Improvement Proposals on ISO/IEC 15775 Test Charts for Copier and Printer Outputs

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Abstract

This paper describes current activities of Japanese domestic working group 3 for ISO/IEC JTC1/SC28 in JBMA (Japan Business Machine Makers Association). The International Standard IS0/IEC 15775 "Information technology - Office machines - Method of specifying image reproduction of colour copying machines by analog test charts - Realization and application" was published in December 1999. We have been involved in developing the standard for the last four years. The four digital ISO-test charts are downloadable as PostScript(PS)- and PDF-files from the DIN (Deutsches Institut für Normung) or BAM (Federal Institute for Materials Research and Testing) web sites for production of the test charts. This standard is proposed to extend the application not only to copiers but also to printers, scanners and displays as fast-track DIS 19839-1 to 4[1,2,3,4] from DIN as the standards for color management testing. We made three kinds of the test charts (analog and digital) basically according to the original standard. Then we improved some parts of test charts based on extensive discussion among our WG3 and the International SC28 members for a better application of the current and future standards. These analog charts are printed by excellent offset lithography. The improvements for each chart are compared with the original standard and the published DIN test charts[5]. The quality of these test charts is pointed out.

Introduction

A test chart that is officially in full agreement with ISO/IEC 15775 has yet to be published. In the standard, the four kinds of test chart are defined as: two achromatic test charts (No. 1:high contrast and No. 3:low contrast) and two chromatic test charts (No. 2: cmyk and No. 4: rgbk). Figure 1 shows one of the chromatic test charts. The four digital ISO-test charts are downloadable as PS and PDF-files from the DIN or BAM web sites[6] for production of the test charts. The unique characteristics of chromatic test charts is that the 32 color patches defined with CIELAB values (Figure 2) are used to evaluate the color reproduction between the test charts and outputs of copiers. However, several technical problems for the practical application are found in the standard test charts. For example, poor picture quality, moiré problem due to the specific line screens, misreading of Siemens-star and so on. We proposed some improvement on ISO/IEC 15775 test charts at DFZ-BAM-Workshop[7] in 1999, and actually showed there three kinds of test chart as an Asian version corresponding to the original test chart No. 2, 3 and 4. These newly developed analog charts are printed by excellent offset lithography in Japan. Some image qualities of them are compared with DIN test charts. We strongly feel the need of improvements on the current components in test charts for a better application of the current and future standards.
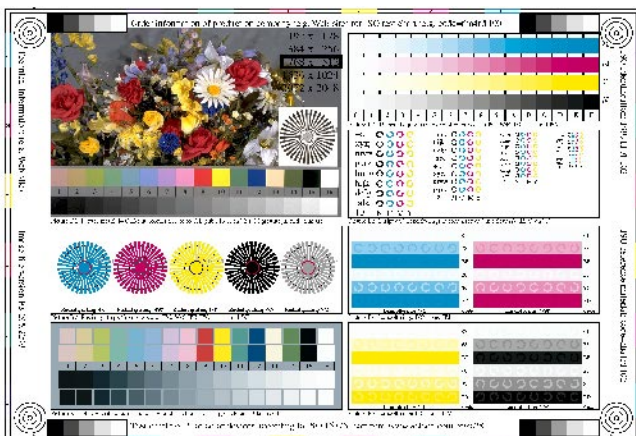

Figure 1. Test Chart No. 2 according to ISO/IEC 15775.

Figure 2. B3&D3: 14 CIE-test colors according to CIE-Publ. 13.3 and B/W + 16 gray steps.

JBMA Test Charts

Table 1 shows the materials for JBMA test charts and the printing procedure. The paper characteristics and the printing procedure is described here. The achromatic test charts (No. 3) is shown in Figure 3 and one of the chromatic test charts (No. 2) is shown in Figure 4. The picture contents are laid

out in blocks and numbered. In the test chart No. 3, there are six blocks and each block is numbered from C1 to C6.

Table 1. Materials for Test Charts and Printing Procedure.

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Paper	Fine art paper, glossy, natural white (Mitubishi Real Art Both Sides) Area weight: 157 g/m^2
CTP	PI-R2080 (DAINIPPON SCREEN MFG.)
Resolution of printing film	2400 dpi
Screen	DAINIPPON SCREEN CR-SQR018 / Square Dots
Screen frequency	175 lpi
Screen Angle	C=75º, M=15º, Y=0º, K=45º, R=45º, G=45º, B=45º
Print Color	T3 (Achromatic) 2 plates T2&4 (Chromatic) 4 plates
Printing Press	Komori L-426P

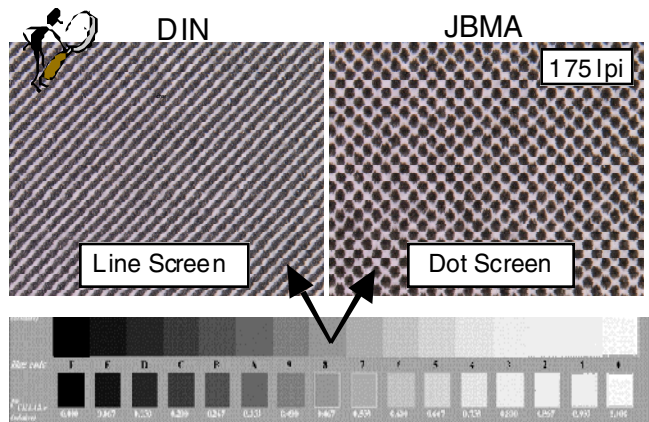*Figure 3. JBMA Test Chart No. 3 (achromatic).*
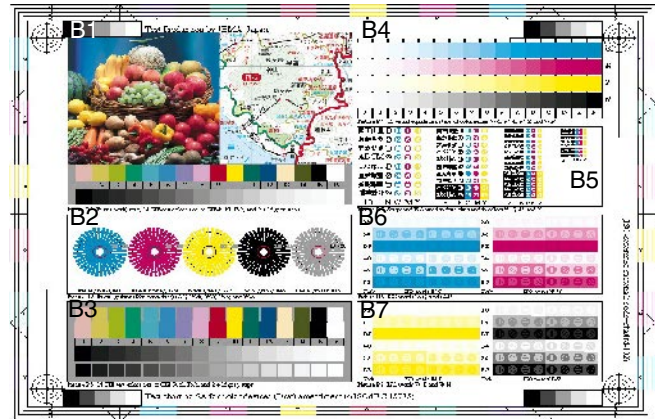
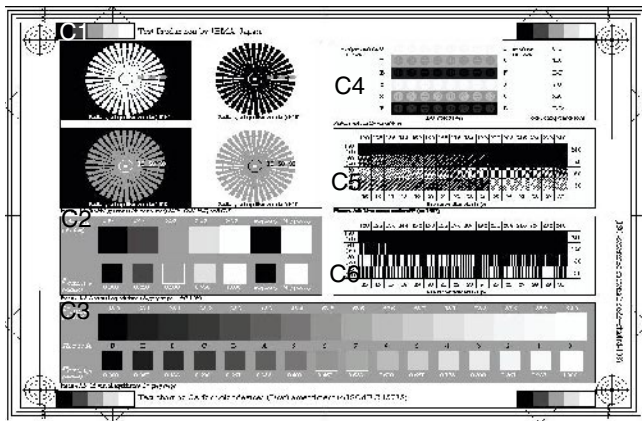*Figure 4. JBMA Test Chart No. 2 (chromatic).*

Figure 5. C3: Screen: DIN vs. JBMA.
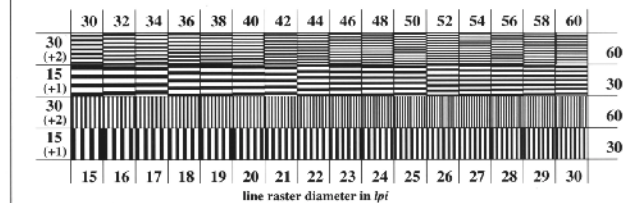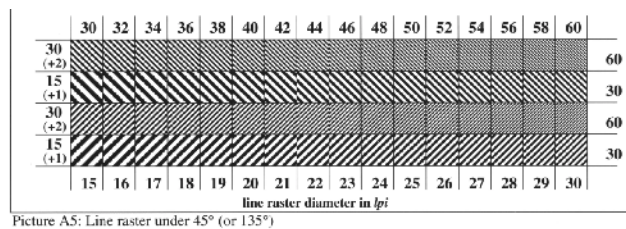
Figure 6. C5&C6: Line rasters.
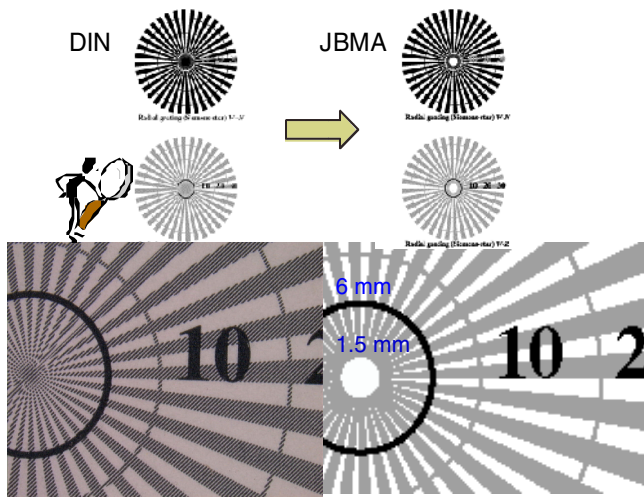
Figure 7. C1: Siemens-star: DIN vs. JBMA.

Figure 9. B1 & D1: Fruit motif, map and 14 CIE-test colors according to CIE-Publ.13.3 and B/W + 16 gray steps.

Improvements for Achromatic Test Charts

Improvements are as follows:

1. Changing from specific line screen to general dot screen
2. Deleting the center of Siemens-star
3. Changing the maximum line raster frequency from 240 lpi to 60 lpi
4. Changing from Landolt-rings to ISO-words

Figure 5 shows the magnified images of a gray patch in the 16-step gray scale of test chart No.3. Although a specific line screen is used in DIN chart shown in the left figure, we have applied a general dot screen as shown in the right figure. The Japanese WG has concluded that the usage of dot screen is more realistic for users to evaluate the tone reproduction, because most press documents, like books, newspaper, and so on, are printed with the dot screen.

The optional limitation of maximum spatial frequency, 60 lpi in raster lines in C5 and in horizontal and vertical lines in C6 are very practical for users to avoid misjudgment due to moiré problem at higher spatial frequencies (Figure 6).

To avoid misreading of copy resolution under 6 mm diameter, we have eliminated the portion under 1.5 mm diameter as shown in Figure 7.

ISO characters are widely used in various test charts, such as ITU-T test chart No. 4 which is used to evaluate fax and copier. Therefore, we are more familiar with ISO characters[8] than with Landolt-rings in this area. In the future when this test chart will be used for testing not only copier but also printer outputs, we believe that ISO words are more adequate for character legibility evaluation (Figure 8).
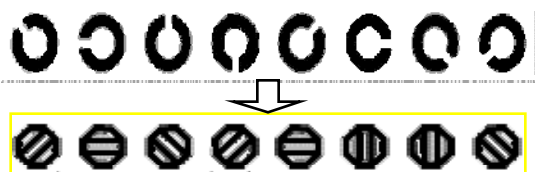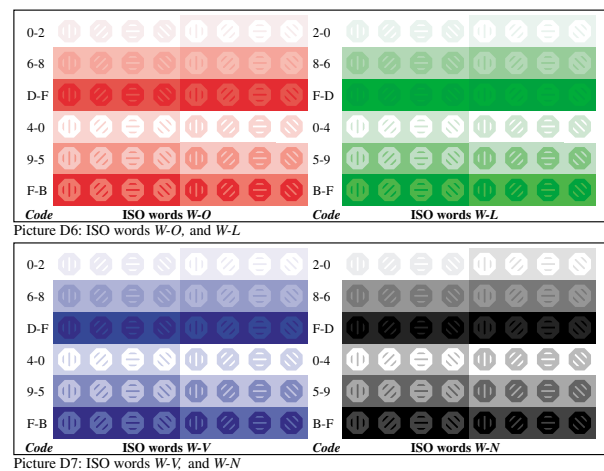

Figure 8. Landolt-rings to ISO words[8].

Figure 10. D6&D7: ISO words in colors, R, G, B, K. Four ISO characters are called a ISO word.

Improvements for Chromatic Test Charts

Improvements are as follows:

1. Picture Images: Pictorial and Map image
2. Deleting the center of Siemens-star
3. Changing from Landolt-rings to ISO-words
4. Introducing Asian Script and Reverse Fonts
5. Changing from specific line screen to general dot screen

As for the picture image B1, we can choose any images according to 15775 standard as shown in Figure 9. We have chosen a pictorial image and a map image which are often copied in offices. Three different images are merged into one image. According to the standard, we have prepared the size of this image in 3072 x 2048 and so on. We have also calculated the conversion matrix 3 x 4 from RGB data to L*a*b* values with 32 CIE colors.
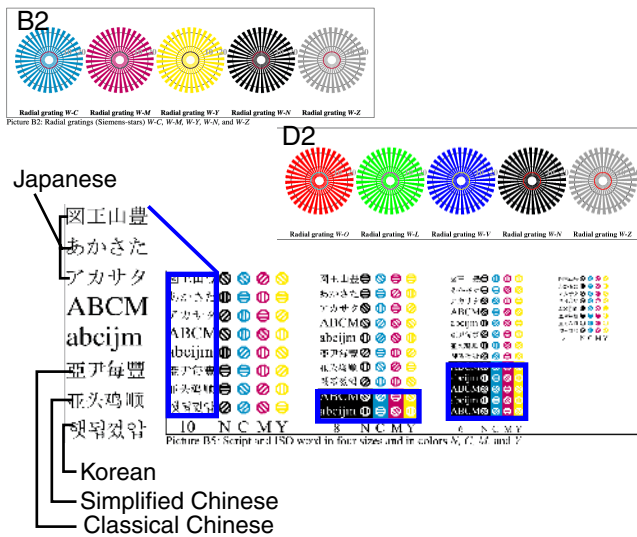
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Figure 11. B2&D2: Siemens-stars and B5&D5: Script and ISO words.

We have changed from "Landolt-rings" to "ISO words" in B6, B7 area in the test chart No. 2 and D6, D7 in the test chart No. 4. A combination of background and image is arranged to give more chance to test various pairs as shown in Figure 10.

Siemens-stars are printed with solid using C, M, Y, K and Gray inks for test chart No. 2 and R, G, B, K and Gray inks for test chart No. 4. To avoid misreading of copy resolution under 6 mm diameter, we have eliminated the portion under 3 mm diameter as in the test chart No. 3 as shown in Figure 11.

We hope these charts are used widely in Asian area, so in addition to the alphabet, we have included Asian Scripts like the three kinds of Japanese characters, the classical and simplified Chinese and Korean as shown in Figure 11. The reverse character sets are added, because these are also frequently used in various printings.

The reason to change from "Specific line screen" to "General dot screen" is the same as in the case of test chart No. 3.

B3 or B4 block is printed with 4 colors, CMYK and 175 lpi. Although the specific line screen is used in DIN chart, we applied general dot screen, which is commonly used in the ordinal documents. The target for color difference between defined L*a*b* values and outputs for B3 and D3 is within three CIELAB units.

Now, the JBMA digital charts are downloadable from JBMA web site as follows:
http://www.jbma.or.jp/~isoiec/sc28/testchart/index.htm.
We will show the 3rd version of JBMA test charts and report their quality of them in the interactive session.

Conclusion

Amendments for ISO/IEC 15775 test charts are proposed to improve their effectiveness and ease to use for international users. The practical improvements for each charts are explained. We are going to make efforts to amend ISO/IEC 15775 and improve the test charts continuously.

References

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8. ISO 446:1991 Micrographics - ISO character and test chart No. 1- Description and use.

Biography

Tetsuya Itoh received his BS in physics from Nagoya University in 1977 and his Ph.D. in Engineering from Toyohashi University of Technology in 2000. He is currently an associate scientist at Minolta Co., Ltd. where he is working on image quality analysis and assessment. He is a member of ISJ, IIEEJ, ITE, OSJ and IS&T.
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