Annex A: Visual work place assessment

informative

Display output linearization and evaluation of achromatic ISO/IEC-test chart output for 8 different ambient light reflections at visual work places

A.1 Introduction

A.1.1 Linear input - output relationship for ISO/IEC-test charts of ISO/IEC 15775

There is a basic user requirement for a linear relationship between user friendly colour coordinates and the visual colour output. Depending on the application there are many sets of equivalent colour coordinates.

5 steps of grey series black - white (N - W)	**Colour space, colour space coordinates and PostScript operator calculations according to ISO/IEC 15775:1999-12**				
Linear mixture between black and white in CIELAB colour space	***CIELAB: L*,a*,b* LAB* (absolute) LAB* setcolor***	***l* CIE w* = l* setgray***	**CMYN (CMYK)** ***000n* setcmykcolor***	**CMYN (CMYK)** ***cmy0* setcmykcolor***	**OLV (RGB)** ***www* setrgbcolor***
1,00 N + 0,00 W (black N)	18.01 0.50 -0.46	0,00	0,00 0,00 0,00 1,00	1,00 1,00 1,00 0,00	0,00 0,00 0,00
0,75 N + 0,25 W	37.36 0.13 0.84	0,25	0,00 0,00 0,00 0,75	0,75 0,75 0,75 0,00	0,25 0,25 0,25
0,50 N + 0,50 W	56.71 -0.24 2.15	0,50	0,00 0,00 0,00 0,50	0,50 0,50 0,50 0,00	0,50 0,50 0,50
0,25 N + 0,75 W	76.06 -0.61 3.45	0,75	0,00 0,00 0,00 0,25	0,25 0,25 0,25 0,00	0,75 0,75 0,75
0,00 N + 1,00 W (white W)	95.41 -0.98 4.76	1,00	0,00 0,00 0,00 0,00	0,00 0,00 0,00 0,00	1,00 1,00 1,00

Fig. A.1: Equivalent colorimetric coordinates for the device system ORS18

Fig. A.1 shows equivalent colorimetric coordinates for a 5 step grey series between black *N* and white *W f*or the Offset Reflective System ORS18. Fig. A.1 is taken from ISO/IEC TR 19797:2004 which defines a method for output linearization of 16 step grey and colour series. The output can be measured and for the standard output ORS18 the measurement data are given. If the CIELAB *L** lightness data are used then the calculated *relative* output lightness *l** data are identical to the input whiteness *w** data which are used by the *PostScript* operator *setgray* in the digital file. In this case the input – output relationship in a *w* – l** diagram is a diagonal line which indicates a special *linear* relationship between input and output. The output linearization method of ISO/IEC TR 19797 matches all these intentions, including equal output for the five equivalent colorimetric input coordinates.

NOTE: *relative* lightness *l** is calculated from the CIELAB lightness *L** of grey and L^*_N of black and L^*_W of white by the following equation

$$l^* = (L^* - L^*_{N}) / (L^*_W - L^*_N) \quad (1)$$

However usually the input – output relationship is *non* linear but it can be made linear with the following method: In a first step a file with 16 equally spaced device input coordinates *w* (without *) and the PS operator *w setgray* produce an output. For the grey output colours the *absolute* lightness *L** data are measured and the *relative* output lightness *l** data are calculated. Then for **equally spaced** *relative* output lightness *l** a device dependent mapping between *w** and *w* solves the problem. If the software transforms the 5 or 16 equally spaced digital values *w** in the file to the device dependent *w* values, then the output is visually equally spaced and the intended equally spaced *l** output data are produced.

A.1.2 Linear input - output relation of the non linear *sRGB* space according to IEC 61966-2-1

The International Standard IEC 61966-2-1 defines relationships between different colour coordinates of the *sRGB* colour space CIEXYZ, and CIELAB. There are linear ($R_{sRGB} = rgb$) and non linear ($R'_{sRGB} = rgb^*$) coordinates in IEC 61966-2-1. The linear coordinates *(rgb)* have a *linear* relationship to CIEXYZ and the *non linear* coordinates *(rgb*)* have for the achromatic colours a linear relationship to the CIELAB lightness *L**.

The connection between *linear* and *non linear* coordinates used in IEC 61966-2-1 is approximately

$$R'_{sRGB} = (R_{sRGB})^{1/2.4} \quad (2)$$

which is for the achromatic colours very similar to the following colorimetric equation ($0 <= Y <= 100$)

$$L^* = 100\ (Y/100)^{1/2.4} \quad (3)$$

which is in the range $1 <= Y <= 100$ a good approximation for the CIELAB lightness *L** defined as

$$L^* = 116\ (Y/100)^{1/3} - 16 \quad (4)$$

NOTE: If one compares equations (2) and (3) and uses the linear relationship between R_{sRGB} and *Y*, then

R'_{sRGB} must be linearly related to the CIELAB lightness L^* and the *relative* CIELAB lightness l^* defined in (1). All printer and nearly all monitor applications operate in the range 1 <= Y <= 100 and then approximately

$l^* = L^* / 100 = (Y / 100)^{1/2.4}$. Different exponents or "gamma" values will be used in some figures later.

Therefore at least in the range between black ($L^*_N = 8$, $l^*_N = 0$) and white ($L^*_W = 95$, $l^*_W = 1$) the RGB'_{sRGB} *(rgb*)* data have a linear relationship to the relative lightness l^* data. In application therefore the so called sRGB devices have a linear input – output relationship between the RGB'_{sRGB} data in the file and the measured *relative* lightness l^* of the output.

NOTE: White standard offset paper has a luminance reflectance Y = 88.6 and not Y=100. The Y values used in the equation of the sRGB space are usually normalized to the media white. According to ISO/IEC 15775 and ISO/IEC TR 24705 the CIELAB media white and media black define the relative lightness 1 and 0. Therefore the equation (1) for relative lightness is the only correct colorimetric equation and used in this paper. Colorimetric device coordinates with a linear relationship to the coordinates of CIELAB are called *-coordinates (star-coordinates), others with a linear relationship to the coordinates of CIEXYZ are defined without a * (star).

A.1.3 Large change of the input - output relationship by display reflections of the ambient light

ISO/IEC TR 24705 includes tables for the grey and colour changes on displays by different ambient room light reflections on the monitor surface. For comparison of hardcopy (paper) and softcopy (monitor) output a standard display according to ISO/IEC TR 24705 is normalized for black and white to the same lightness compared to the standard offset paper.

A white lightness L^*_W = 95.4 (luminance factor Y_W = 88.6) and a black lightness L^*_N = 18.01 (luminance factor Y_N = 2.51) is used. The luminance factor Y_N = 2.51 is taken as standard ambient room light reflection on the monitor surface. In the office for *computer* displays a range between Y_N = 1 and Y_N = 10 is appropriate. The luminance of modern LCD monitors is higher compared to CRT monitors.Therefore LCD monitors have a lower room light reflection compared to the white LCD monitor.

A.1.4 Linearized output and input – output relationship by 8 display reflections of the ambient light

One can calculate tables for different room light reflections between Y_N = 0 and Y_N = 40. For the standard ambient reflections the luminance contrast between white and black is $Y_W : Y_N$ = 88.6 : 2.5 = 37 : 1. The luminance contrast decreases from very high values if Y_N is near zero up to the value $Y_W : Y_N$ = 88.6 : 40 = 2 : 1 for about 40% room light reflection. This is the minimum ergonomic requirement according to this standard series (see ISO/DIS 9241-30X).

NOTE: For data projectors used in daylight offices the relation between projector and room luminance on the screen may reach the ratio 2:1. In this case still 16 grey steps can be distinguished if the relative luminance on the screen is adjusted to the real lighting and viewing conditions.

The following six figures show six output pages of a **16 page file** which includes the calculations for eight room light reflections, see the URL (16 pages, 1.7 MByte)

http://www.ps.bam.de/ME15/10L/L15E00FP.PDF

The output of this file produces 16 pages for eight different luminance ratios between $Y_W : Y_N$ = 88.6 : 0 and $Y_W : Y_N$ = 88.6 : 40 = 2 : 1.

The uneven pages (1, 3, ..., 13, 15) are intended to produce a linearized output of the ISO/IEC-test chart according to ISO/IEC 15775.

The even pages (2, 4, ..., 14, 16) produce the input – output relationships and some tables defined in Annex G of ISO/IEC 15775.

A linearization method and a linearized display output of the achromatic ISO/IEC-test chart no. 3, see the URL (1 page, 100 kByte).

http://www.ps.bam.de/ME16/10L/L16E00FP.PDF

is the basis for the ISO-test report of this International Standard ISO 9241-306. The graphical elements and the methods for this evaluation are identical to the methods given in ISO/IEC 15775 and in ISO/IEC TR 24705 for monitor output.

To consider the ambient light reflections some small modifications have been applied to the questions in the test report of this International Standard ISO 9241-306.

Two different ISO-test reports are necessary for the *computer* display and the *external* display.

A flowchart is given for all steps, for example the linearization method and the two test reports.

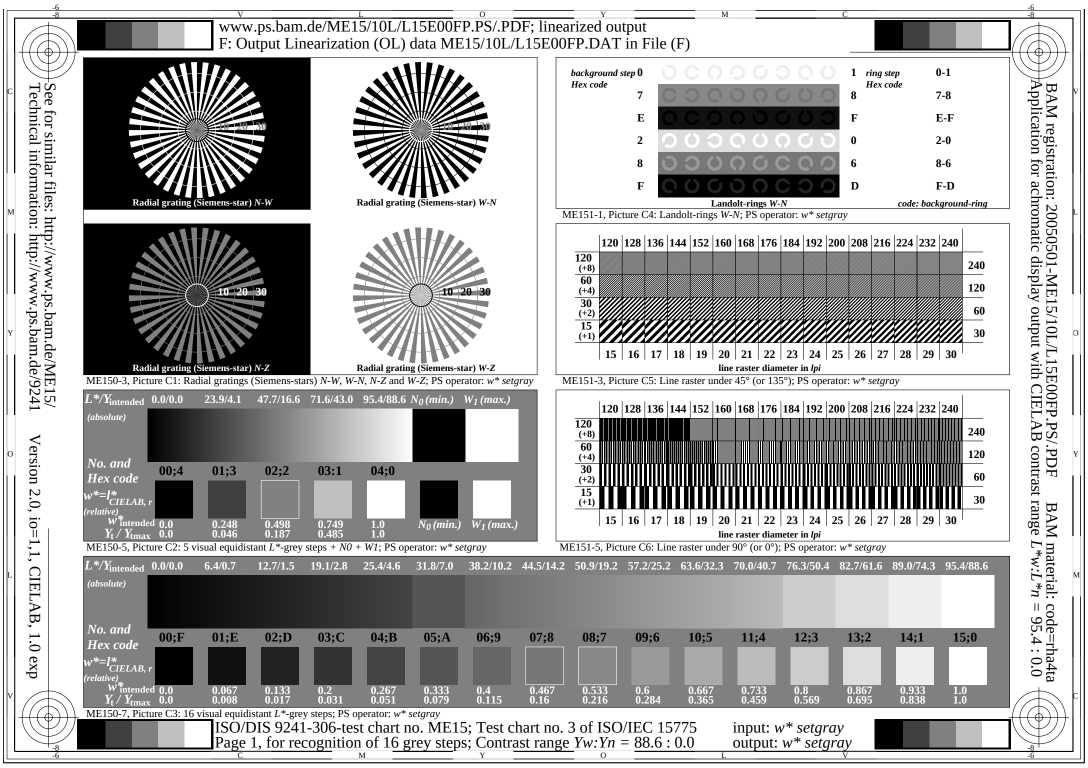

Fig. A.2: ISO/IEC-test chart no. 3 according to ISO/IEC 15775, page no. 1 for the high contrast range

Fig. A.2 shows the ISO/IEC-test chart no. 3 according to ISO/IEC 15775 for the high contrast range ($Y_W : Y_N$ = 88.6 : 0.0, $L^*_W : L^*_N$ = 95.4 : 0.0) and appears on the output page no. 1

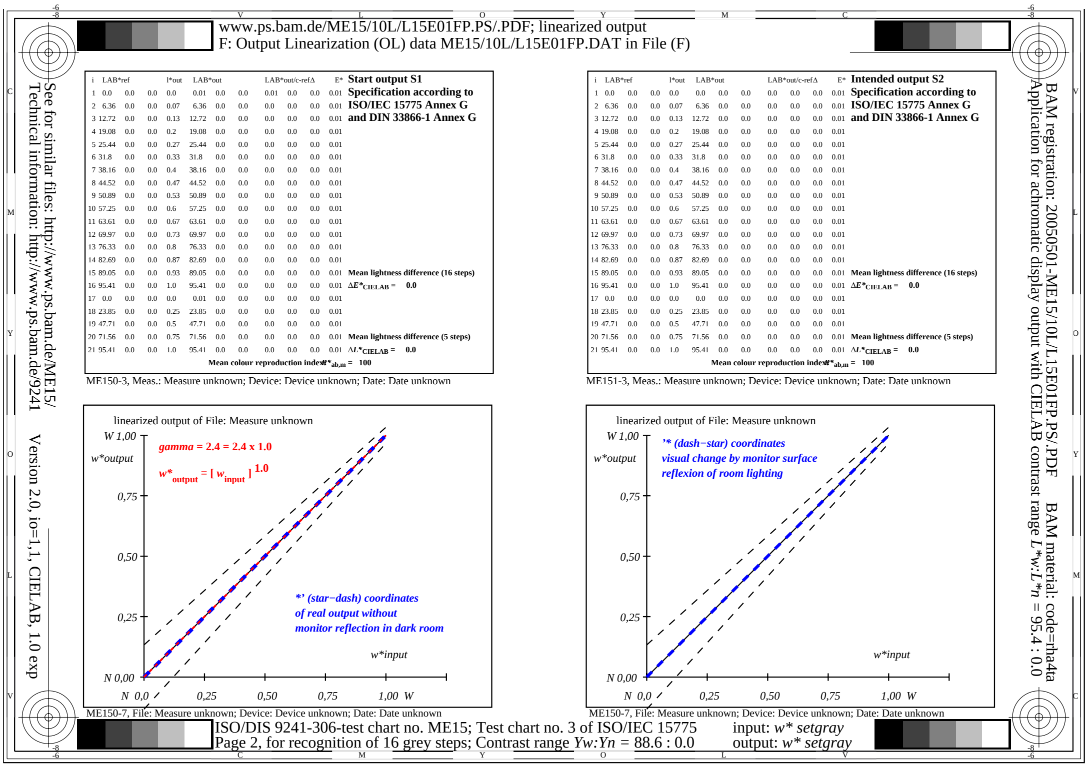

Fig. A.3: Ideal input – output relationship, page no. 2 for the high contrast range

Fig. A.3 shows the ideal input – output relationship of a monitor system for the high contrast range ($Y_W : Y_N$ = 88.6 : 0.0, $L^*_W : L^*_N$ = 95.4 : 0.0) and appears on the output page no. 2. The input values may be the equal *rgb* values of the *sRGB* colour space (IEC 61966-2-1) and the output values the relative CIELAB lightness $l^* = (L^* - L^*_N) / (L^*_W - L^*_N)$. The absolute CIELAB lightness values L^* between the black lightness L^*_N (=noir) and the white lightness L^*_W are given in the above tables. They are equally spaced between the value zero and the value 95.4 which is the standard normalization for both monitors and the white standard offset paper, compare ISO/IEC 15775 and ISO/IEC TR 24705. In the following figures the black lightness L^*_N changes from 0 to 18 (Fig. A.4 and A.5) up to 70 (Fig. A.6 and A.7). This leads to large changes of the lightness and luminance contrast ratios.

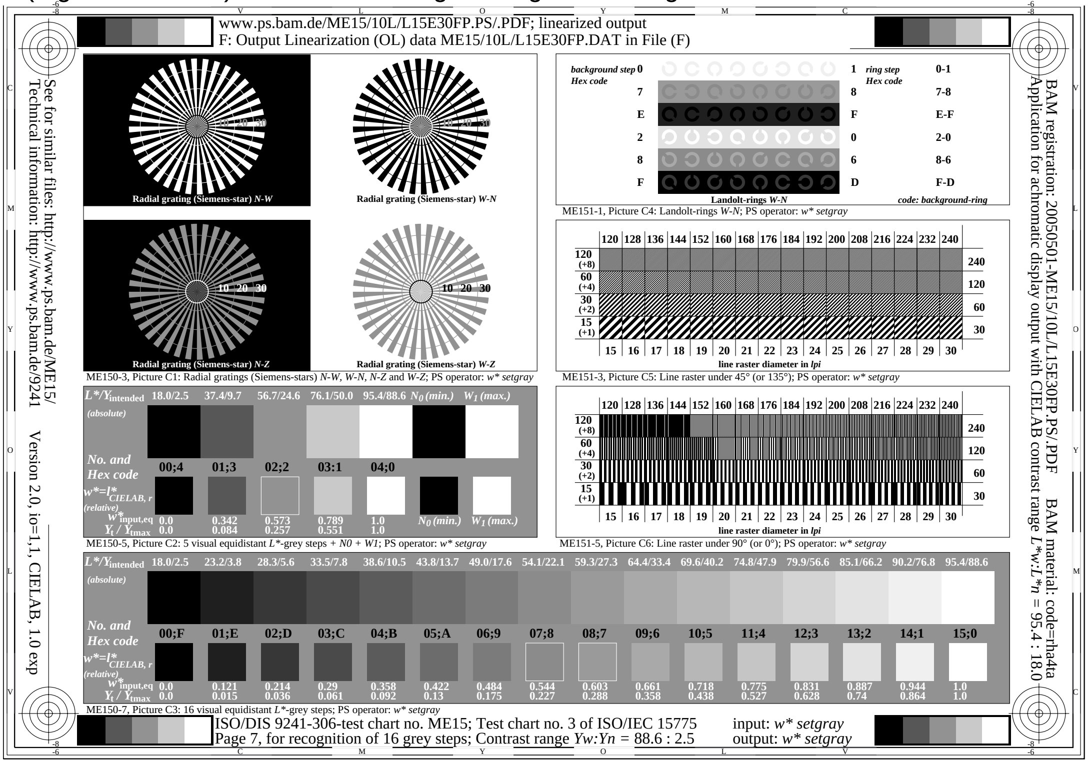

Fig. A.4: ISO/IEC-test chart no. 3 according to ISO/IEC 15775, page no. 7 for the medium contrast range

Fig. A.4 shows the ISO/IEC-test chart no. 3 according to ISO/IEC 15775 for the medium contrast range ($Y_W : Y_N$ = 88.6 : 2.5, $L^*_W : L^*_N$ = 95.4 : 18.0) and appears on the output page no. 7.

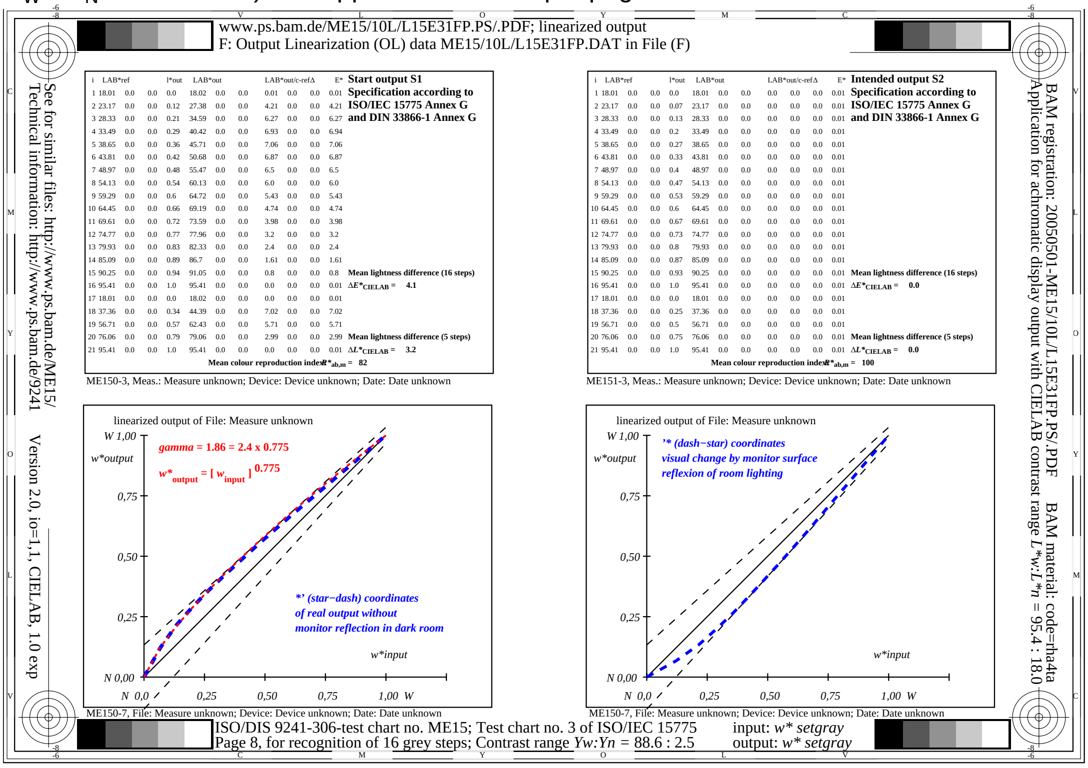

Fig. A.5: Input – output relationship, page no. 8 for the standard medium contrast range

Fig. A.5 shows the input – output relationship of a monitor system for the medium standard contrast range ($Y_W : Y_N$ = 88.6 : 2.5, $L^*_W : L^*_N$ = 95.4 : 18) and appears on the output page no. 8. In the dark room the output appears lighter (table and figure on left side). The daylight reflection on the monitor surface creates the inverse input – output relationship. This leads finally to the equally spaced output values of the lightness in the right top table. Luminance measurements lead approximately to the same values. Without the monitor surface reflection the output values *LAB***$_{out}$ of the lightness are not equally spaced, compare left top table.

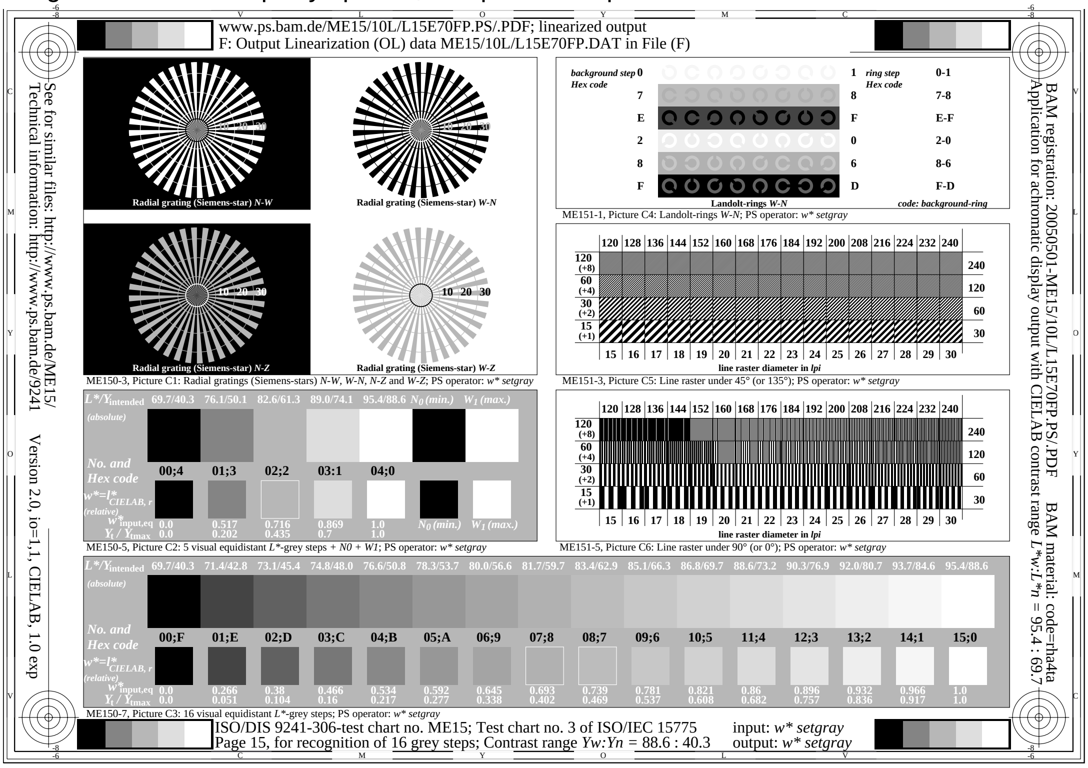

Fig. A.6: ISO/IEC-test chart no. 3 according to ISO/IEC 15775, page no. 15 for the low contrast range

Fig. A.6 shows the ISO/IEC-test chart no. 3 according to ISO/IEC 15775 for the low contrast range ($Y_W : Y_N$ = 88.6 : 40.6, $L^*_W : L^*_N$ = 95.4 : 70.0) and appears as the output page no. 15

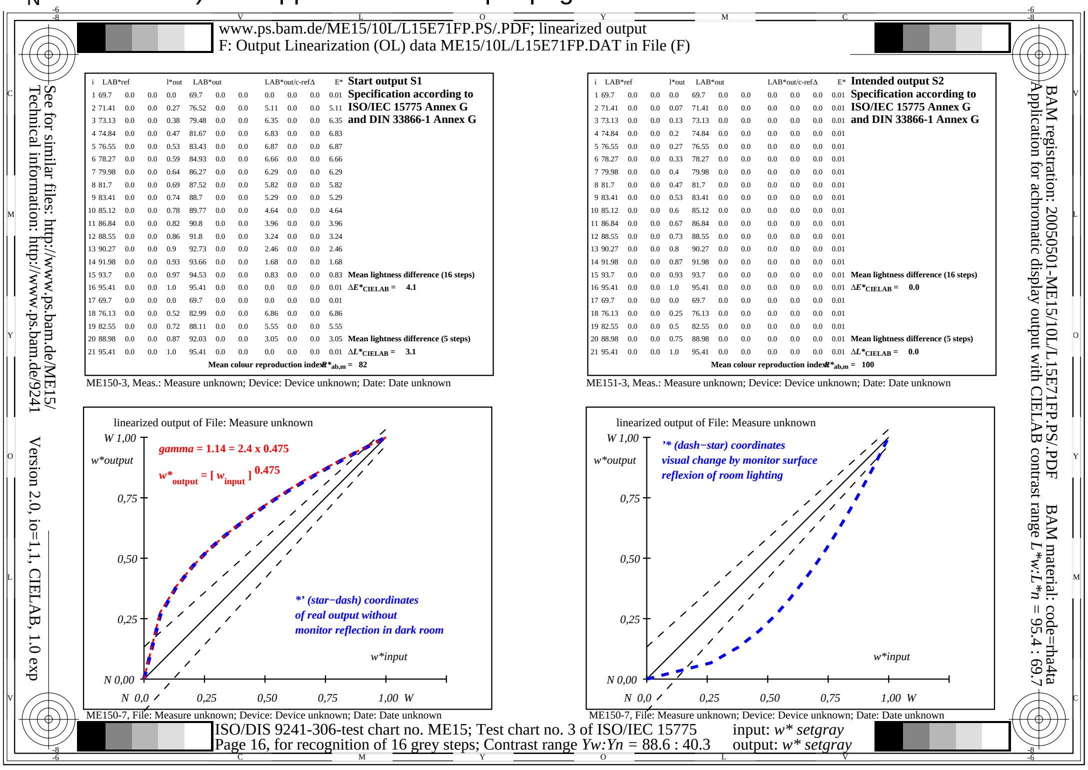

Fig. A.7: Input – output relationship, page no. 16 for the low contrast range

Fig. A.7 shows the input – output relationship of a monitor system for the low contrast range ($Y_W : Y_N$ = 88.6 : 40, $L^*_W : L^*_N$ = 95.4 : 70) and appears on the output page no. 16. This low contrast range may appear on the projection screen if data projectors are used in the daylight office. The calculated medium lightness difference is equal in Fig. A.5 and A.7 (value 4.1). In the low contrast range there is a reduced lightness range ΔL^* = 25 instead of the much larger lightness range ΔL^* = 77 for the medium contrast range. If in the dark room the gray scale includes too less steps in the dark area then it appears equally spaced in the daylight office for the luminance contrast ratio 2:1.

A.2. Output linearization with the standard achromatic ISO/IEC-test file

A.2.1 Inverse input - output relationship to consider the ambient light reflections.

It is known by experience that more and more ambient light reflections decrease the recognition of the dark grey steps and the recognition of the Landolt-rings in the dark area. The input – output relationship of this effect is shown in the right bottom graphs of Fig. A.5 and A.7. For compensation the input data are changed in the file. This inverse input – output relationship is shown in the left bottom graphs of Fig. A.5 and A.7.

For the luminance ratio 2:1 between white and black the discrimination disappears for about 6 steps of 16 steps in the dark area. This may produce security and safety problems. Therefore it is necessary to use an output linearization method which produces always 16 equally spaced steps for any ambient light condition including the luminance ratio 2:1. A simple method is needed which allows to test if this goal is reached.

The grey output of page 15 appears much too light in the dark grey area and the grey differences appear to large. However if finally 40% ambient light reflections are produced then the 16 grey steps appear visually equally spaced.

It is therefore the task to produce ***for any output*** (not only the *PDF* output) the ***inverse input – output relationship for any ambient light condition*** (between a very large luminance ratio and the luminance ratio 2:1) on any computer operating system *(Windows and Mac).*

One must realize that the output always depends not only on the ambient light conditions but also on hardware, and software at the work place. Therefore a solution for one work place may fail on another work place and the many changes of reflections between sunrise and sunset in the office may require several changes at the work place during daytime. Therefore in application simple and effective methods for naive users are necessary. A kind of 8 step method shown in the 16 page file and its output examples in Fig. A.2 to A.7 is appropriate to realized the effect. High priority has the question how to implement the visual results by simple methods at the work place.

Additionally the output of the ISO/IEC-test chart is usually different at the *compute*r display and at the *external* display, for example a data projector output on a screen in the office which is illuminated by daylight.

A.2. 2 View of the ISO/IEC-test file according to ISO/IEC 15775

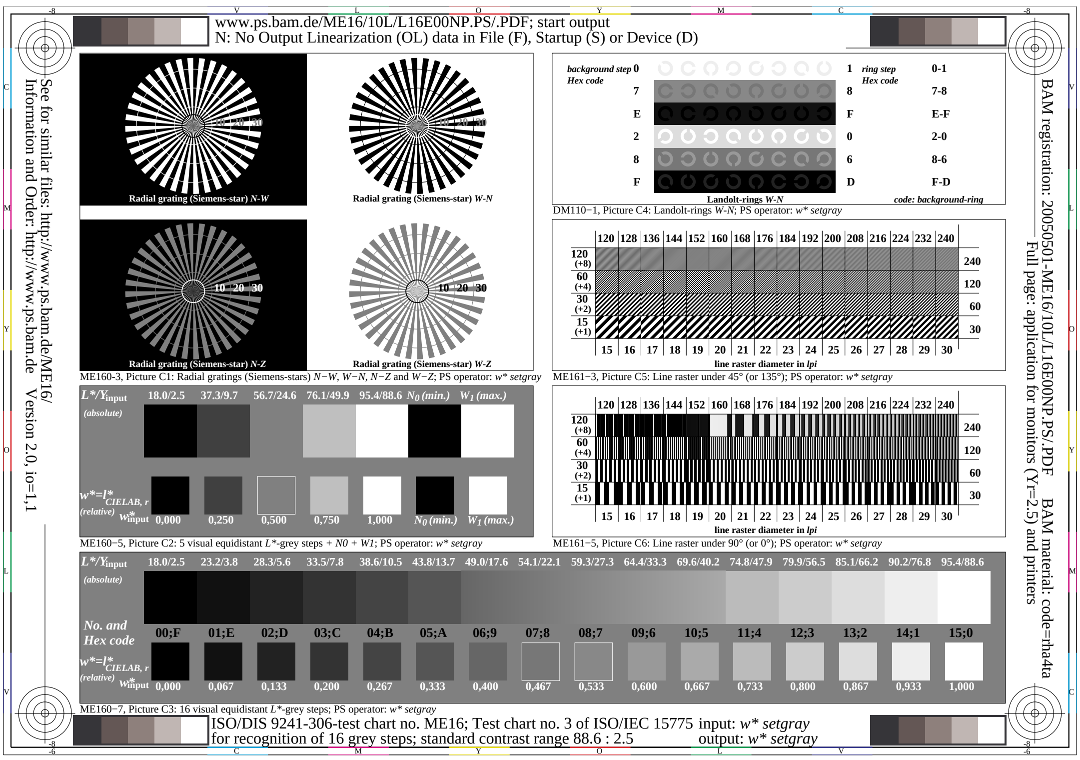

Fig. A.8: ISO/IEC-test chart no. 3 according to ISO/IEC 15775 for output linearization

Fig. A.8 shows the ISO/IEC-test chart no. 3 according to ISO/IEC 15775 for output linearization. In the file the digital values for the 16 grey steps change between 0 and 1 in equal steps between 1/15, 2/15, and 14/15. If the output of

Fig A.8 is shown on both the *computer* display and the *external* display then it is intended for the 16 grey steps output to be equally visually spaced on both displays.

For practical applications a quick change on both displays with two independent tools is necessary. On the computer system *Apple Macintosh Version X 10.4* there is a tool "System preferences, Displays, Color, Calibrate" which shows two windows for the two displays. Each window allows to create independent profiles for both the *computer* display, for example an LCD display, and the *external* display, for example a VGA display.

There is a default profile for the *computer* display with a default gamma value 1.8 for the *Apple Macintosh*. A user can change the gamma value and can store for example 8 different "Profiles Color LCD x" with x=1.14, 1.32, ..., 2.22, 2.40.

Remark: The effective gamma values for the intended output are calculated in Fig. A.2 to A.7. Some modifications of these gamma values and its range may be appropriate for different applications.

Fig. A.9: 8 gamma values which produce 8 different input – output profiles for the *computer* display

Fig. A.9 shows 8 gamma values which are used for 8 different input – output profiles for the *computer* display. The option "calibrate" of Fig. A.9 has been used to create the 8 profiles with the 8 appropriate gamma values and names. The input – output relationships of these 8 profiles are inverse compared to the input – output relationships of the ambient light reflections Y_N= 0.0, 0.63, 1.25, 2.51, 5.02, 10.04, 20.08, 40.16 shown in the 16 page test file and in Fig. A.3, A.5, and A.7.

If the recommended ISO/IEC-test chart is viewed on the *computer* display then a step by step click on the eight different profiles changes the visual output of the test chart (and all other windows). It takes a few seconds to choose the ISO/IEC-test chart output with the intended 16 step grey scale which is visually equally spaced for the *computer* display.

In some cases additional *external* displays are at the work place. If for example an *external* monitor or data projector is at the *external* display connector then a second display tool is shown on the computer system *Apple Macintosh Version X 10.4*.

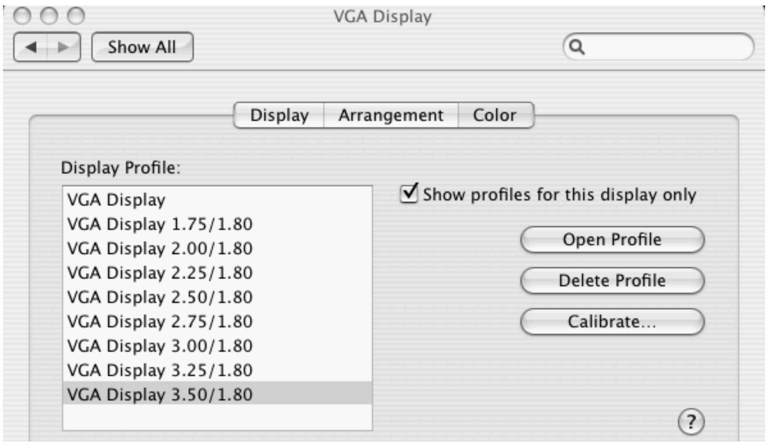

Fig. A.10: 8 "gamma" values which produce 8 different input – output profiles for the *external* display

Fig. A.10 shows 8 "gamma" values which may be used to create 8 different input – output profiles for the *external* display. The "gamma" value 1.80 is called the "native gamma" on the computer system *Apple Macintosh Version X 10.4*.

There are "gamma" values in the range 1.00 to 3.50, but only the values in the range 1.75 to 3.50 have been useful for the intended linearized output. Larger modifications of the "gamma" values may be appropriate for different applications.

If the recommended ISO/IEC-test chart is viewed on the *external* display, for example on the data projector screen, then a step by step click on the eight different profiles changes the visual output of the test chart (and all other windows on the *external* screen; there is no change in this case on the *computer* display). It takes a few seconds to choose the ISO/IEC-test chart output with the intended 16 grey steps which are visually equally spaced for the *external* display.

Result:

There is a quick method for output linearization of both the *computer* display and the *external* display. For output linearization on both screens it is essential for the visual control to have the ISO/IEC-test charts on both screens.

These properties allow to produced a linearized output by a workflow diagram.

A. 2. 3 Complete workflow for output linearization and ISO/IEC-test report data

The procedure to reach the linearized output and the evaluation of this result is shown in the following workflow

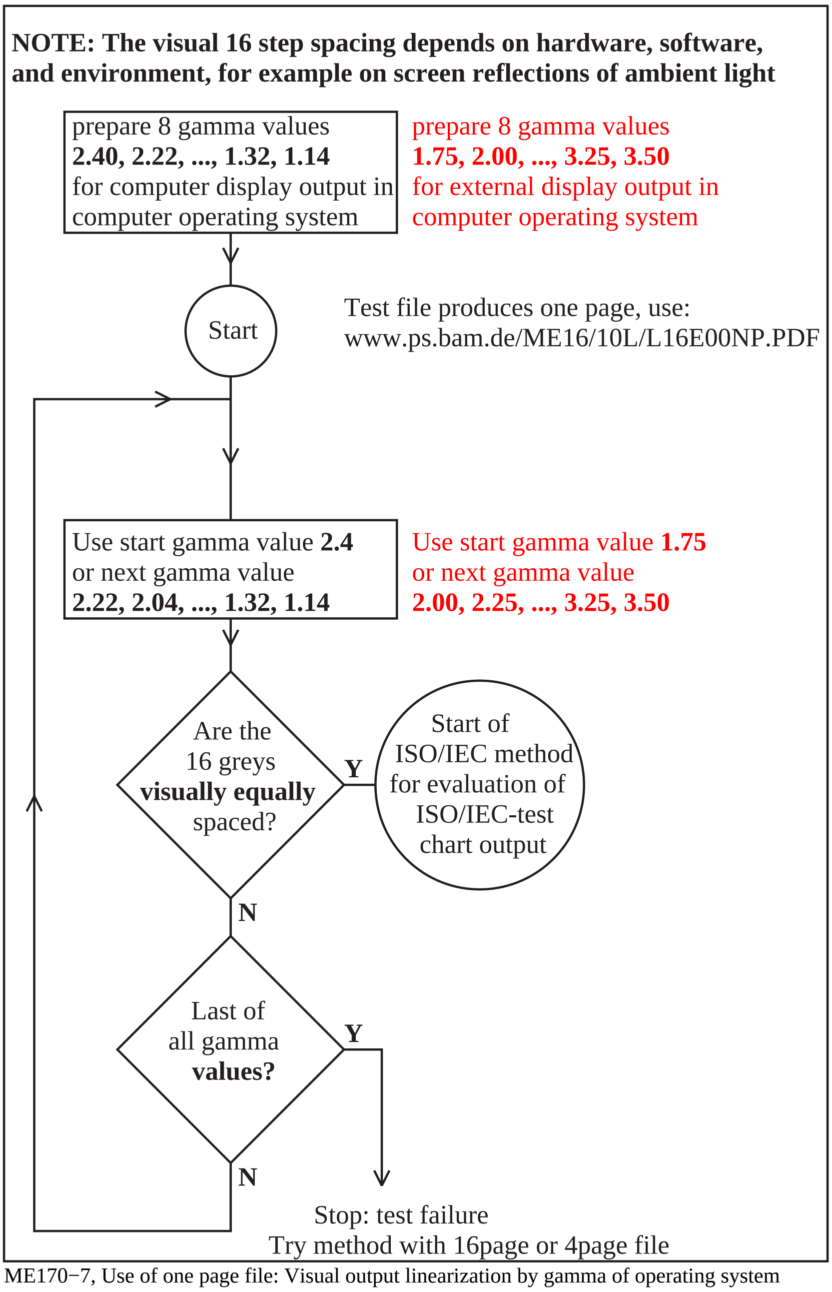

Fig. A.11: Workflow to produce a linearized output of the 16 grey steps and the test report data

Fig. A.9 shows two workflow to produce a linearized output for the 16 grey steps. For both the computer display and the external display (see text in red color) the standard ISO/IEC-test chart file is used.

A.3.Test report of this International Standard ISO 9241-306

The test report of this International Standard ISO 9241-306 is based on the test report of ISO/IEC-test chart no. 3 according to ISO/IEC TR 24705. The one page output of the achromatic ISO/IEC-test chart file is used according to ISO/IEC 15775, and ISO/IEC TR 24705, compare Fig. A.8.

A.3.1 Output linearization method and test report for the *computer* display and the *external* display

After output linearisation according to the workflow given in Fig. A.11 at least one ISO-test report according to ISO 9241-306 is necessary for the *compute*r and / or the *external* display.

Fill out at least for one either the *computer* display and / or the *external* display:

1. the test report Form A for the frame area given in Annex B.

   NOTE: Some additional data describe the test person, the test date and the software and operating system used.

2. the test report Form B for the image area given in Annex C.

   NOTE: For the test of line screens reproduction the resolution limit 60 lpi of ISO/IEC 15775 for printer output is reduced to 30 lpi for display output.

The output linearization method for the *achromatic* ISO/IEC-test chart for both the *computer* and the *external* display is shown here *as example* on the computer system "*Apple Macintosh X 10.4*". Similar methods may be available on the computer systems "*Window*" and others.

A.4 Future *chromatic* output linearization based on measurement and visual data

For the *colour printer* output there is a *colou*r output linearization method defined in ISO/IEC TR 19797 which is based on the CIELAB measurement data of a first printer output. The second output uses the measurement data and is linearized.

For *achromatic monitor* output a *visual* method for achromatic output linearization has been developed, see the paper with the title "Visual efficiency for image output on colour monitors", see the URL (16 pages, 1.5 Mbyte)

http://www.ps.bam.de/VISE05.PDF

There is a first output of five step grey scales. The visual assessment data are used for the second linearized output.

For *chromatic monitor* output a visual method for colour output linearization has been developed recently, see the URL (8 pages, 1.0 MByte)

http://www.ps.bam.de/ME05/10L/L05E00FP.PDF

There is a first output of five step colour scales. The visual assessment data are used for the second linearized output.

For *colour display* output which considers eight ambient light reflections a solution may be based on lockup tables. For newer developments, see the under "publications" on the server

http://www.ps.bam.de

There may be tools in next future for the direct input of for example 16 values of the "gamma curves" of instead of one "gamma value". "Gamma curves" are available under the option "Open Profile" in Fig. A.9 and A.10. There is a 4 page file, see the URL (4 pages, 400 kByte)

http://www.ps.bam.de/ME14/10L/L14E00FP.PDF

which allows to determine *visually* the *actual* input – output relationship by the assessment of 5 step scales, compare page 3 and 4 with the *actual* output spacing values 0.10, 0.30 and 0.75 instead of the equal spacing values 0.25, 0.50, 0.75. The *calculated* inverse input – output relationship on page 4 with 16 steps of the "gamma curve" may replace the "gamma curve" in the "Open Profile" section. There are tools on Windows to include the "gamma curve" but these methods may be too difficult for naive users.

There are other alternatives for output linearization. The 16 page file used here includes a linearization method in the *PS* file. One can apply this method to *any PS* file, if the *PostScript* linearization code is copied for example to the "*Start-up folder*" of the software "*Adobe Acrobat Distiller*" which transforms *PS* to *PDF* files. The software uses this linearisation code which includes either visual or measurement output data of the display.This method is appropriate for *any* computer operating system. Again this method may be too difficult for naive users.

Annex B:
Form A for the frame area according to ISO 9241-306

informative

This Form may be freely copied.
For this test the *computer* display output in the size 282mm x 194 mm is recommended.
For an *external* display output any output size is possible.

The ISO/IEC-test chart 3 (original, reference) is useful to explain the test intention.

Please fill out or mark by **(x)**:

Test of achromatic ISO/IEC-test chart 3 for *computer* display ( ) or for *external* display ( ):
ISO-test chart: e. g. Test chart 3 for colour devices (write text from the frame area of ISO-test chart)
....

ISO/IEC-BAM-identification: e. g. 20050501-ME15/10L/ (write code from top right side) ....
ISO/IEC-reference material: e. g. r(h/c)a4(r/t)(a/d) (write code from bottom right side) ....
File-name: e. g. L15E00NP.PDF (write code from top side)..

Test person *(e. g. Name, First name):*..
Test date *(e. g. 2005-05-01):*..
Computer operating system and version *(e. g. Unix Build X.Y):*..
PDF Reader software and version for display output *(e. g. Adobe Reader 7.0):*..
Display *(computer* or *external)* driver and “gamma value” of linearized output:..

Remarks:
The **output size** on the *computer* display should be the same as the original (282 mm x 194 mm) for the inner thicker frame rectangle. If possible one should adjust with an accuracy of 2 mm to this size by the software using a ruler.

The output size of the *external* display is different. For the test report the scaling factors (see below) of the corresponding output size of the *computer* display should be used.

Test of agreement of the four 5-step grey scales according to the grey scales in the frame region:
Are there clearly seen differences between the four 5-step grey scales near the four corners? Yes/No
If Yes: Indicate by **(x)** – only one **(x)** – which grey scale deviates most from the average of the four grey scales and mark if this is darker or lighter.

top left	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
top right	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
bottom left	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?
bottom right	**( )**	if **(x)**: Is this darker **( )** or lighter **( )**?

Test of the scaling factors using width and height of the inner rectangle in the frame region:
The width and height of the inner rectangle in *x*- and *y*-direction in mm of the reproduction (Δx_o and Δy_o; o = output) must be measured. The scaling factors (s_x and s_y) in *x*- and *y*-direction must be calculated. For this 3 digits in mm and with rounding like the example are used (e. g. s_x = 1,01 and s_y = 0,98).

$s_x = \Delta x_o / \Delta x_r$ = . . . mm / 282 mm = . , . . $s_y = \Delta y_o / \Delta y_r$ = . . . mm / 194 mm = . , . .

NOTE: The width Δx_r and height Δy_r of the inner rectangle is defined in *PS*-file (or equivalent) as 282 mm in *x*-direction and 194 mm in *y*-direction.

9241TRAN:IDEGAX000515.PDF

Form A for the visual interpretation of the ISO/IEC-test chart 3 according to ISO 9241-306 for the *computer* display output ( ) or *external* display output ( )

Remark: This form is similar compared to Form C for the visual interpretation of the ISO/IEC-test chart 3 reproduction for colour devices according to ISO/IEC TR 24705:2005(E)

Annex C:
Form B for the picture area according to ISO 9241-306

informative

This Form may be freely copied.
For this test the *computer* display output in the size 282mm x 194 mm is recommended,
For an *external* display output any output size is possible.
The ISO/IEC-test chart 3 (original, reference) is useful to explain the test intention.

Test of the radial grating according to picture C1

N–W-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with naked eye	resolution diameter:	.... mm
W–N-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with naked eye	resolution diameter:	.... mm
N–Z-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with naked eye	resolution diameter:	.... mm
W–Z-radial grating:	Is the resolution diameter < 6 mm?		Yes/No
	Test with naked eye	resolution diameter:	.... mm

Test of 5 visually equally spaced *L-grey steps according to picture C2**

Are all the 5-steps on the upper row distinguishable?		Yes/No
If No: How many steps can be distinguished?	of the given 5 steps:	.... Steps

Test of 16 visually equally spaced *L-grey steps according to picture C3**

Are all the 16-steps on the upper row distinguishable?		Yes/No
If No: How many steps can be distinguished?	of the given 16 steps:	.... Steps

Test of the Landolt-rings *N–W* according to picture C4

Is the recognition frequency of the Landolt-rings > 50% (5 of 8 at least)?

background – ring	
0 – 1	Yes/No
7 – 8	Yes/No
E – F	Yes/No
2 – 0	Yes/No
8 – 6	Yes/No
F – D	Yes/No

Test of the line screen under 45° according to picture C5

Can equally spaced lines be seen?

Visual testing: Equally spaced line screeen can be seen from 15 to 30 lpi	Yes/No
Test with a naked eye: Equally spaced line screeen can be seen from 15 lpi:	to .... lpi

Test of the line screen under 90° according to picture C6

Can equally spaced lines be seen?

Visual testing: Equally spaced line screeen can be seen from 15 to 30 lpi	Yes/No
Test with a naked eye: Equally spaced line screeen can be seen from 15 lpi:	to .... lpi

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Form B for the visual interpretation of the ISO/IEC-test chart 3 display output according to ISO 9241-306

Remarks: This form is similar compared to Form E for the visual interpretation of the ISO/IEC-test chart 3 reproduction for colour devices according to ISO/IEC TR 24705:2005(E). For the test of line screens the limit 60 lpi has been reduced to 30 lpi as most of the display output can only resolve up to 30 lpi.