 is made based on that a scanner and a decoder are separated devices, which is a quite old fashion system. Although, a combination case of a scanner and a decoder is mentioned.

This document specifies more details how to test and evaluate reader performances, which covers test items specified in ISO/IEC 15423.

Information technology – Automatic identification and data capture techniques – Bar code printer and bar code reader performance testing specification

1 Scope

This document specifies the performance evaluation specifications of thermal transfer type printers (hereinafter referred to as bar code printers), consumables, and bar code readers (regardless of the reading method) used in bar code systems. The rank of performance is also defined by the evaluation items.

This document can be applied to the following evaluation tests by combining ISO/IEC 15416 and ISO/IEC 15415, which define the print qualities of bar code symbols.

NOTE This document is not prevented from being cited in the evaluation of thermal printers using thermal paper and printers using "plain or exclusive paper" (commercial printing, ink jet printers, electrophotographic printers, etc.).

a) Print performance of bar code printers (including consumables)

b) Brightness and smoothness of "reception paper or label", and adhesion of the label

c) Strength of reception paper or label on which the bar code is printed

d) Reading performance of bar code readers

e) Electrical, mechanical and environmental characteristics of bar code printers and bar code readers

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 105-A03, *Textiles — Tests for colour fastness — Part A03: Grey scale for assessing staining*

ISO 105-C06, *Textiles — Tests for colour fastness — Part C06: Colour fastness to domestic and commercial laundering*

ISO 105-F09, *Textiles — Tests for colour fastness — Part F09: Specification for cotton rubbing cloth*

ISO 105-X11, *Textiles — Tests for colour fastness — Part X11: Colour fastness to hot pressing*

ISO 105-X12, *Textiles — Tests for colour fastness — Part X12: Colour fastness to rubbing*

ISO 2470-1, *Paper, board and pulps — Measurement of diffuse blue reflectance factor — Part 1: Indoor daylight conditions (ISO brightness)*

ISO 29862, *Self adhesive tapes — Determination of peel adhesion properties*

ISO 6353-2, *Reagents for chemical analysis — Part 2: Specifications — First series*

ISO 8791-5, *Paper and board — Determination of roughness/smoothness (air leak methods) — Part 5: Oken method*

ISO/IEC 15426-1, *Information technology — Automatic identification and data capture techniques — Bar code verifier conformance specification — Part 1: Linear symbols*

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

ISO/IEC 19762, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary*

ISO/IEC 60068-2-1, *Environmental testing — Part 2-1: Tests — Test A: Cold*

ISO/IEC 60068-2-6, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)*

ISO/IEC 60068-2-78, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

ISO/IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

ISO/IEC 61000-4-2, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques — Electrostatic discharge immunity test*

ISO/IEC 61000-4-3, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test*

ISO/IEC 61000-4-4, *Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test*

IEC CISPR 32, *Electromagnetic compatibility of multimedia equipment — Emission requirements*

3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in ISO/IEC 19762, and the following 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

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

3.1 Terms and definitions

3.1.1
adhesion characteristics
clinging performance of a label attached to a base material to be adhered.

3.1.2
brightness
degree of whiteness of the print surface of the reception paper or label.

3.1.3
ceramic label
label in which a bar code symbol is printed on the surface of a raw ceramic material before-burning, and then is burned to form a ceramic.

3.1.4
consumables
reception papers, labels and ribbons that shall be refilled by the user as needed.

3.1.5
fixed mount reader
bar code reader (also called a stationary reader) that is fixed to specific locations.

3.1.6
label
reception paper having an adhesive applied to the back surface thereof.

3.1.7
ladder type print
print state in which the height direction of the bar is perpendicular to the movement direction of the medium to be printed.

3.1.8
lateral motion reading speed
maximum speed at which a one-dimensional symbol can be read while the symbol or the bar code reader is moving in a direction perpendicular to the elements of symbols.

3.1.9
nominal dpi
number of dots per inch, rounded to be conventionally an integral number, multiplied by 25,4 times the number of dots per mm.

3.1.10
performance rank
ranking for performance of each evaluation item.

3.1.11
picket fence print
print state in which the height direction of the bar is in the horizontal direction with respect to the movement direction of the medium to be printed.

3.1.12
print
transfer ink from a ribbon to a reception paper or a label using a thermal transfer printer and represent a bar code, etc.

3.1.13
printing
press a bar code using a plate and ink.

3.1.14
reception paper
paper or film having an ink receptible layer.

3.1.15
release liner
paper or film (also referred to as backing paper) having a surface processed to be anti-adhesive.

3.1.16
ribbon
roll of hot-melt ink applied to one side of a film.

3.1.17
smoothness
degree of the flatness of a reception paper or label surface.

3.1.18
test chart
high-precision bar code symbol printed on a photo paper for use in the reading performance test of bar code readers.

3.1.19
thermal print head
electronic component having a structure in which a multiple of minute heating resistors are linearly arranged, and which works to apply heat to a ribbon.

3.1.20
thermal transfer printer and bar code printer
equipment that incorporates a function of converting data into a bar code image and transfers ink from a ribbon using heat (by any method of thermal transfer) to the image.

3.2 Symbols

In this document, unless otherwise specified, the following symbols are used:

AV Variation of read time between print quality grades in axial non-uniformity test

B Number of bends in the interface cable strength test

BRPT Test charts for bar code reader performance tests

DCV Variation of reading time between print quality grades in decoding facility test

DOF Reading depth when bar code reader reads symbol (depth of field)

DV Variation of read time between print quality grades in defect test

F Smoothness of the reception paper

FV Variation of read time between print quality grades in fixed pattern damage test

GV Variation of read time between print quality grades in grid non-uniformity test

H Fall distance in non-pack drop test

L Maximum illuminance in the ambient illuminance test

Ms Moving speed of the moving object reading speed test

MV Variation of read time between print quality grades in modulation test

N Number of depressions in the trigger switch endurance test

PSmax Maximum print speed

Re Minimum print resolution

RT Value obtained by dividing the reading time in the reading speed test by the number of readings (100)

RTV Time obtained by subtracting the minimum reading time from the maximum reading time in the symbol contrast test

T Time to print 50 consecutive sets of standard images

Tmps The value obtained by dividing T by 50 when consecutive sets of standard images were printed with print quality overall grade 1,5 or a value more than but close to 1,5

UV Variation of read Time between print quality grades in unused error correction capacity test

Va Electrostatic strength in the air discharge test

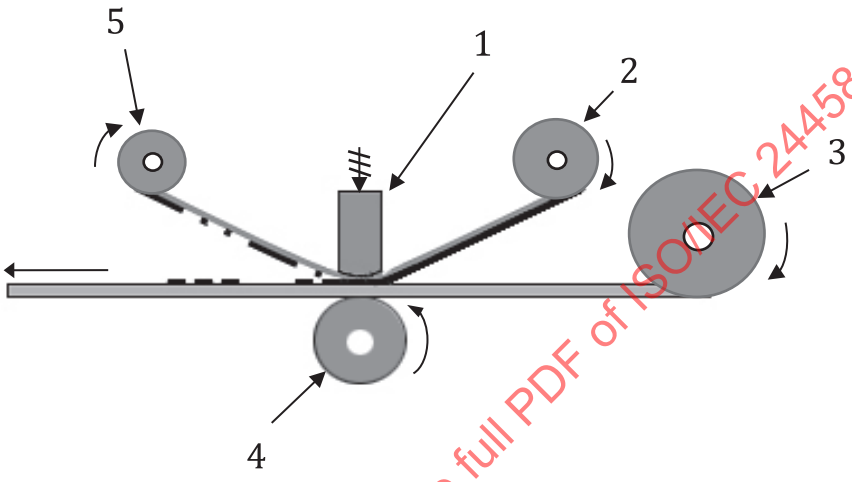
Vc Electrostatic strength in contact discharge test

4 Bar code printer and consumables

4.1 Bar code printer

4.1.1 General requirements

Basic print-mechanism of a general thermal transfer printer is shown in Figure 1.



Key

1 thermal print head
2 ribbon (unwinding)
3 reception paper of label roles (supplying)
4 platen roller
5 ribbon (winding)

Figure 1 — Basic print mechanism of thermal transfer printer

As shown in Figure 1, a "reception paper or label" and a ribbon are passed between the platen roller and the thermal print head, and the thermal print head is normally pressed down and secured to provide the appropriate print pressure. As the platen roller rotates in the direction of the arrow, the "reception paper or label" and ribbon move in the transport direction. In synchronism with this movement, the ink on the ribbon is melted by heating the heating elements of the thermal print head and transferred to the “reception paper or label”. At this time, the heating element that heats is only an element corresponding to the image to be printed.

Print condition setting and environmental conditions are as follows.

a) Print condition setting on thermal transfer printer to be evaluated

It is desirable that a thermal transfer printer to be evaluated in this document is set to a condition estimated to be optimal for the "reception paper or label" and the ribbon used in the test. This print setting serves to maximize the print performance of the bar code printer to be evaluated.

NOTE In the thermal transfer type, it is known that the print quality varies depending on the combination of the "reception paper or label" and the ribbon.

b) Ambient environment conditions

For bar code printers in which ink is melted by heat and transferred to a “reception paper or label”, ambient temperature affects print quality, but also thermal conductivity, specific heat capacity, etc. of the “reception paper or label”, the ribbon, the platen, etc. affect print quality. Also, condensation on the thermal print head may cause failure. In order to print bar codes while maintaining high print quality, precaution shall be paid to the surrounding environment.

Performance tests of bar code printers shall be performed under the following environmental conditions. However, when the environmental conditions are individually stipulated in each performance evaluation test item, or when there is a quote standard in each evaluation test item, the stipulations or standard shall be given priority. In addition, during tests, the temperature and/or humidity shall not be abruptly changed to conditions where condensation occurs.

— temperature : 18 °C to 28 °C

— humidity : 30 % Rh to 70 % Rh

— Before starting the performance evaluation tests, the main body of the bar code printer (non-energization), the "reception paper or label" and the ribbon used for the tests shall be left in the above-mentioned temperature and humidity environment for at least 6 h.

Ambient environmental conditions at the time of the tests shall be recorded in the test result report of 4.3 together with the test results.

4.1.2 Performance evaluation items and test methods

4.1.2.1 Standard image for evaluation of printer performance tests

Standard images for evaluation of printer performance (hereinafter referred to as standard images) shall be used and evaluated under the specified conditions.

The standard image is based on BCP-nnn-1 (nnn is nominal dpi; the same applies hereinafter) and BCP-nnn-2 (see Figure 2), and the combination shown in Figure 4 is set in accordance with the width of the reception paper or label. The standard image has the following features (see Annex A).

— One-dimensional and two-dimensional symbols for evaluating bar code print quality

— Corner marks (see Figure 5) that help to visually determine print quality

— Image pattern to use all of the heating elements that enables failure detection of the thermal printhead heating elements

— 90 degrees rotated bar code for knowing the quality of print in ladder type and in picket fence type

— Strings to determine the legibility of small characters

— Counter for counting the number of prints (one set)

— Logo mark may be printed in image mode (see A.2)

The corner mark shall use the bitmap image defined in A.1.1. The other images shall be created by a dedicated commands of the bar code printer to be evaluated. The positions at which the one-dimensional symbols and the two-dimensional symbols are printed are based on the arrangement shown in Figure 2, but the base points of each symbol are not defined. However, it shall not be arranged so as to infringe the quiet zone of the symbol.

The size of BCP-nnn-1 and BCP-nnn-2 is 50,8 mm × 76,2 mm (2 inches × 3 inches), which can be used in conjunction for nominal 200, 300, 400 and 600 dpi bar code printers commonly used for “reception papers or labels” of 50,4 mm (2 inches) to 203,2 mm (8 inches) wide and 254,0 mm (10 inches) wide (see Figure 4).

NOTE 1 dpi is the resolution and the number of dots per inch (1 inch is 25,4 mm).

NOTE 2 The standard image is mainly used to evaluate the maximum print speed, the minimum print resolution, the suitability of the reception paper or label with the ribbon, and the like.

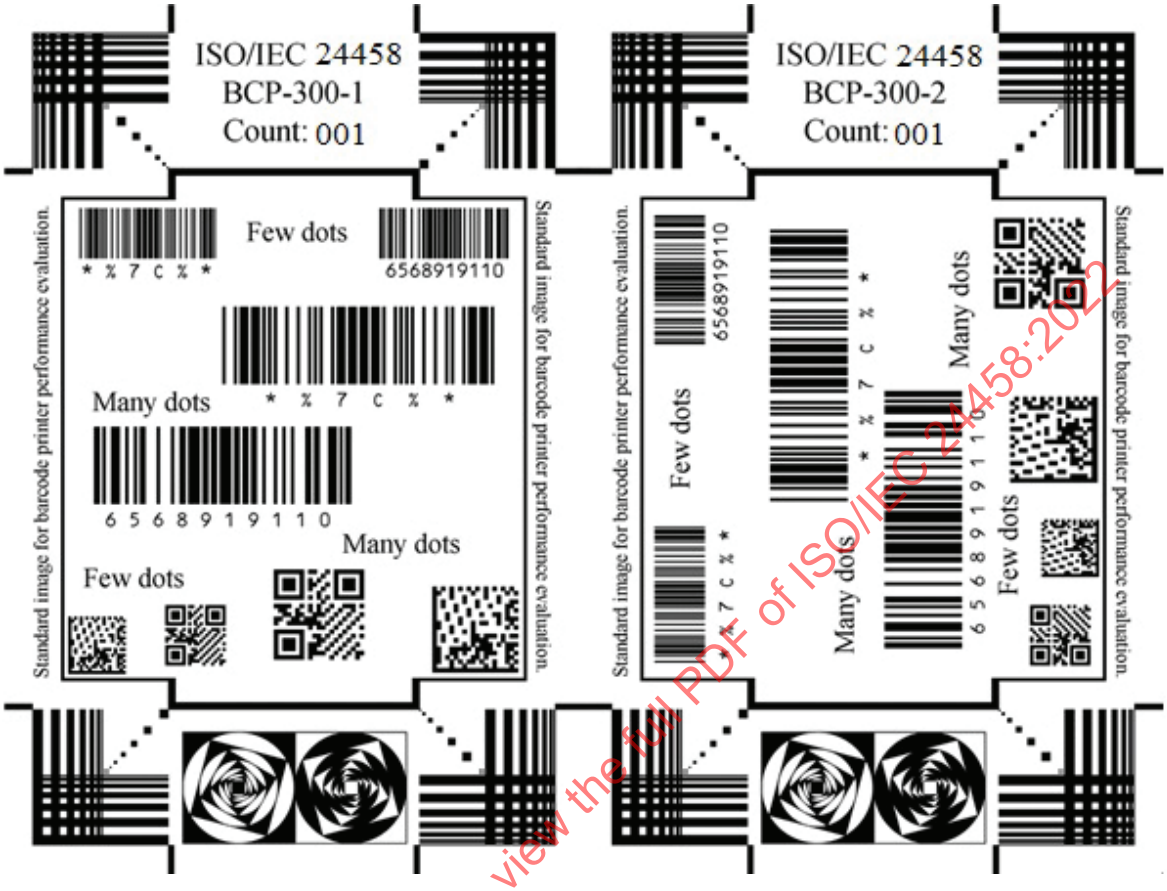


Figure 2 — Example of individual image arrangement of standard image for evaluation of performance of bar code printer

— The International Standard number ("ISO/IEC 24458"), standard image number ("BCP-300-1" and "BCP-300-2"), number count ("count:001") and "Standard image for bar code printer performance evaluation." displayed on the standard image shall be selected from the fonts and sizes built into the barcode printer.

NOTE 3 Font and size are taken into account so as not to break the overall balance.

— As the frame line width surrounding the bar code symbol, the numbers of dots constituting the minimum element (many dots) of the one-dimensional symbol are used (see Table 1).

— The value of the number-of-sheets count is printed on anyone (or all) of the standard images in the set of standard images defined in Figure 4. Table 1 shows the number of dots constituting the minimum elements of the one-dimensional symbol and the two-dimensional symbol according to dpi of the bar code printer.

Table 1 — Number of dots making up the minimum element at nominal dpi

Nominal dpi	One-dimensional symbol		Two-dimensional symbol	
	Few dots	Many dots	Few dots	Many dots
180	1(0,143 mm)	2(0,286 mm)	2(0,286 mm)	3(0,429 mm)
200	1(0,125 mm)	2(0,250 mm)	2(0,250 mm)	3(0,375 mm)
NOTE Numbers in parentheses are reference values obtained by converting the number of dots into mm.				

Table 1 *(continued)*

Nominal dpi	One-dimensional symbol		Two-dimensional symbol	
	Few dots	Many dots	Few dots	Many dots
300	2(0,167 mm)	3(0,250 mm)	3(0,250 mm)	4(0,333 mm)
360	2(0,143 mm)	3(0,214 mm)	3(0,214 mm)	5(0,357 mm)
400	2(0,125 mm)	4(0,250 mm)	3(0,188 mm)	6(0,375 mm)
600	2(0,083 mm)	6(0,250 mm)	3(0,125 mm)	8(0,333 mm)
NOTE Numbers in parentheses are reference values obtained by converting the number of dots into mm.				

The specifications of the one-dimensional symbol and the two-dimensional symbol to be printed with the standard image are shown in Table 2.

Table 2 — Specifications of bar codes printed in standard Image

Item	Code 39 (See ISO/ IEC 16388)	Code 128 (See ISO/IEC 15417)	Data matrix (See ISO/IEC 16022)	QR code (See ISO/ IEC 18004)
Data	*%7C%*	STC 65 68 91 91 10	40 "0"s	41 "0"s
Narrow/wide ratio (N)	1:3	—	—	—
Intercharacter gap	1X	—	—	—
Check character	None	66(STX)	—	—
Bar height (Regardless with few dots or many dots bar width)			—	—
(180 dpi)[a]	[35 dots (approx.5 mm) or more]			
200 dpi	40 dots (approx.5 mm) or more			
300 dpi	60 dots (approx.5 mm) or more			
(360 dpi)[a]	[70 dots (approx.5 mm) or more]			
400 dpi	80 dots (approx.5 mm) or more			
600 dpi	120 dots (approx.5 mm) or more			
Symbol size and error correction level	-	-	20 x 20 automatic	21 x 21 L
Readable characters and points	OCR B not specified	OCR B not specified	None	None
NOTE The first "STC" in the data of the code 128 represents the start C.				
[a] The bar height can vary because a “reception paper or label” less than 50,8 mm (2 inches) wide can be improperly printed.				

The print combination of the standard image according to the “reception paper or label” width is according to Figure 4. The downward arrow is the direction of transportation of the "reception paper or label" and the ribbon. In Figure 4, the 127,0 mm (5 inches) wide and the 177,8 mm (7 inches) wide are printed by providing blanks of 25,4 mm (1 in) (if there are changes in the 127,0 mm (5 inches) width and the 177,8 mm (7 inches) width, provide appropriate blanks) between BCP-nnn-1 and BCP-nnn-2. At this time, the two protruding lines of the opposed corner marks shall be extended and connected. The “reception paper or label” and the ribbon shall be of a size sufficient to print a standard image.

Bar code printers that use a “reception paper or label” other than the width shown in Figure 4, for example, in the form of a tape less than 50,8 mm (2 inches) wide, may relocate the elementary images

that make up the standard image and print them side-by-side in series. In this case, print may be performed in the following manner.

— Four corner marks (without two outwardly protruding bars)

— Code 39 changed to the number of printable dots and the number of printable characters

— Printable two-dimensional symbols in Table 2 (sufficient quiet zones shall be provided)

— ISO/IEC number

— Standard image number

— Count the number of sheets

Further, the symbols to be verified for the bar code print quality may be evaluated only by the symbols that have been printed.

An example of using a tape-like reception paper or label less than 2 inches wide is shown in Figure 3.

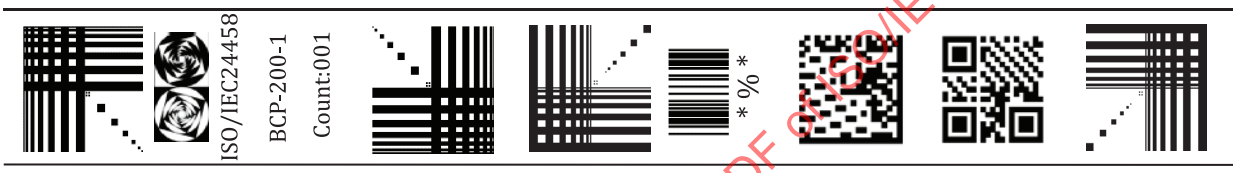


Figure 3 — Example of standard image arrangement for "reception paper or label" less than 50,8 mm (2 inches) wide

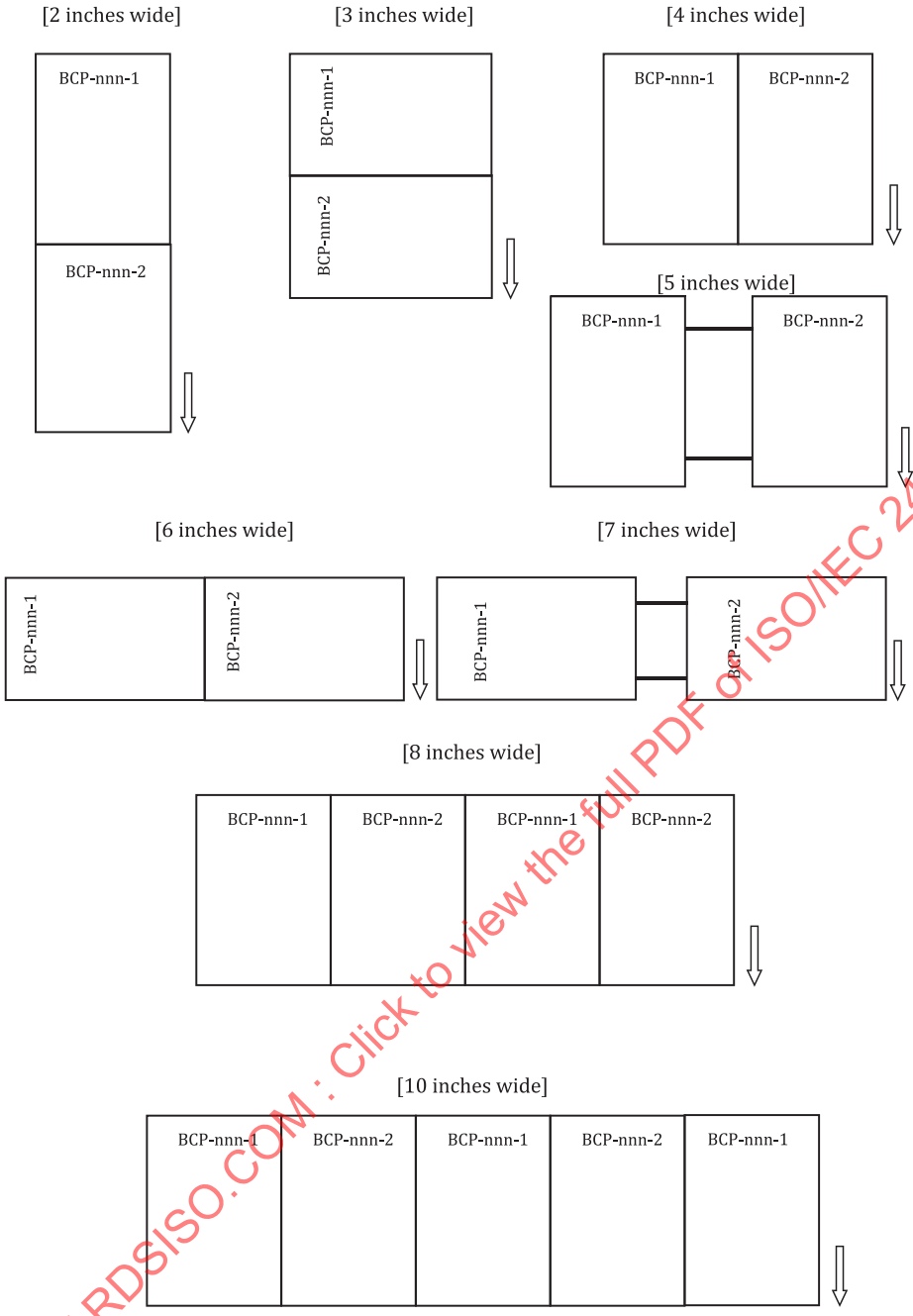


Figure 4 — Standard image print configuration by difference in "reception paper or label" width

Regarding corner marks, enlarged images are shown in Figure 5 and print details are shown in Table 3.

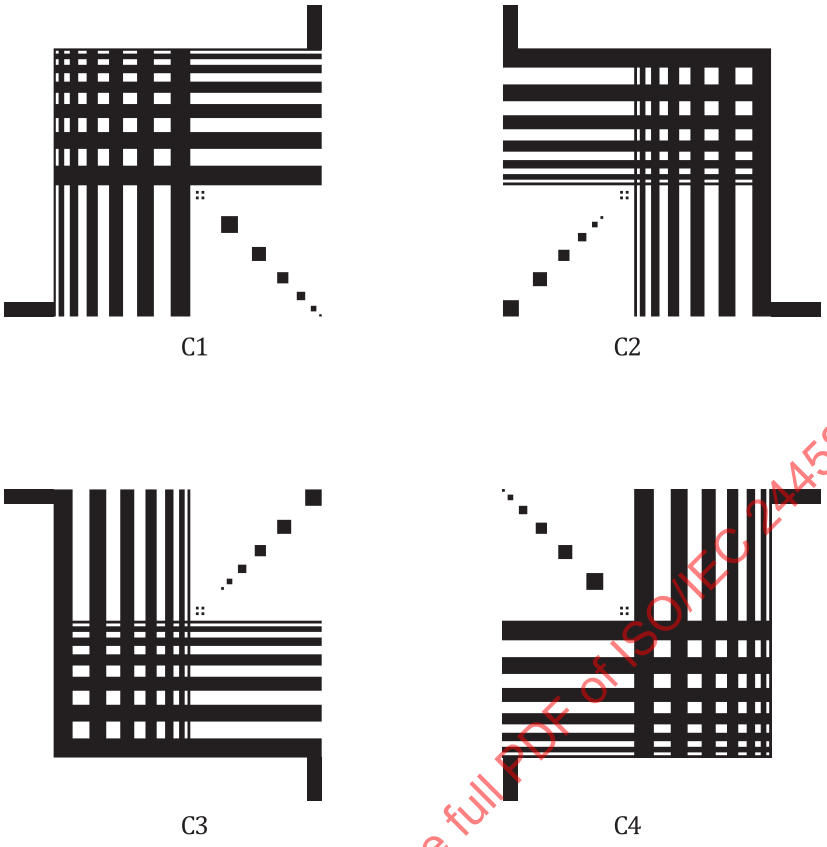


Figure 5 — Enlarged image of corner marks (for nominal 200, 400 and 600 dpi)

Table 3 — Print corner marks

Item	Configuration
Corner marks	Bitmap images (see A.1.2) corresponding to the dpi (nominally 200 dpi, 300 dpi, 400 dpi and 600 dpi) of the bar code printer are printed at specified positions and specified orientations without enlargement or reduction. The print position is as shown in Figure 2.
Protruding line	The corner marks have two lines protruding outward from the whole square. These lines serve to detect a failure of the thermal printhead heating element. For "reception papers or labels" with widths of 127,0 mm (5 inches) and 177,8 mm (7 inches), a length of bar sufficient to fill the gap between BCP-nnn-1 and BCP-nnn-2 is required. The widths of the lines are 4 dots in the nominal 200 dpi and 6 dots in the nominal 300 dpi. The nominal 400 dpi uses twice the nominal 200 dpi of dots, and the nominal 600 dpi uses three times the nominal 200 dpi of dots.
NOTE Do not apply to "reception papers or labels" less than 50,8 mm (2 inches) wide.	

4.1.2.2 Print quality

Here, the evaluation test method of the overall print quality grade of symbols, the maximum print speed and the minimum print resolution are defined. The evaluation specimen is a set of the first, 25th, and 50th samples in which the standard images are arranged according to the width of reception paper or the label as shown in Figure 4 and are printed consecutively. The bar code symbols and corner marks to be evaluated are shown in Table 4.

Table 4 — Bar code symbols and corner marks to be evaluated

Nominal width of the reception paper or label	Bar code symbol to be evaluated for print quality
50,8 mm (2 inches) wide, 101,6 mm (4 inches) wide, 127 mm (5 inches) wide, 203,2 mm (8 inches) wide and 10 inches wide	One-dimensional symbols and two-dimensional symbols (many dots) and four corner marks in BCP-nnn-1 In case of 8-inches wide and 10-inches wide, one-dimensional symbols and two-dimensional symbols (many dots) and four corner marks in the left-most BCP-nnn-1.
76,2 mm (3 inches) wide, 152,4 mm (6 inches) wide and 177,8 mm (7 inches) wide	One-dimensional symbols and two-dimensional symbols (many dots) and four corner marks in BCP-nnn-2
Less than 50,8 mm (2 inches) wide	Code 39, two-dimensional symbols and four corner marks

The bar code printer shall be tested while the speed of transfer of the “reception paper or label” is constant.

The evaluation items of the print performance of the bar code printer and the test methods thereof are as follows.

a) Overall print quality grade

Overall print quality grade of symbols of three sets of “reception papers or labels” printed standard images shall be measured using a verifier conforming to ISO/IEC 15426-1 for one-dimensional symbols and to ISO/IEC 15426-2 for two-dimensional symbols, then verified their grade according to ISO/IEC 15416:2016 for one-dimensional symbols and ISO/IEC 15415:2016 for two-dimensional symbols. The lowest grade among print quality grades (grades expressed numerically) of the above mentioned three samples is figured as the evaluation grade.

b) Maximum print speed

The evaluation of the maximum print speed of the bar code printer shall be performed by printing the standard images under the condition that the overall print quality grade (grade expressed numerically) of the symbols specified in Table 4 shall be 1,5 or a value more than but close to 1,5.

The maximum print speed is determined by the time required to print a set of standard images. The method is as follows.

1) Select the appropriate “reception paper or label” and ribbon, then place them in the bar code printer.

2) The transporting speed of the bar code printer is set at near the target speed, and the time T when 50 sets of standard images are printed in the continuous print mode is measured and temporarily recorded.

3) Check whether the overall print quality grade of the bar code symbols to be evaluated for print quality in Table 4 is 1,5 or more.

The overall print quality grade is a grade expressed numerically, and the measurement aperture of the bar code verifier shall be 0,8 X.

4) In the case of more than 1,5, the transporting speed of the bar code printer is further set to "fast", and 2) and 3) are repeated. If it is less than 1,5, the transporting speed of the bar code printer is further set to "slow", and 2) and 3) are repeated. In the case of a bar code printer in which the transporting speed cannot be finely set, the value is set to 1,5 or a value more than but close to 1,5.

5) The value obtained by dividing T by 50 when 1,5 (or a value more than but close to 1,5) is obtained is the time for print a set of standard images (the time for print one “reception paper or label”), and this is taken as *T*mps.

6) The value obtained by dividing the length (mm) in the transporting direction shown in Figure 4 by the *T*mps value (decimal points are rounded off) is defined as the maximum print speed *PS*max (mm/s).

In this evaluation study, the maximum transporting speed may not become the maximum print speed as it is.

c) Minimum print resolution

1) The minimum print resolution of the bar code printer is not determined by the dpi number of the thermal print head, but is determined by how thin an image element can be printed, when print is performed while ensuring an overall bar code print quality grade of 1,5 or a value more than but close to 1,5.

2) In this document, a standard image adapted to the dpi of the bar code printer is used, and the number of small blank spaces identified in the four corner marks determines the print resolution.

NOTE 1 In general, the 1×1 blank area becomes to be un-identified first. The minimum print resolution often varies depending on the portion to be printed in the form of a fence or in the form of a ladder.

3) The "reception paper or label" and the ribbon used in the evaluation test of the minimum print resolution are preferably selected to be suitable for high density print. In addition, it is desirable that adjustable parameters of the bar code printer are set to be optimum for the minimum print resolution evaluation test.

4) The minimum print resolution is evaluated by the number of visually identified blank areas of squares of different sizes (24 total) and rectangles of different side lengths (120 total) in the four corner marks. It is desirable to observe the image in an enlarged manner so that the image can be clearly identified.

The composition ratio of the closed blank space existing in each corner mark of Figure 5 is shown in Table 5.

Table 5 — Composition ratio of blank areas (squares and rectangles) present in corner marks

C1 corner mark

1×1	1×2	1×3	1×4	1×5	1×6
2×1	2×2	2×3	2×4	2×5	2×6
3×1	3×2	3×3	3×4	3×5	3×6
4×1	4×2	4×3	4×4	4×5	4×6
5×1	5×2	5×3	5×4	5×5	5×6
6×1	6×2	6×3	6×4	6×5	6×6

C2 corner mark

6×1	6×2	6×3	6×4	6×5	6×6
5×1	5×2	5×3	5×4	5×5	5×6
4×1	4×2	4×3	4×4	4×5	4×6
3×1	3×2	3×3	3×4	3×5	3×6
2×1	2×2	2×3	2×4	2×5	2×6
1×1	1×2	1×3	1×4	1×5	1×6

C3 corner mark

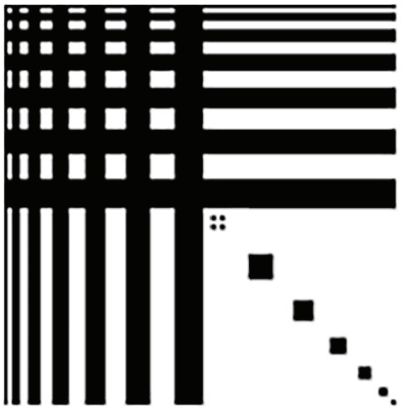
1×6	1×5	1×4	1×3	1×2	1×1
2×6	2×5	2×4	2×3	2×2	2×1
3×6	3×5	3×4	3×3	3×2	3×1
4×6	4×5	4×4	4×3	4×2	4×1
5×6	5×5	5×4	5×3	5×2	5×1
6×6	6×5	6×4	6×3	6×2	6×1

C4 corner mark

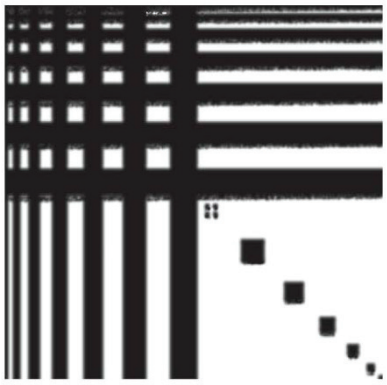
6×6	6×5	6×4	6×3	6×2	6×1
5×6	5×5	5×4	5×3	5×2	5×1
4×6	4×5	4×4	4×3	4×2	4×1
3×6	3×5	3×4	3×3	3×2	3×1
2×6	2×5	2×4	2×3	2×2	2×1
1×6	1×5	1×4	1×3	1×2	1×1

NOTE 2 Numbers in the table show relative dimensions of a blank space in "height" x "width".

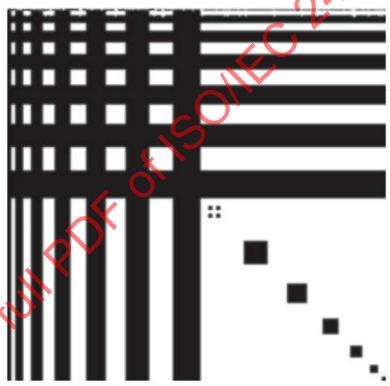
5) The number of not clearly discernable blank spaces shall not be added to the number of identified blank spaces: "the blank space crushed by the thickening of the lines and the blank space divided into multiple spaces [Figure 6 b)]" and "the blank space which is not partially closed among the four sides constituting the blank space to be closed [Figure 6 c)]".



a) Correct blank space



b) Crushed blank space (1×1~1×5) and Multi-segmented blank space (1×6)



c) Blank space that is not closed (1×3~1×6)

Figure 6 — Examples of countable spaces a) and uncountable spaces b) and c)

4.1.2.3 Electrical property

Performance evaluation items and test methods for electrical properties shall be as follows.

a) Operating power supply voltage range (V)

Measure the upper and lower limits of the power supply voltage at the input end of the power supply cable when the bar code printer operates normally using the voltmeter specified in ISO/IEC 60051-2 or a voltmeter equivalent to or higher than the voltmeter.

b) Maximum operating power (W or VA)

The maximum power consumed when 100 or more sheets of standard images with overall bar code print quality of 1,5 or higher are continuously printed shall be measured at the input end of the power supply cable using the power meter specified in ISO/IEC 60051-3 or a power meter equivalent to or higher than the power meter.

c) Maximum standby power (W or VA)

The maximum power consumed by the bar code printer in the sleep mode (in the range of rated power supply voltages, no communication, minimum brightness of various displays, and a state in which print can be started immediately if there is a print directive) shall be measured at the input end of the power supply cable using the power meter specified in ISO/IEC 60051-3 or a power meter equivalent to or higher than the power meter.

d) Electro-static strength (kV)

After both "air discharge" and "contact discharge" specified in ISO/IEC 61000-4-2 are applied to the bar code printer, the maximum test voltage at which normal operation can be maintained shall be measured in both discharge mode.

e) Resistance to power supply line noise (kV)

The resistance to power supply line noise is the resistance of the bar code printer against electromagnetic noise (frequency is 100 kHz) flowing into the power supply line of the bar code printer. The test shall be performed according to ISO/IEC 61000-4-4, and the highest test voltage at which the bar code printer operates normally is measured.

f) Unwanted radiation noise

The unwanted radiation noise from the bar code printer and the noise propagating through the connected power line, signal lines, etc., which can adversely affect the surrounding electronic equipment shall be measured according to IEC CISPR 32.

g) Immunity (EMC)

The immunity is the electromagnetic compatibility (EMC) of the bar code printer against electromagnetic noise coming from the surroundings. Perform the test according to ISO/IEC 61000-4-3, then measure the electric field strength at the highest test level at which the bar code printer can operate normally during the test.

4.1.2.4 Environmental characteristic

Performance evaluation items and test methods for environmental characteristics are as follows.

a) Low temperature operation (°C)

Apply the "Test Ad" of ISO/IEC 60068-2-1 to the bar code printer and measure the lowest temperature at which the printer can operate normally.

b) High temperature and high humidity operation (°C and %)

Apply the tests of ISO/IEC 60068-2-78 to the bar code printer and measure the most severe temperature and humidity at which the bar code printer can operate normally.

4.1.2.5 Mechanical characteristics (vibration resistance characteristics with packaging)

Apply the test of ISO/IEC 60068-2-6 to the bar code printer, then confirm that the printer operates normally even after the test is carried out under the following conditions.

— Frequencies 10 Hz to 55 Hz

— Accelerometric 20 m/sec^2/X, Y, Z axes

— Cycles: 100 cycles in each direction

4.1.3 Performance ranking

4.1.3.1 General

Performance is ranked according to performance evaluation results for each evaluation test item specified so. The ranks are rank “S”, rank “I”, rank “II”, and rank “III” from the top.

NOTE The rank “S” is a performance rank that existing bar code printers have not achieved at the time of the preparation of this document and is set as a target for promoting future technological development.

4.1.3.2 Print performance

The ranking of print performances is as follows.

a) Overall print quality

No ranking is performed.

b) Maximum print speed PS_{max} (mm/s)

The test is performed according to 4.1.2.2 b) and the rank is selected from Table 6 based on the test results.

Table 6 — Rank of maximum print speed

Ranking	PS_{max}(mm/s)	PS_{max} (in/s) (reference)
S	$PS_{max} > 355$	$PS_{max} > 14$
I	$355 \geqq PS_{max} > 203$	$14 \geqq PS_{max} > 8$
II	$203 \geqq PS_{max} > 76$	$8 \geqq PS_{max} > 3$
III	$76 \geqq PS_{max}$	$3 \geqq PS_{max}$

c) Minimum print resolution

The test is performed according to 4.1.2.2 c) and the rank is selected from Table 7 based on the test results (the number of identified blanks).

Table 7 — Rank of minimum print resolution

Ranking	Number of identified blank spaces R_e
S	$R_e = 144$
I	$143 \geqq R_e > 131$
II	$131 \geqq R_e > 124$
III	$124 \geqq R_e$

4.1.3.3 Electrical property

The ranking of electrical properties is as follows.

a) Operating power supply voltage range (V)

No ranking is performed.

b) Maximum operating power (W or VA)

No ranking is performed.

c) Maximum standby power (W or VA)

No ranking is performed.

d) Electro-static strength (kV)

The tests are performed according to 4.1.2.3 d) and the ranks are selected from Table 8 based on the test results.

Table 8 — Electro-static Strength Rank

Ranking	Test voltage (kV)	
	Contact discharge V_C	Air discharge Va
S	12 or more	20 or more
I	8	15
II	6	8
III	4 or less	4 or less
NOTE ISO/IEC 61000-4-2 quoted in 4.1.2.3 d) specifies stepped test voltages, and therefore does not rank at interim values.		

e) Resistance to power supply noise (kV)

The test is performed according to 4.1.2.3 e) and the rank is selected from Table 9 based on the test results.

Table 9 — Power supply resistance noise rank

Ranking	Test voltage (kV)
S	6
I	4
II	2
III	1 or less
NOTE ISO/IEC 61000-4-4 quoted in 4.1.2.3 e) specifies stepped study voltages and therefore does not rank at interim values.	

f) Unwanted radiation noise

No ranking is performed.

g) Immunity

The test is performed according to 4.1.2.3 g) and the rank is selected from Table 10 based on the test results.

Table 10 — Immunity rank

Ranking	Test field strength (V/m)
S	30
I	10
II	3
III	1

4.1.3.4 Environmental characteristic

No ranking is performed.

4.1.3.5 Mechanical characteristics (vibration resistance characteristics in packaging)

No ranking is performed.

4.2 Consumables (reception papers, labels and ribbons)

4.2.1 General requirement

The test conditions for evaluating performance are as follows.

NOTE Since determining the characteristics of the ribbon alone requires a specific test equipment and is generally difficult, the performance is determined by the characteristics after the bar code is printed on the label in this document.

a) Ambient environmental conditions

Tests for performance evaluation shall be conducted under the following ambient environmental conditions. However, in the case where the ambient environmental conditions are individually specified in each performance evaluation item, or in the case where there is a quoted standard in each performance evaluation item, the specification or the standard shall be given priority.

Ambient environmental conditions at the time of the test shall be recorded in the test result report of 4.3 together with the test results.

— Temperature : (23 ± 2) °C

— Humidity : (50 ± 5) %Rh

b) Reception papers or labels

For brightness and smoothness tests, samples of "reception papers or labels" that are not printed at all shall be prepared.

c) Others

In addition, for the test of scratch resistance, water resistance, chemical resistance, heat resistance, etc., a ribbon suitable for the type of the "reception paper or label" shall be used, and the "reception paper or label" on which the bar code symbol prescribed in Figure 7 is printed shall be used as a specimen.

Key

1 reception paper or label

2 rubbing area

3 verification area

Dimensions of "reception papers or labels": about 120 mm × 30 mm

— The bar code symbol is preferably printed on the central of the "reception paper or label".

— Bar code symbols may be without human readable characters.

Bar code symbol: Code128, X dimension = 0,5 mm, height = about 15 mm

Data: 6568919110 (Character Set C)

Figure 7 — Print label specifications for evaluation test

4.2.2 Performance evaluation items and test methods

4.2.2.1 Basic characteristic

The consumables test methods shall be as follows.

a) Brightness (%)

For the brightness test specimens, 100 “reception papers or labels” of the dimensions specified in ISO 2470-1 shall be prepared. 10 sheets are stacked in one set in the case of reception papers, and 9 sheets without a release liner are stuck on a remaining sheet to be one set in the case of labels. Then, 10 sets of test specimens are prepared in each case. The brightness of 10 test specimens are measured according to ISO 2470-1 and the results are averaged.

However, this test does not apply to ceramic labels.

b) Smoothness (s)

“Reception papers or labels (in the form with release papers)” used in the test for smoothness are measured 10 times according to ISO 8791-5 and the results are averaged.

However, this test does not apply to ceramic labels.

4.2.2.2 Abrasion resistance tests

Perform the tests with the friction tester type II specified in the ISO 105-X12, then verify the overall print-quality grades at the places where the bar code symbols were rubbed (see Figure 7). When the specimens on which the bar code symbol is printed is mounted on the friction tester type II, they may be attached to an appropriate base paper if necessary. The overall print quality grade (grades expressed numerically) of the bar code symbol before the test shall be in the range of 2,5 to 4,0. For each of the 10 samples, calculate the degree to which the overall print quality grade before the test was reduced after the test, and determine the average value of the 10 specimens (rounded off to the first decimal place).

However, these tests do not apply to ceramic labels.

Common test conditions are as follows.

— Friction head : 20 mm × 20 mm, R45

— Stroke-length : 100 mm

— Force to push : (2 ± 0,1) N

— Stroke speed : 30 reciprocations of 100 mm per minute

— Number of specimens : 10

— Number of stroke : 50 reciprocation

— Verification area : approximately 100 mm×16 mm at the central of the rubbing area (see Figure 7)

The test method using the corrugated card-board piece, the test method using water, the test method using ethanol, and the test method using the synthetic detergent are as follows.

a) Corrugated card-board abrasion resistance test

The corrugated card-board pieces used in the corrugated card-board abrasion resistance test shall be B-flutes (3 mm thickness and 50 ± 2 flutes/30 cm) with dimension of 20 mm × 20 mm.

Figure 8 shows the stroke direction of the corrugated card-board piece.

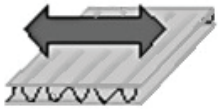


Figure 8 — Direction of stroke movement of corrugated card-board piece

b) Water abrasion resistance test

The test shall be performed by impregnating approximately 0,5 ml of general industrial water as shown below or water equivalent thereto to one white cotton cloth (approximately 50 mm× 50 mm) specified by ISO 105-F09.

Electrical conductivity (mS/m at 25 °C)	: not more than 0,5
Organic carbon (TOC) (mg C/l)	: not more than 1
Zinc (μg Zn/l)	: not more than 0,5
Chloride ion (μg Cl^-/l)	: not more than 10
Sulfuric acid ion (μg SO_4^{2-}/l)	: not more than 10

c) Ethanol abrasion resistance test

The test shall be performed by impregnating approximately 0,5 ml of ethanol specified in ISO 6353-2 to one white cotton cloth (approximately 50 mm× 50 mm) specified in ISO 105-F09.

d) Synthetic detergent abrasion resistance test

The test shall be performed by impregnating approximately 0,5 ml of synthetic detergent No. 1 or No. 2 as defined in ISO 105-C06 to one white cotton cloth (approximately 50 mm× 50 mm) specified in ISO 105-F09.

4.2.2.3 Iron press resistance test

The test shall be performed according to the dry test of electrical-iron method (Method B) specified in ISO 105-X11 under the following conditions. Maximum test temperature shall be determined when the transition of inks does not exceed the colour difference upper limit of grayscale colour Tables 3-4 specified in ISO 105-A03.

However, this test does not apply to ceramic labels.

— Pressures : (2,5 ± 0,5) kPa

— Time : 15 s

— Temperatures : (70 ± 5) °C, (90 ± 5) °C, (110 ± 5) °C, (150 ± 5) °C and (200 ± 5) °C

4.2.2.4 High temperature resistance

Measure the temperature with a two-colour thermometer, etc when a raw ceramic label is sintered.

This test applies only to ceramic labels.

4.2.2.5 Stickiness of labels

Stickiness of labels test methods shall be as follows.

a) Detachability

When a label is detached from the release paper, determine if the acceptance criteria shown in Table 11 is satisfied.

b) Adhesion and removability

These tests shall be performed according to Method 1 with 180 degrees angle specified in ISO 29862. Determine if each acceptance criteria shown in Table 11 is satisfied.

c) Holding force

This test shall be performed according to Method 1 with 180 degree angle specified in ISO 29862 with a weight of (1000 ± 5) g and time of 60 minutes. Determine if its acceptance criteria shown in Table 11 is satisfied.

However, these tests do not apply to ceramic labels.

Table 11 — List of bar code label stickiness performance evaluation Items

Performance evaluation items			Acceptance criteria
Type 1 (Permanent)	Detachability	Paper label/Film label	There shall be no tearing of the paper (film) label and the release liner, and no glue peeling.
	Adhesion	Paper label	2,4 N/10 mm or more
		Film label	1,8 N/10 mm or more
	Holding force	Paper label/Film label	3 mm or less
Type 2 (Removable)	Detachability	Paper label/Film label	There shall be no tearing of the paper (film) label and the release liner, and no glue peeling.
	Adhesion	Paper label	0,6 N/10 mm or more
		Film label	0,2 N/10 mm or more
	Holding force	Paper label/Film label	3 mm or less
	Removability	Paper label/Film label	No glue residue shall be present.

4.2.3 Performance ranking

4.2.3.1 General

Performance is ranked according to the performance evaluation test results for each evaluation test item specified so. The ranks are rank “S “, rank “I”, rank “II “, and rank “III” from the top, and the evaluation test items that did not reach the specifications are given the ranks of “F”.

NOTE The rank “S” is a performance rank for which existing consumables have not been achieved at the time of the preparation of this document and is set as a target for promoting future technological development.

4.2.3.2 Basic characteristic

The ranking of performances of consumables is as follows.

a) Brightness (%)

No ranking is performed.

b) Smoothness (s)

The tests are performed according to 4.2.2.1 b), and the rank is selected from Table 12 based on the test results.

Table 12 — Smoothness rank

Ranking	Smoothness *F*(s)
S	-
I	$F > 1\,500$
II	$1\,500 \geqq F > 400$
III	$400 \geqq F$

4.2.3.3 Abrasion resistance tests

The corrugated card-board abrasion resistance test, water abrasion resistance test, ethanol abrasion resistance test and synthetic detergent abrasion resistance test shall be performed according to 4.2.2.2, respectively. In each evaluation test, the rank is selected from Table 13 based on the degree to which the overall grade of bar code print quality before the test (numerical grade, to the first decimal place) was reduced after the test.

Table 13 — Abrasion resistance rank

Ranking	Reduction in the overall print quality grade value
S	0
I	Less than 0,5
II	0,5 or more and less than 1,0
III	1,0 or more
F	Overall print quality grade value 0,4 or less

4.2.3.4 Iron press resistance test

The test is performed according to 4.2.2.3 and the rank is selected from Table 14 based on the test results.

Table 14 — Iron press resistance rank

Ranking	Maximum test temperature
S	200 ± 5 °C
I	150 ± 5 °C
II	90 ± 5 °C, 110 ± 5 °C
III	70 ± 5 °C
F	Grayscale condition values are not satisfied.

4.2.3.5 High temperature resistance

No ranking is performed.

4.2.3.6 Stickiness

No ranking is performed.

4.3 Test report

The test result report shall contain the following items.

a) Performance test items specified in 4.1.2 and 4.2.2

b) Test results based on the test methods specified in 4.1.2 and-4.2.2

c) Results of ranking in the method specified in 4.1.3 and 4.2.3

d) Printer model name, printer manufacturer name, thermal head size, nominal dpi, “reception paper or label” type, operator and test date

e) Any deviations from the procedure

f) Any unusual features observed

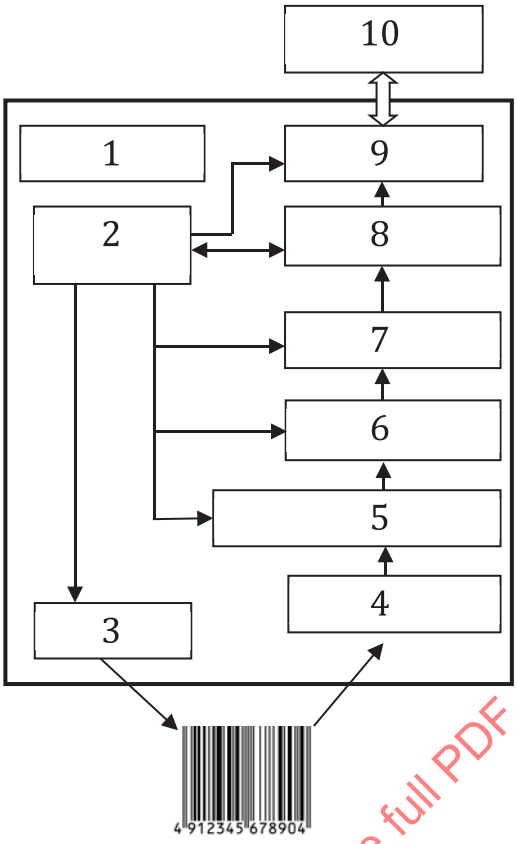
An example of the test report is shown in D.1.

5 Bar code reader

5.1 General

5.1.1 Principle

To read a bar code symbol, an entire bar code symbol shall be scanned in a certain manner, regardless of the type of a bar code reader. Figure 9 shows the basic configuration of a bar code reader.



Key

1 power supply
2 control unit
3 light source
4 optical system
5 light element detector
6 analog processing
7 digital processing
8 decoding process
9 interface
10 external device

Figure 9 — Basic configuration of a bar code reader

5.1.2 Ambient environment conditions

The performance evaluation tests of bar code readers shall be performed under the following ambient environment conditions. However, when the environment conditions are individually stipulated in each evaluation test item, or when there is a referenced standard in each evaluation test item, the stipulation or standard shall be given priority. In addition, during tests, the temperature and/or humidity shall not be abruptly changed to conditions where condensation occurs.

— Temperature :18 °C to 28 °C

— Humidity :30 % Rh to 70 % Rh

— Ambient illuminance :750 Lux or less on a symbol surface

Ambient environment conditions at the time of the test are recorded in the test result report of 5.4 together with the test results.

5.2 Performance evaluation items and test methods

5.2.1 Test chart for reading performance tests

5.2.1.1 General

To perform the reading performance tests of a bar code reader, precision test charts produced using high-precision optical print technologies shown in Annex E shall be used.

A grade value of each test chart shall be close to the lowest value as much as possible within each grade value range with enough consideration on productivity based on tolerances of density and dimensions.

— Dimensional accuracy :±5 µm

— Density accuracy :±0,03 (if reflectance is 2 % or less, ± 0,04)

— Substrate density :0,08

— Surface finish :Semi-gross

— Measurement aperture diameter :0,8 X

NOTE Bar code readers and print quality verifiers are designed to provide correct results when scanned with an aperture diameter that is 0,8 times the minimum element dimension (X) or module size of the bar code symbol.

Evaluation test items using each test chart are shown in Table 15.

Table 15 — Test items for each test chart

Test chart	Chart number	Performance evaluation Items
Test chart for one-dimensional symbols	BRPT-1RES	Reading range, reading angle, reading speed and reading test of moving symbol
	BRPT-1SC-1, –2, –3, –4, –5, –6, –7, –8	Symbol contrast
	BRPT-1MOD-1, –2, –3, –4	Modulation
	BRPT-1DEF-1, –2, –3, –4	Defect
	BRPT-1DEC-1, –2, –3, –4	Decodability
Test chart for two-dimensional symbols	BRPT-2RES	Reading range, reading angle and reading speed
	BRPT-2SC-1, –2, –3, –4, –5, –6, –7, –8	Symbol contrast
	BRPT-2MOD-1, –2, –3, –4	Modulation
	BRPT-2FP-1, –2, –3, –4	Fixed pattern damage
	BRPT-2GNU-1, –2, –3, –4	Grid non-uniformity
	BRPT-2ANU-1, –2, –3, –4	Axial non-uniformity
	BRPT-2UEC-1, –2, –3, –4	Unused error correction (UEC)
NOTE Explanation on test charts is given in Annex E.		

5.2.1.2 Test chart for one-dimensional symbols

The one-dimensional symbol test charts are used to test performances of the reading range, reading angle, reading speed, reading test of moving symbol, symbol contrast, modulation, defects and

decodability, which are the reading performances of a bar code reader. Types of test charts used in the tests are shown in a) to e).

a) For reading range, reading angle, reading speed tests and reading test of moving symbol (No. BRPT-1RES)

The test charts shall be used when testing the reading range, the largest reading angle (pitch angle, skew angle and tilt angle) and the reading speed corresponding to the X dimension.

NOTE 1 All of the symbols in the test charts have overall print quality grade of "4" and there are eight types with X dimensions of 0,100, 0,150, 0,200, 0,250, 0,300, 0,350, 0,400 and 0,450 mm.

b) For symbol contrast test (No. BRPT-1SC-1 to-8)

The symbol contrast is the difference between the maximum reflectance from the substrate surface on which the one-dimensional symbol is printed and the minimum reflectance from the dark module.

This is reversed in the case of inverted symbols.

Generally, the closer this difference is to 100 %, the better the reading performance of the bar code reader is (this is not the case for bar code readers adjusted for low symbol contrast.).

The number of test charts for symbol contrast test shall be eight in the grades as specified in Table 16. When determining the minimum symbol contrast that a bar code reader can read correctly, the test charts of Table 17 shall be used.

Table 16 — Test chart for symbol contrast test

Chart number	Grade	Symbol contrast (%)	R_{max}, examples (%)	R_{min} examples (%)
BRPT-1SC –1	4	74	80	6
BRPT-1SC –2	3	58	80	12
BRPT-1SC –3	2	42	80	38
BRPT-1SC –4	1	21	80	59
BRPT-1SC –5	4	74	79	5
BRPT-1SC –6	3	58	63	5
BRPT-1SC –7	2	42	47	5
BRPT-1SC –8	1	21	26	5

NOTE 2 BRPT-1SC-1 to –8 are based on ISO/IEC 15416:2016, 5.4.4 (symbol contrast). The BRPT-1SC-1 to –4 are created by keeping the light reflectance constant and changing the dark reflectance. In addition, BRPT-1SC-5 to –8 are created by keeping the dark reflectance constant and changing the bright reflectance. All symbols are Code 39 which X dimension is 0,500 mm and the data are "%7C%".

c) For modulation test (No. BRPT-1MOD-1 to -4)

The number of test charts for modulation test shall be four in the grades as specified in Table 17.

Table 17 — Test Chart for Modulation Test

Chart number	Grade	Modulation
BRPT-1MOD –1	4	0,77
BRPT-1MOD –2	3	0,65
BRPT-1MOD –3	2	0,55
BRPT-1MOD –4	1	0,45

NOTE 3 All symbols are Code 39 which X dimensions is 0,500 mm and the data are "U%7C". The reflectance of a particular dark element is changed to correspond to the grade according to ISO/IEC 15416:2016, 5.4.7 (Modulation) and 6.1.2. (Reflectance parameter grading).

d) For defect test (No. BRPT-1DEF-1 to −4)

The number of test charts for defect test shall be four in the grades as specified in Table 18.

Table 18 — Test chart for defect test

Chart number	Grade	Defect
BRPT-1DEF −1	4	0,10
BRPT-1DEF −2	3	0,18
BRPT-1DEF −3	2	0,23
BRPT-1DEF −4	1	0,28

NOTE 4 All symbols are Code 39 which X dimensions is 0,500 mm and the data are “%7C%”. The defects corresponding to the grades are created in a particular bar element according to ISO/IEC 15416:2016, 5.4.8 (Defects) and 6.1.2. (Reflectance parameter grading)

e) For decodability test (No. BRPT-1DEC-1 to −4)

The number of test charts for decodability test shall be four in the grades as specified in Table 19.

Table 19 — Test chart for decodability test

Chart number	Grade	Decodability
BRPT-1DEC −1	4	0,657
BRPT-1DEC −2	3	0,543
BRPT-1DEC −3	2	0,383
BRPT-1DEC −4	1	0,291

NOTE 5 All symbols are Code 39 which X dimensions is 0,500 mm and the data are “%7C%”. The dimension of a particular bar element is changed to correspond to the grade according to the ISO/IEC 15416:2016, 5.4.9.

5.2.1.3 Test chart for two-dimensional symbols

The two-dimensional symbol test charts are used to obtain the performance ranks of the reading range, reading angle, reading, symbol contrast, modulation, fixed pattern damage, grid non-uniformity, axial non-uniformity and unused error correction, which are the reading performances of the bar code reader. Types of test charts used in the tests are shown in a) to g).

a) For reading range, reading angle and reading speed tests (No. BRPT-2RES)

The test charts corresponding to the X dimension shall be used when the reading range, the reading angle (pitch angle, skew angle and tilt angle) and reading speed tests are performed.

NOTE 1 All the symbols in the test charts have an overall print quality grade of “4” and eight X dimensions of 0,100, 0,150, 0,200, 0,250, 0,300, 0,350, 0,400 and 0,450 mm. The data encoded in the QR Code symbol is, “0000000000000000000000000000000000000000000” (41 digits of 0) with an error correction level of “L” adopted.

NOTE 2 This symbol incorporates a module error in advance so that the error correction codeword is exhausted. Therefore, when read by a reader, if even one module in a codeword other than the codeword incorporating the error cannot be correctly recognized, it cannot be read (if there is an error only in the codeword incorporating the error correction, the symbol can be read.).

b) For symbol contrast test (No. BRPT-2SC-1 to −8)

The symbol contrast is the difference between the maximum reflectance from the substrate surface on which the two-dimensional symbol is printed and the minimum reflectance from the dark module.

This is reversed in the case of inverted symbols.

Generally, the closer this difference is to 100 %, the better the reading performance of the bar code reader is (this is not the case for bar code readers adjusted for low symbol contrast.).

The number of test charts for symbol contrast test shall be eight in the grades as specified in Table 20. When determining the minimum symbol contrast that a bar code reader can read correctly, the test charts of Table 20 shall be used.

Table 20 — Test chart for symbol contrast test

Chart number	Grade	Symbol contrast (%)	R_{max}, examples (%)	R_{min} examples (%)
BRPT-2SC −1	4	74	80	6
BRPT-2SC −2	3	58	80	22
BRPT-2SC −3	2	42	80	38
BRPT-2SC −4	1	21	80	59
BRPT-2SC −5	4	74	79	5
BRPT-2SC −6	3	58	63	5
BRPT-2SC −7	2	42	47	5
BRPT-2SC −8	1	21	26	5

NOTE 3 BRPT-2SC-1 to −8 are based on ISO/IEC 15415:2016, 7.8.3 (symbol contrast). The BRPT-2SC-1 to −4 are created by keeping the light reflectance constant and changing the dark reflectance. In addition, BRPT-2SC-5 to −8 are created by keeping the dark reflectance constant and changing the bright reflectance. The symbol is a QR code of X = 1,50 mm.

c) For modulation test (No. BRPT-2MOD-1 to −4)

The number of test charts for modulation test shall be four in the grades as specified in Table 21.

Table 21 — Test chart for modulation test

Chart number	Grade	Modulation
BRPT-2MOD −1	4	0,53
BRPT-2MOD −2	3	0,43
BRPT-2MOD −3	2	0,33
BRPT-2MOD −4	1	0,23

NOTE 4 The symbol is a QR Code according to a) but the X dimension is 1,50 mm and the reflectance of a particular module is changed to correspond to the grade according to ISO/IEC 15415:2016, 7.8.4 (Modulation measurement and related measurement).

d) For fixed pattern damage test (No. BRPT-2FP-1 to −4)

The number of test charts for fixed pattern damage test shall be four in the grades as specified in Table 22.

Table 22 — Test chart for fixed pattern damage test

Chart number	Grade	Number of damaged modules
BRPT-2FP –1	4	0
BRPT-2FP –2	3	1
BRPT-2FP –3	2	2
BRPT-2FP –4	1	3

NOTE 5 The symbol is a QR Code according to a) but the X dimension is 1,50 mm and particular fixed pattern(s) is (are) damaged to correspond to the grade according to ISO/IEC 15415:2016, 7.8.5 (Fixed pattern damage).

e) For grid non-uniformity test (No. BRPT-2GNU-1 to -4)

The number of charts for grid non-uniformity test shall be four in the grades as specified in Table 23.

Table 23 — Test chart for grid non-uniformity test

Chart number	Grade	Grid non-uniformity
BRPT-2GNU –1	4	0,19
BRPT-2GNU –2	3	0,44
BRPT-2GNU –3	2	0,57
BRPT-2GNU –4	1	0,69

NOTE 6 The symbol is a QR Code according to a) but the X dimension is 1,50 mm, and the interval of grid is made non-uniform to correspond to the grades according to ISO/IEC 15415:2016, 7.8.7 (Grid non-uniformity).

f) For axial non-uniformity test (No. BRPT-2ANU-1 to –4)

The number of test charts for axial non-uniformity testing shall be four in the grades as specified in Table 24.

Table 24 — Test chart for axial non-uniformity test

Chart number	Grade	Axial non-uniformity
BRPT-2ANU –1	4	0,049
BRPT-2ANU –2	3	0,072
BRPT-2ANU –3	2	0,088
BRPT-2ANU –4	1	0,110

NOTE 7 The symbol is a QR Code according to a) but the X dimension is 1,50 mm, and the interval of the axial is made non-uniform to correspond to the grades according to the ISO/IEC 15415:2016, 7.8.6 (Axial non-uniformity).

g) For unused error correction test (No. BRPT-2UEC-1 to –4)

The number of charts for unused error correction test shall be four in the grades as specified in Table 25

Table 25 — Test chart for unused error correction test

Chart number	Grade	Unused error correction codeword rate
BRPT-2UEC –1	4	0,625
BRPT-2UEC –2	3	0,500
BRPT-2UEC –3	2	0,375

Table 25 *(continued)*

Chart number	Grade	Unused error correction codeword rate
BRPT-2UEC –4	1	0,250

NOTE 8 The symbol is a QR Code according to a) but the X dimension is 1,50 mm and the colours of some modules are inverted to correspond to the grades according to the ISO/IEC 15415:2016, 7.8.8 (Unused error correction). Therefore, the error correction level is "H" and the good read result is 15 digits of 0.

5.2.2 Reading performance

5.2.2.1 General

Bar code reader reading performances are determined by performing each reading performance evaluation test.

The overall performance rank of the bar code reader is not determined by integrating the results of each performance item.

NOTE 1 These are not tests for competing the reading time by reader manufacturers or models, but tests for evaluating the tendency of the reading time due to the difference of the bar code symbol print quality.

The same operator shall test one evaluation test item in succession in order to minimize the influence of the fluctuation of the reading time by the operator and the fluctuation of the communication time between the bar code reader and the external device. However, this does not apply to automated test equipment.

When reading test charts of different print quality grades, variation of read time between grades "4" through "1" are determined.

NOTE 2 In this document, it is assumed that the reading time differs depending on the difference of the print quality grades according to ISO/IEC 15416:2016 E.3 (Interpretation of scan reflectance profile and it's grading).

Annex C provides a summary of ISO/IEC 15416:2016 E.3 for reference. For each symbol of the test chart used in each test item, 100 consecutive readings are attempted and recorded in the read record form of Annex B. Read record forms shall be created in order to automatically record the reading results by software. Reading shall enter the next reading operation by triggering (by a trigger switch in the case of a hand-held reader or by an external signal in the case of a stationary reader) immediately after confirming the good lead indicator (sound, light, vibration or transmitted data) in the previous reading.

NOTE 3 At the time of creating this document, the communication interface between a bar code reader and an external device is USB keyboard emulation. However, when the environment where the read record form is used becomes new in the future, the read record form may be changed.

In the read record form, if the reading is not completed after 5 s from the triggering, the read time is recorded as 5 s as a timeout and the next triggering is waited.

5.2.2.2 Performance evaluation Items and test methods

Performance evaluation items and test methods for reading performance shall be as follows.

a) Reading range test

The parameters obtained in the reading range test are the minimum reading distance, the maximum reading distance, DOF (maximum reading distance - minimum reading distance), and horizontal and vertical viewing angles by reading test charts with different resolutions selected based on specifications of the bar code reader. Then, create a reading range diagram based on the reading limit distance and the maximum field of view obtained by reading results of each resolution test chart which were read 100 %. An example of a reading range diagram is shown in Figure 11.

In creating the reading range diagram, the following precautions shall be taken.

— A straight line extending from the centre of the reading window of the bar code reader is set as a centre axis (refer to a dashed-dotted line in Figure 10 and 11). Symbols shall be arranged so that the centre axis is the centre of the bar code symbol plane, and the distance shall be measured in mm.

— In order to prevent the directly reflected light by the bar code symbol surface from entering the reading window of the bar code reader, it is preferable that the bar code symbol is inclined by 10 to 15 degrees from the central axis in the skew angle direction.

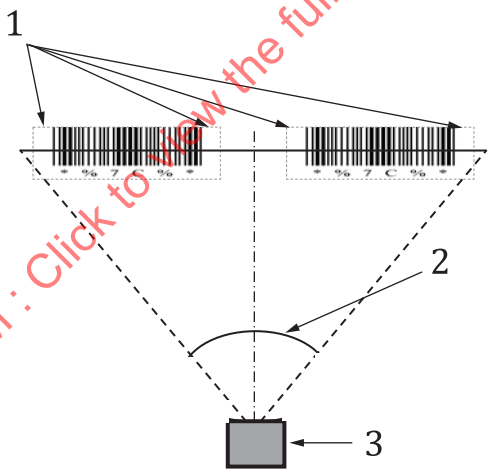
— When determining the field of view, it is preferable to perform the test while moving the rear part of the bar code reader vertically and horizontally around a virtual line perpendicular to the central axis of the reading window of the bar code reader.

  At this time, means for measuring the angle at which the bar code reader is inclined from the central axis shall be provided.

  When such a test equipment cannot be prepared, the bar code symbol side may be moved so that the relative positions of the bar code reader and the bar code symbol are the same as in the above method.

  The bar code symbols used in these tests shall be considered including quiet zones (see Figure 10). In this test, it shall be taken into account that the field of view does not spread linearly.

— This test does not apply to omni scanning readers but does not prevent it from being cited as a reference.



Key

1 quiet zone

2 horizontal viewing angle

3 Barcode reader

Figure 10 — Treatment of quiet zones at viewing angles

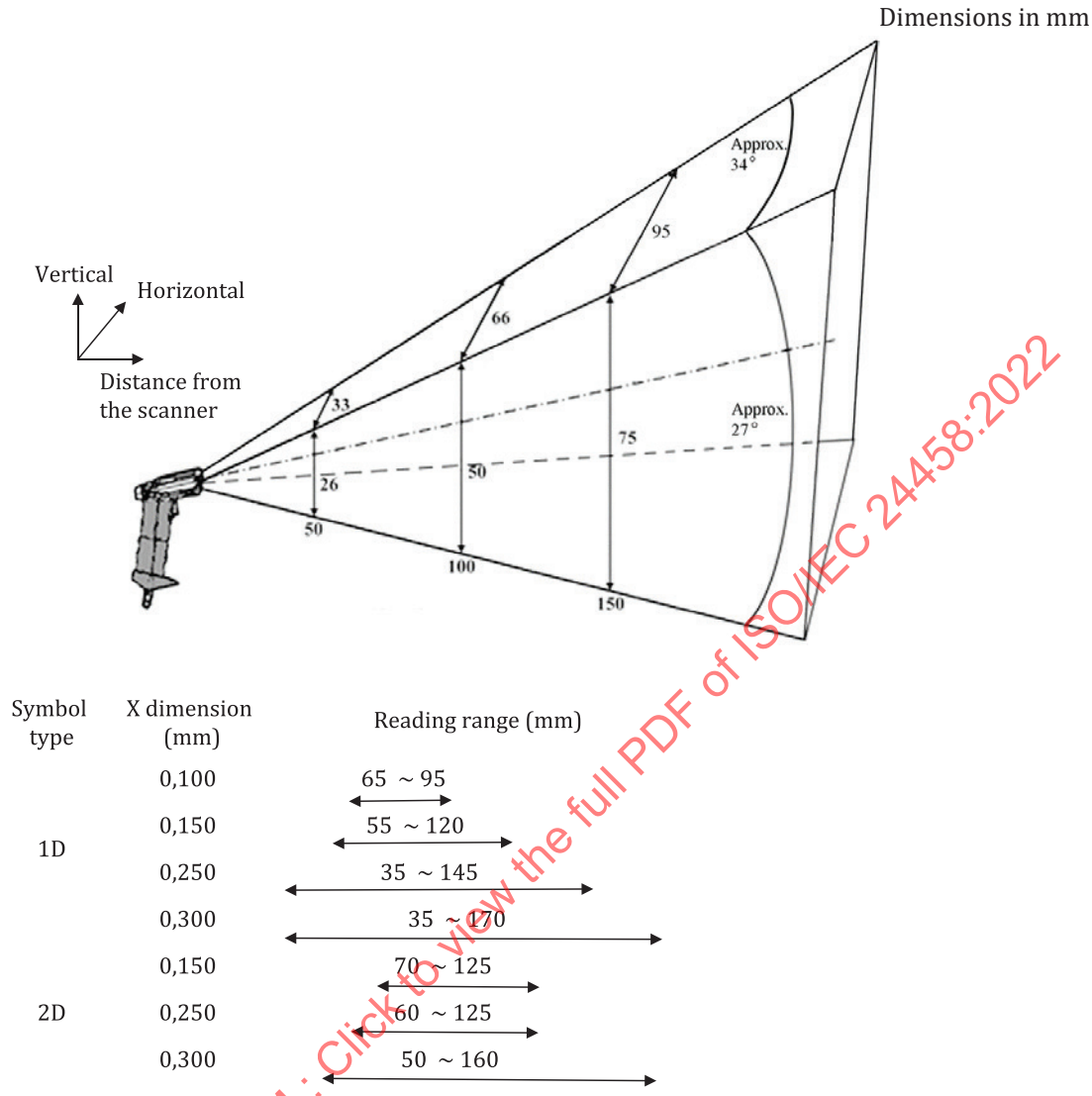


Figure 11 — Example of the reading range diagram

b) Reading speed test

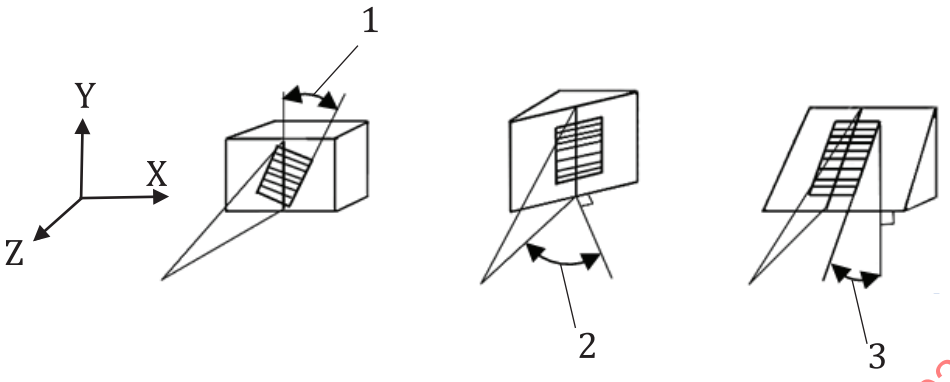
The test shall be performed with a one-dimensional symbol of 0,250 mm in BRPT-1RES and a two-dimensional symbol of 0,250 mm in BRPT-2RES, with a suitable reading distance (the median reading depth).

The reading speed *RT* (s) is an average reading time when the symbol was read 100 times with 100 % read rate.

NOTE 4 Reading speed is a scale generally called as “reading taste” and is one of the significant performances of bar code readers.

c) Reading angle tests

These tests determine how “incomplete scanning, insufficient reflected light and image distortion”, that occurs when a bar code reader scans a bar code symbol or captures a symbol image, effect on the reader's reading performance. A jig or protractor capable of measuring the angle shown in Figure 12 is used to determine the largest angle at which the reading rate is 100 % at distances (the median reading depths) adapted to the resolution of the test chart (one-dimensional symbol is the 0,250 mm of BRPT-1RES and two-dimensional symbol is the 0,250 mm of BRPT-2RES).



Key

1 tilt angle
2 skew angle
3 pitch angle

Figure 12 — Illustration of reading angle

d) Symbol contrast test

The test shall be performed on one-dimensional symbols and two-dimensional symbols using the test charts BRPT-1SC-1 to −4, −5 to −8 and BRPT-2SC-1 to −4, −5 to −8 respectively.

Perform the reading speed test of b) at the reading distance (the median reading depth) adapted to the resolution, and determine the reading rate (in this test, the reading rate may not be 100 %) and the reading time. Obtain the reading time variation RT_V(s) for each group (–1 to −4 and −5 to 8) by subtracting the minimum reading time from the maximum reading time.

e) Modulation test

The test shall be performed on one-dimensional symbols and two-dimensional symbols using the test charts BRPT-1MOD-1 to −4 and BRPT-2MOD-1 to −4 respectively.

Perform the reading speed test of b) at the reading distance (the median reading depth) adapted to the resolution, and determine the reading rate (in this test, the reading rate may not be 100 %) and the reading time. Obtain the reading time variation M_V(s) for (–1 to −4) by subtracting the minimum reading time from the maximum reading time.

f) Defect test

The test shall be performed only on one-dimensional symbols using the test charts BRPT-1DEF-1 to −4.

Perform the reading speed test of b) at the reading distance (the median reading depth) adapted to the resolution, and determine the reading rate (in this test, the reading rate may not be 100 %) and the reading time. Obtain the reading time variation D_V(s) for (–1 to −4) by subtracting the minimum reading time from the maximum reading time.

g) Decodability test

The test shall be performed only on one-dimensional symbols reading the test charts BRPT-1DEC-1 to −4.

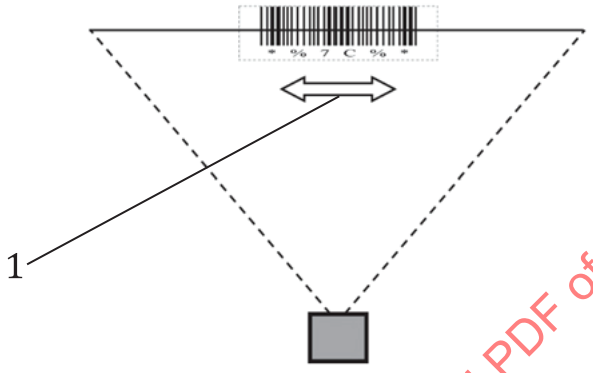
Perform the reading speed test of b) at the reading distance (the median reading depth) adapted to the resolution, and determine the reading rate (in this test, the reading rate may not be 100 %) and the reading time. Obtain the reading time variation DC_V(s) for (–1 to −4) by subtracting the minimum reading time from the maximum reading time.

h) Reading test of moving symbol (maximum readable moving speed)

This test item is applied only in case that a one-dimensional symbol is read by a fixed mount reader.

The test determines the maximal transfer speed (m/s) at a distance (the median reading depth) adapted to the resolution of the test chart (0,250 mm of the BRPT-1RES) and resulted in a reading rate of 100 %, when the bar code reader reads bar code symbols moving in a ladder direction (see - Figure 13).

NOTE 5 Since the moving object reading speed obtained in this test varies depending on the width of the bar code symbol (symbol structure used, number of characters to be encoded, X dimension, element width ratio, and inter-character gap), precaution is required in actual applications.



Key

1 symbol transfer direction

Figure 13 — Ladder Scanning

i) Fixed pattern damage test

The test shall be performed only on two-dimensional symbols using the test charts BRPT-2FP-1 to −4.

Perform the reading speed test of b) at the reading distance (the median reading depth) adapted to the resolution, and determine the reading rate (in this test, the reading rate may not be 100 %) and the reading time. Obtain the reading time variation F_V(s) for (−1 to −4) by subtracting the minimum reading time from the maximum reading time.

j) Grid non-uniformity test

The test shall be performed only on two-dimensional symbols using the test charts BRPT-2GNU-1 to −4.

Perform the reading speed test of b) at the reading distance (the median reading depth) adapted to the resolution, and determine the reading rate (in this test, the reading rate may not be 100 %) and the reading time. Obtain the reading time variation G_V(s) for (−1 to −4) by subtracting the minimum reading time from the maximum reading time.

k) Axial non-uniformity test

The test shall be performed only on two-dimensional symbols using the test charts BRPT-2ANU-1 to −4.

Perform the reading speed test of b) at the reading distance (the median reading depth) adapted to the resolution, and determine the reading rate (in this test, the reading rate may not be 100 %) and the reading time. Obtain the reading time variation A_V(s) for (−1 to −4) by subtracting the minimum reading time from the maximum reading time.

l) Unused error correction test

The test shall be performed only on two-dimensional symbols using the test charts BRPT-2UEC-1 to −4.

Perform the reading speed test of b) at the reading distance (the median reading depth) adapted to the resolution, and determine the reading rate (in this test, the reading rate may not be 100 %) and the reading time. Obtain the reading time variation U_V(s) for (−1 to −4) by subtracting the minimum reading time from the maximum reading time.

m) Ambient illumination test

This test determines the effect of disturbance light, which enters the reading window of the bar code reader from the surroundings when the bar code reader reads bar code symbols. For each of the ambient lights specified in Table 26, measure the maximum illuminance L on the symbol surface, at which the bar code reader can perform 100 % reading rate within a range of distance adapted to the resolution of the test chart (for one-dimensional symbol: BRPT-1RES, 0,250 mm and for two-dimensional symbol: BRPT-2RES, 0,250 mm), while the illuminance on the bar code symbol surface is changed. Record not only the test results, but also the manufacturer's name and model number of the light source used in the test result report in 5.4.

Table 26 — Ambient light types

Daylight fluorescent lamp (AC)
Inverter fluorescent lamp
Daylight LED DC lighting
LED pulsed containing red wavelength
Sunlight

5.2.3 Electrical property

Performance evaluation items and test methods for electrical properties shall be as follows.

a) Operating power supply voltage range (V)

Measure the upper and lower limits of the power supply voltage at the input end of the power supply cable when the bar code reader operates normally using the voltmeter specified in ISO/IEC 60051-2 or a voltmeter equivalent to or higher than the voltmeter.

b) Maximum consumption current (mA or A)

Measure the maximum consumption current with communicable state and all good lead indicators (sound, light, and vibrations) set to “ON” from the time the trigger is turned ON to the time the good lead indicators are ON at the input end of the power supply cable using an ammeter specified in ISO/IEC 60051-2 or an ammeter equivalent to or higher than the ammeter.

c) Electro-static strength (kV)

A “contact discharge” of ISO/IEC 61000-4-2 shall be applied to measure the maximal voltage V_C that does not discharge when the discharge electrode is brought into direct contact with the mating areas and junctions of the bar code reader housing components.

This test applies only to readers whose housings are made of resin(s).

d) Resistance to power supply line noise (kV)

Resistance to power supply line noise is the resistance against electro-magnetic noise (frequency is 100 kHz) flowing in from the power supply lines of the bar code reader. The test shall be performed according to ISO/IEC 61000 4-4, and the highest test-level voltages at which the bar code reader operates normally is measured.

e) Unwanted radiation noise

The unwanted radiation noise from the bar code reader and the noise propagating through the connected power cables, signalling cables, etc., which can adversely affect the surrounding equipment (electronics) shall be measured according to IEC CISPR 32.

f) Immunity (EMC)

Immunity is the electromagnetic compatibility (EMC) of a bar code reader against electromagnetic noise coming from the surroundings. Perform the test according to ISO/IEC 61000-4-3, and measure the electric field strength at the highest test level at which the bar code reader can operate normally during the test.

5.2.4 Environmental characteristic

Performance evaluation items and test methods for environmental characteristics are as follows.

a) Operation temperature and humidity (°C and %)

Tests shall be performed with operation temperature and humidity (°C and %) according to ISO/IEC 60068-2-78 to determine the most severe temperature and humidity that the reader can operate normally.

b) Storage temperature and humidity (°C and %)

When the storage temperature and humidity (°C and %) are returned to the normal test environmental temperature and humidity from the storage condition without condensation, measure the range of the storage temperature and humidity which results in a reading rate of 100 % within near the same time as the reading time in the normal test environment at a distance adapted to the resolution of the test charts (for one-dimensional symbol bar code readers: BRPT-1RES, 0,250 mm and for two-dimensional symbol bar code readers: BRPT-2RES, 0,250 mm).

If condensation occurs in or on the reading window portion, the test shall be performed after the condensation disappears.

c) Water-drop-proof and dust-proof

Determine the IP-code according to ISO/IEC 60529.

5.2.5 Mechanical properties

Performance evaluation items and test methods for mechanical characteristics are as follows.

a) Drop test without packaging (m)

This evaluation test applies only to hand-held bar code readers (excluding bar code readers with LCD mounted such as handy terminals). The bar code reader with its interface cable attached naturally drops to hit the 5-sides and 8 edges (ridges) 10 times each, and the bar code reader without the interface cable drops to hit the 6-sides and 12 edges (ridges) 10 times each onto a concrete floor. After the test has been carried out, the highest fall distance shall be measured where the barcode reader can read the test charts (for one-dimensional symbol bar code readers: BRPT-1RES, 0,250 mm and for two-dimensional symbol bar code readers: BRPT-2RES, 0,250 mm) 100 %.

b) Drop test with packaging (m)

This evaluation test applies only to stationary bar code readers. Under normal packaging conditions, the bottom of the packaging box is to naturally fall once onto the concrete floor. After the test has been carried out, the highest fall distance shall be measured where the bar code reader can read the test charts (for one-dimensional symbol bar code readers: BRPT-1RES, 0,250 mm and for two-dimensional symbol bar code readers: BRPT-2RES, 0,250 mm) 100 %.

c) Vibration resistance characteristics with packaging

Apply the test of ISO/IEC 60068-2-6 to the bar code reader, then confirm that the bar code reader operates normally even after the test is performed under the following conditions.

— Frequencies: 10 Hz to 150 Hz

— Accelerometric: 20 m/sec^2 / X, Y, Z axes

— Cycles: 20 cycles in each direction

After the test has been carried out, the reading rate shall be 100 % at distances adapted to the resolution of the test charts (for one-dimensional symbol bar code readers: BRPT-1RES, 0,250 mm and for two-dimensional symbol bar code readers: BRPT-2RES, 0,250 mm).

d) Trigger switch durability (times)

This test applies only to hand-held bar code readers with trigger switches.

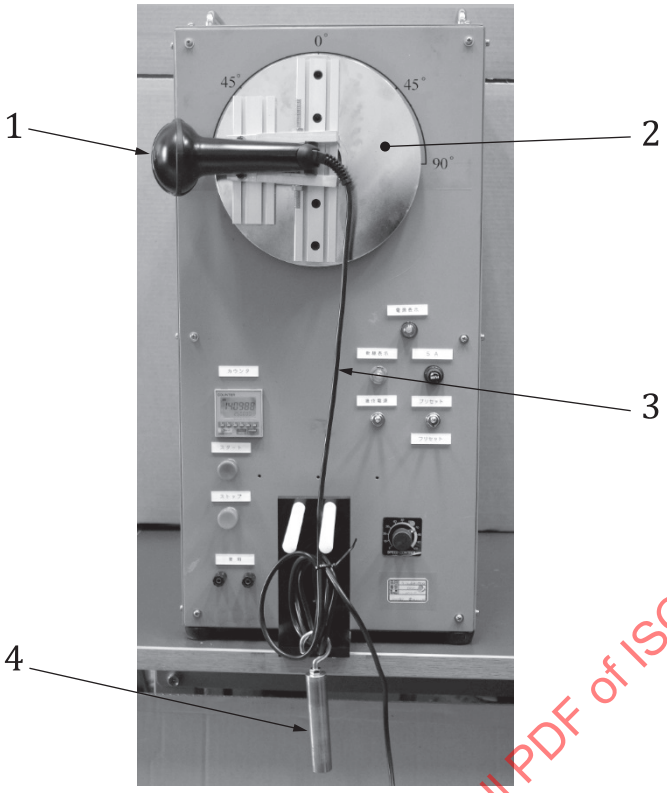
Measure the number of times that the trigger switch can be guaranteed to operate as a trigger switch when repeatedly pressed at a speed of 120 times per minute with the pressing force 2,94 N and the releasing force 0,00 N in the central of the trigger switch.

e) Cable strength (bending test) (times)

The bar code reader head is held by the holder of the test machine and the head is rotated 90 degrees to the left and right with a 500 g weight applied to the cable.

The number of times until any one of the core wires in the cable is broken is measured (all cores are connected in series to detect the disconnection of the wires).

Figure 14 shows an example of the test method.



Key

1 barcode reader
2 pendulum turntable
3 interface cable
4 weight

Figure 14 — Image illustration of cable bending tester

5.3 Performance ranking

5.3.1 General

Performance is ranked according to the performance evaluation test results for each evaluation test item specified so. The ranks are rank “S”, rank “I”, rank “II”, and rank “III” from the top.

NOTE The rank “S” is a performance rank for which existing bar code readers have not achieved at the time of preparation of this document and is set as a target for promoting future technological development.

5.3.2 Reading performance

In all evaluation tests, if there is a data error (misreading) in even one character in the read data, the bar code reader shall be ranked “0” (precedence over other evaluation test results).

When reading rate with any of the test chart grades (“4” through “1”) cannot perform 100 % reading rate, the rank shall be rank “III”.

The ranking of the reading performances of a bar code reader is as follows.

a) Reading range (resolution, reading distance and field of view)

No ranking is performed.

b) Reading speed

The test is performed according to 5.2.2.2 b) and the rank is selected from Table 27 based on the test results.

Table 27 — Reading speed rank

Ranking	Reading rate (%)	Reading time *RT*(s)
S	100	$RT < 0{,}001$
I	100	$0{,}05 > RT \geqq 0{,}001$
II	100	$0{,}30 > RT \geqq 0{,}05$
III	100	$RT \geqq 0{,}30$
Note Since 0,001 s to 0,01 s are difficult to determine in the test of 5.2.2.2 b), a dedicated test facility is required.		

c) Read angle (tilt angle, skew angle, and pitch angle)

No ranking is performed.

d) Symbol contrast

The test is performed according to 5.2.2.2 d) and the rank is selected from Table 28 based on the test results.

Table 28 — Symbol contrast rank

Ranking	Symbol contrast (Bar change)		Symbol contrast (background change)	
	Reading rate (%)	Reading time variation *RTV*(s)	Reading rate (%)	Reading time variation *RTV*(s)
S	100	$RTV < 1$	100	$RTV < 2$
I	100	$3 > RTV \geqq 1$	100	$10 > RTV \geqq 2$
II	100	$RTV \geqq 3$	100	$RTV \geqq 10$
III	99 or less	-	99 or less	-

e) Modulation

The test is performed according to 5.2.2.2 e) and the rank is selected from Table 29 based on the test results.

Table 29 — Modulation Rank

Ranking	Reading rate (%)	Reading time variation *MV*(s)
S	100	$MV < 1$
I	100	$3 > MV \geqq 1$
II	100	$MV \geqq 3$
III	99 or less	-

f) Defect

The test is performed according to 5.2.2.2 f) and the rank is selected from Table 30 based on the test results.

Table 30 — Defect rank

Ranking	Reading rate (%)	Reading time variation *DV*(s)
S	100	$DV < 1$

Table 30 *(continued)*

Ranking	Reading rate (%)	Reading time variation *DV*(s)
I	100	$3 > DV \geqq 1$
II	100	$DV \geqq 3$
III	99 or less	-

g) Decodability

The test is performed according to 5.2.2.2 g) and the rank is selected from Table 31 based on the test results.

Table 31 — Decodability rank

Ranking	Reading rate (%)	Reading time variation *DCV*(s)
S	100	$DCV < 1$
I	100	$5 > DCV \geqq 1$
II	100	$DCV \geqq 5$
III	99 or less	-

h) Reading of moving symbol (maximum readable moving speed)

The tests is performed according to 5.2.2.2 h) and the rank is selected from Table 32 based on the test results.

Table 32 — Reading of moving symbol rank

Ranking	Transfer speed *MS* (m/s)
S	$MS > 3$
I	$3 \geqq MS > 2$
II	$2 \geqq MS > 0{,}5$
III	$0{,}5 \geqq MS$

i) Fixed pattern damage

The test is performed according to 5.2.2.2 i) and the rank is selected from Table 33 based on the test results.

Table 33 — Fixed pattern damage rank

Ranking	Reading rate (%)	Reading time variation *FV*(s)
S	100	$FV < 1$
I	100	$2 > FV \geqq 1$
II	100	$FV \geqq 2$
III	99 or less	-

j) Grid non-uniformity

The test is performed according to 5.2.2.2 j) and the rank is selected from Table 34 based on the test results.

Table 34 — Grid non-uniformity rank

Ranking	Reading rate (%)	Reading time variation *GV*(s)
S	100	$1 > GV$

Table 34 *(continued)*

Ranking	Reading rate (%)	Reading time variation *GV*(s)
I	100	$2 > GV \geqq 1$
II	100	$GV \geqq 2$
III	99 or less	-

k) Axial non-uniformity

The test is performed according to 5.2.2.2 k) and the rank is selected from Table 35 based on the test results.

Table 35 — Axial non-uniformity rank

Ranking	Reading rate (%)	Reading time variation *AV*(s)
S	100	$1 > AV$
I	100	$2 > AV \geqq 1$
II	100	$AV \geqq 2$
III	99 or less	

l) Unused error correction

The test is performed according to 5.2.2.2 l) and the rank is selected from Table 36 based on the test results.

Table 36 — Unused error correction rank

Ranking	Reading rate (%)	Reading time variation *UV*(s)
S	100	$1 > UV$
I	100	$2 > UV \geqq 1$
II	100	$UV \geqq 2$
III	99 or less	-

m) Ambient illumination

The test is performed according to 5.2.2.2 m) and the rank is selected from Table 37 based on the test results.

Table 37 — Ambient illumination rank

Ranking	Ambient illuminance *L* (1000 Lux)				
	Daylight fluorescent lamp	Inverter fluorescent lamp	Daylight LED DC lighting	LED pulsed containing red wavelength	Sunlight
S	$L > 50$	$L > 35$	$L > 30$	$L > 40$	$L > 100$
I	$50 \geqq L > 25$	$35 \geqq L > 15$	$30 \geqq L > 15$	$40 \geqq L > 15$	$100 \geqq L > 50$
II	$25 \geqq L > 10$	$15 \geqq L > 10$	$15 \geqq L > 10$	$15 \geqq L > 10$	$50 \geqq L > 10$
III	$10 \geqq L$	$10 \geqq L$	$10 \geqq L$	$10 \geqq L$	$10 \geqq L$

5.3.3 Electrical property

The ranking of electrical properties of a bar code reader is as follows.

a) Operating power supply voltage range

No ranking is performed.

b) Maximum consumption current

No ranking is performed.

c) Electrostatic strength

The test is performed according to 5.2.3 c) and the rank is selected from Table 38 based on the test results.

Table 38 — Electrostatic strength rank

Ranking	Electrostatic strength V_C (kV)
S	$V_C > 25$
I	$25 \geqq V_C > 20$
II	$20 \geqq V_C > 10$
III	$10 \geqq V_C$

d) Resistance to power supply line noise

The test is performed according to 5.2.3 d) and the rank is selected from Table 39 based on the test results.

Table 39 — Resistance to power supply line noise rank

Ranking	Test voltage (kV)
S	6
I	4
II	2
III	1 or less

e) Unwanted radiation noise

No ranking is performed.

f) Immunity (EMC)

The test is performed according to 5.2.3 f) and the rank is selected from Table 40 based on the test results.

Table 40 — Immunity rank

Ranking	Test level of field strength (V/m)
S	30
I	10
II	3
III	1

5.3.4 Environmental characteristic

No ranking is performed.

5.3.5 Mechanical property

The ranking of mechanical properties of a bar code readers is as follows.

a) Drop test without packaging

The test is performed according to 5.2.5 a) and the rank is selected from Table 41 based on the test results.

Table 41 — Drop test without packaging rank

Ranking	Fall distance *H*(m)
S	$H > 3{,}0$
I	$3{,}0 \geqq H > 1{,}8$
II	$1{,}8 \geqq H > 1{,}0$
III	$1{,}0 \geqq H$

b) Drop test with packaging

No ranking is performed.

c) Vibration resistance characteristics with packaging

No ranking is performed.

d) Trigger switch durability

The test is performed according to 5.2.5 d) and the rank is selected from Table 42 based on the test results.

Table 42 — Trigger switch durability rank

Ranking	Number of presses *N* (times)
S	$N > 500\,000$
I	$500\,000 \geqq N > 300\,000$
II	$300\,000 \geqq N > 100\,000$
III	$100\,000 \geqq N$

e) Cable strength (bending test)

The test is performed according to 5.2.5 e) and rank is selected from Table 43 based on the test results.

Table 43 — Cable strength rank

Ranking	Number of bending *B* (times)
S	$B > 3\,000\,000$
I	$3\,000\,000 \geqq B > 2\,000\,000$
II	$2\,000\,000 \geqq B > 1\,000\,000$
III	$1\,000\,000 \geqq B$

5.4 Test report

The test result report shall contain the following items.

a) Performance test items specified in 5.2

b) Test results based on the test method specified in 5.2

c) Result of ranking in the method specified in 5.3

d) Reader model name, reader type, reader manufacturer name, symbol type, operator, test date, etc.

e) Any deviations from the procedure

f) Any unusual features observed

An example of the test report is shown in D.2.

Annex A
(informative)

Standard image components corresponding to nominal dpi

A.1 Bit-map image

A.1.1 General

In the standard image, four corner marks and logo marks are printed in a bitmap image corresponding to the nominal dpi of the bar code printer. Since there are many types of the nominal dpi of the bar code printer, and there are cases where each type is not an integral multiplication, the size when the bitmap image is printed may not be the same, but the number of dots is adjusted so that each image has the same size as much as possible.

A.1.2 Corner marks

The header information of the corner marks C1 to C4 corresponding to the nominal dpi is shown in Table A.1.

Table A.1 — Header information for corner mark bitmap image

Item	Bytes	Nominal dpi			
		200	300	400	600
File type	2	42 4D (ASCII "B" "M")			
File size	4	BE 04 00 00	7E 0B 00 00	3E 12 00 00	C6 28 00 00
		1 214 bytes	2 942 bytes	4 670 bytes	10 438 bytes
Reserve 1	2	00 00			
Reserve 2	2	00 00			
Offsetting	4	3E 00 00 00 (62 bytes)			
Header size	4	28 00 00 00 (40 bytes)			
Width of the images	4	60 00 00 00	90 00 00 00	C0 00 00 00	20 01 00 00
		96 dots	144 dots	192 dots	288 dots
Hight of the images	4	60 00 00 00	90 00 00 00	C0 00 00 00	20 01 00 00
		96 dots	144 dots	192 dots	288 dots
Number of planes	2	01 00			
Size per pixel	2	01 00			
Compression format	4	00 00 00 00			
Size of the image data	4	80 04 00 00	40 0B 00 00	00 12 00 00	80 28 00 00
		1 152 bytes	2 880 bytes	4 608 bytes	10 368 bytes
Horizontal resolution	4	40 1F 00 00	E0 2E 00 00	80 3E 00 00	C0 5D 00 00
		8 000 dots	12 000 dots	16 000 dots	24 000 dots
Vertical resolution	4	40 1F 00 00	E0 2E 00 00	80 3E 00 00	C0 5D 00 00
		8 000 dots	12 000 dots	16 000 dots	24 000 dots
Number of pallets	4	00 00 00 00			
Indexed	4	00 00 00 00			
Blue-black	1	FF			

Table A.1 *(continued)*

Item	Bytes	Nominal dpi			
		200	300	400	600
Green-black	1	FF			
Red-black	1	FF			
Reserve (black)	1	00			
Blue and white	1	00			
Green (white)	1	00			
Red (white)	1	00			
Reserve (white)	1	00			

Illustratively, the C1 image data at the nominal 200 dpi is shown in Figure A.1. Subsequent to the header information (62 bytes) in Table A.1, data are sent out in order from the lowest row to the upper row.

The first half of 62 bytes is the header, and the dotted underline portion is the image data.

424DBE040000000000003E0000002800000060000000600000000100010000000000800400000401F0000401F0000000000000000000000FFFFFF0000000000B38F0F83F03F800000000001...FFFFFFFFFFFFFFFFFFFFFFFF

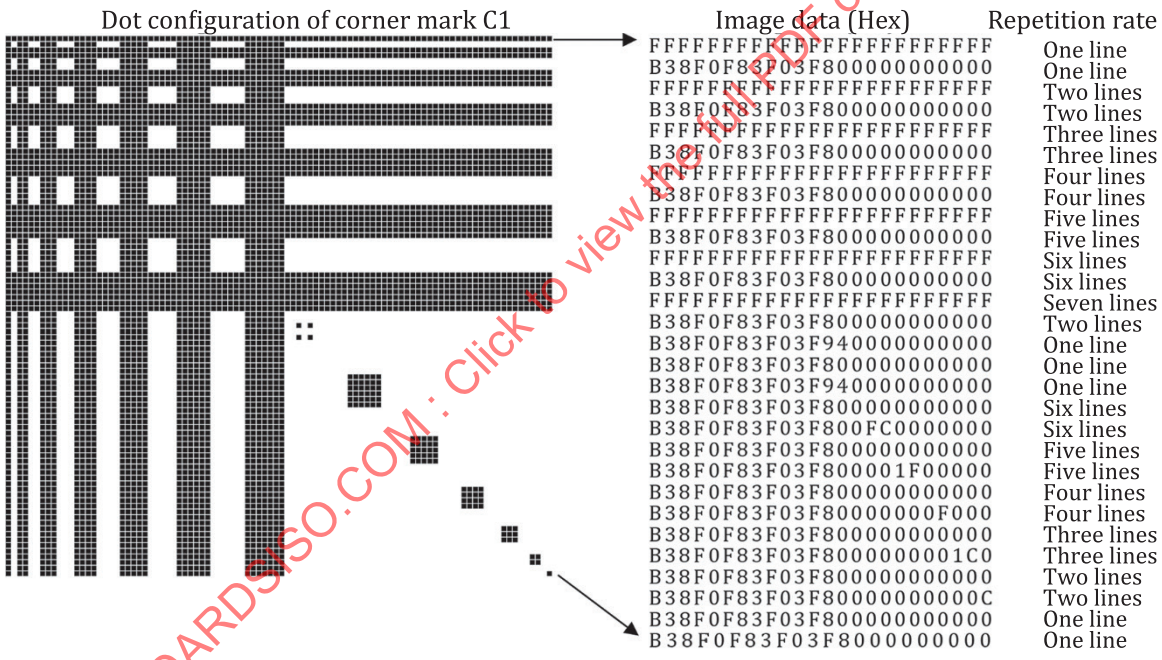


Figure A.1 — Images of the corner mark (C1) of the nominal 200 dpi

The bitmap data of the corner marks (C1 to C4) corresponding to the nominal dpi are provided as supplementary data from https://standards.iso.org/iso-iec/24458/ed-1/en separately from this document (see A.2).

A.2 Supplementary data files

A.2.1 General

The supplementary data files contain bitmap image data of the four corner marks and the logo mark in the standard image corresponding to each nominal dpi.

Details of these data are provided in 4.1.2.1 and 4.1.2.2.