

ISO/IEC JTC 1 N 9438
ISO/IEC JTC 1
Information Technology

2008-12-01

Document Type: Proposed NP

Document Title: SC 28 New Work Item Proposal for TR Type-3 --- Test Method of Colour Gamut Mapping Algorithm for Office Colour Equipment.

Document Source: SC 28 Secretariat

Reference:

Document Status: This document is circulated to JTC 1 National Bodies for concurrent review. If the JTC 1 Secretariat receives no objections to this proposal by the due date indicated, we will so inform the SC 28 Secretariat.

Action ID: ACT

Due Date: 2009-03-01

No. of Pages: 19

<p>ISO/IEC JTC 1/SC 28 OFFICE EQUIPMENT Secretariat: Japan (JISC)</p>
--

DOC TYPE: Text for NP Ballot

TITLE: Ballot on New Work Item Proposal for **TR Type-3 --- Test Method of Colour Gamut Mapping Algorithm for Office Colour Equipment.**

SOURCE: Japan National Body

STATUS: Secretary of SC28 asks National Bodies to investigate possible patents to be used in this standard.
This document is circulated to P, O and L members of JTC 1/ SC28 National Bodies for NP ballot and forwarded to JTC 1 for concurrent review. Please submit your vote via the online balloting system by the due date indicated.

ACTION ID: LB

DUE DATE: **2009-02-28**

DISTRIBUTION: P, O and L members of JTC 1 /SC 28, JTC 1 Secretariat and ITTF

MEDIUM: Electronic (Web server)

NO. OF PAGES: 18

Address Reply to:

Secretariat - ISO/IEC JTC 1/SC 28

c/o RICOH COMPANY, LTD. Technology Strategy Department, Office Business Planning Center
810, Shimo-imaizumi, Ebina-city, Kanagawa 243-0460, Japan

Phone: +81-46-236-2400 Facsimile: +81-46-231-9638 E-Mail: kumakura@jbmia.or.jp

Japan NP for Test Method of Colour Gamut Mapping Algorithm for Office Colour Equipment

To Kaz Kumakura, Secretariat of ISO/IEC JTC 1/SC 28
From Hiroaki Koshibu, Chairman of JTC 1/SC28 Japan National Body
Date November 28, 2008

Japan National Body would like to propose NP for Test Method of Colour Gamut Mapping Algorithm for Office Colour Equipment. Please circulate the attached documents for NP voting.

Best regards,
Hiroaki Koshibu
Chairman of JTC 1/SC28 Japan National Body

G3 New Work Item Proposal

PROPOSAL FOR A NEW WORK ITEM

Date of presentation of proposal: 2008-06-12 (SC28 Plenary Meeting 2008)	Proposer: JAPAN
Secretariat: JISC -Japan	ISO/IEC JTC 1 N XXXX ISO/IEC JTC 1/SC 28 N 1244

A proposal for a new work item shall be submitted to the secretariat of the ISO/IEC joint technical committee concerned with a copy to the ISO Central Secretariat.

Presentation of the proposal - to be completed by the proposer. .

Title TR Type-3 --- Test Method of Colour Gamut Mapping Algorithm for Office Colour Equipment.
Scope This technical report is designed for equipments specific detailed descriptions and exceptions need to be specified to be applicable to office use colour softcopy to hardcopy gamut mapping algorithm evaluation in addition to CIE156 (Guidelines for the Evaluation of Gamut Mapping Algorithms specified general principles of various colour equipments colour gamut mapping algorithm evaluation method). This technical report defines test charts, test chart image processing workflow, media, viewing conditions, measurements, colour spaces and experimental methods which are either not exist in CIE 156 or different from CIE156. The colour softcopy may be displayed on monitors, incorporating such technologies as CRT and LCD. The colour hardcopy may be produced by non impact colour printers, incorporating such technologies as ink-jet and electro-photography.
Purpose and justification <p>Gamut mapping is a mapping of the colour-space coordinates of the elements of a source image to colour-space coordinates of the elements of a reproduction to compensate for differences in the source and output medium colour gamut capability. The evaluation method of the cross-device and cross-media colour image reproduction performance of gamut mapping algorithms (GMAs) was desirable for those people including colour scientists and colour equipment manufacturers and test method for evaluating a colour gamut mapping algorithm has already published as "CIE publication 156 - GUIDELINES FOR THE EVALUATION OF GAMUT MAPPING ALGORITHMS" in 2004. CIE156 has applied and evaluated in a various fields.</p> <p>The some of Japanese MFP manufacturers applied CIE156 to office colour printer and found a necessity of specifying the additional information required for colour gamut mapping algorithm evaluation. The information required for office colour equipment, in addition to CIE156, was in medium, viewing environments, test charts, test chart image processing parameters and workflow etc.</p> <p>CIE156 specified general principles of various colour equipments colour gamut mapping algorithm evaluation method, so equipments specific detailed descriptions and exceptions need to be specified, in addition to CIE156. CIE156 specified colour equipments colour gamut mapping algorithm evaluation method in photography & graphic arts, so office colour equipment specific colour gamut mapping algorithm evaluation report is desirable.</p> <p>In office colour equipment application, users of CIE156 have to specify the additional information, by try and error, and to create their own test method by themselves. With the aforementioned additional report for colour gamut mapping algorithm evaluation method, users who need to apply CIE156 on their products not only save a lot of time and effort, but also get a robust test data when comparing data with different users. It also helps technological improvements in this area.</p> <p>Japan national body proposes to develop a technical report to enable robust and time efficient colour gamut mapping algorithm evaluation data acquisition for office colour equipment application, in addition to CIE156. This technical report can contain Ink-jet and electro-photographic technologies, but sublimation transfer and other printing technologies should be excluded. This technical report development is within the scope of SC28.</p>

Programme of work

If the proposed new work item is approved, which of the following document(s) is (are) expected to be developed?

☐ a single International Standard

☐ more than one International Standard (expected number:)

☐ a multi-part International Standard consisting of parts

☐ an amendment or amendments to the following International Standard(s)

☒ X ☐ a technical report , type3.....

And which standard development track is recommended for the approved new work item?

☒ X ☐ a. Default Timeframe

☐ b. Accelerated Timeframe

☐ c. Extended Timeframe

Relevant documents to be considered

CIE156, ISO 3664, CIE 15.2, IEC61966-2-1

Co-operation and liaison : none**Preparatory work offered with target date(s) : 2012/03**

Signature: Fumio NAKAYA, JISC

Will the service of a maintenance agency or registration authority be required? NO.....

- If yes, have you identified a potential candidate? NO.....

- If yes, indicate name ...

Are there any known requirements for coding? NO.....

-If yes, please specify on a separate page

Does the proposed standard concern known patented items? NO.....

- If yes, please provide full information in an annex

Are there any known accessibility requirements and/or dependencies (see:

<http://www.jtc1access.org>)?... NO....

-If yes, please specify on a separate page

Are there any known requirements for cultural and linguistic adaptability?..... NO.....

-If yes, please specify on a separate page

Comments and recommendations of the JTC 1 or SC SC28 Secretariat - attach a separate page as an annex, if necessary

Comments with respect to the proposal in general, and recommendations thereon:

This new work item, if turned to a program of work by approval in NP ballot, will be assigned to a working group to be newly established under SC28

Voting on the proposal - Each P-member of the ISO/IEC joint technical committee has an obligation to vote within the time limits laid down (normally three months after the date of circulation).

Date of circulation: 2008-11-30	Closing date for voting: 2009-02-28	Signature of Secretary: Kazumasa Kumakura
---	---	---

NEW WORK ITEM PROPOSAL - PROJECT ACCEPTANCE CRITERIA		
Criterion	Validity	Explanation

A. Business Requirement		
A.1 Market Requirement	Essential ____ Desirable <u> x </u> Supportive ____	There is an urgent need for a unified test method of colour gamut mapping algorithm for office colour equipment that can avoid the confusion of the users of CIE156 caused by a test method not for office equipments.
A.2 Regulatory Context	Essential ____ Desirable ____ Supportive ____ Not Relevant <u> x </u>	
B. Related Work		
B.1 Completion/Maintenance of current standards	Yes ____ No <u> x </u> ____	
B.2 Commitment to other organisation	Yes ____ No <u> x </u> ____	
B.3 Other Source of standards	Yes ____ No <u> x </u> ____	
C. Technical Status		
C.1 Mature Technology	Yes <u> x </u> ____ No ____	
C.2 Prospective Technology	Yes ____ No <u> x </u> ____	
C.3 Models/Tools	Yes ____ No <u> x </u> ____	
D. Conformity Assessment and Interoperability		
D.1 Conformity Assessment	Yes ____ No <u> x </u> ____	
D.2 Interoperability	Yes ____ No <u> x </u> ____	
E. Adaptability to Culture, Language, Human Functioning and Context of Use		

E.1 Cultural and Linguistic Adaptability	Yes_____	
	No___ x ____	
E.2 Adaptability to Human Functioning and Context of Use	Yes_____	
	No___x ____	
F. Other Justification		

Attached document

Japan Proposal for the new technical report*

Title

**TR Type-3 --- Test Method of Colour Gamut Mapping Algorithm
for Office Colour Equipment**

***This WD is a tentative document for NP voting**

ISO/IEC JTC1 SC28 Japan National Body

2008-11-17

**contact person
Fumio Nakaya**

Japan Proposal for Test Method of Colour Gamut Mapping Algorithm for Office Colour Equipment Technical Report

Gamut mapping is a mapping of the colour-space coordinates of the elements of a source image to colour-space coordinates of the elements of a reproduction to compensate for differences in the source and output medium colour gamut capability. The evaluation method of the cross-device and cross-media colour image reproduction performance of gamut mapping algorithms (GMAs) was desirable for those people including colour scientists and colour equipment manufacturers and test method for evaluating a colour gamut mapping algorithm has already published as “CIE publication 156 - GUIDELINES FOR THE EVALUATION OF GAMUT MAPPING ALGORITHMS” in 2004. CIE156 has applied and evaluated in a various fields.

The some of Japanese MFP manufacturers applied CIE156 to office colour printer and found a necessity of specifying the additional information required for colour gamut mapping algorithm evaluation. The information required for office colour equipment, in addition to CIE156, was in medium, viewing environments, test charts, test chart image processing parameters and workflow etc.

CIE156 specified general principles of various colour equipments colour gamut mapping algorithm evaluation method, so equipments specific detailed descriptions and exceptions need to be specified, in addition to CIE156. CIE156 specified colour equipments colour gamut mapping algorithm evaluation method in photography & graphic arts, so office colour equipment specific colour gamut mapping algorithm evaluation report is desirable.

In office colour equipment application, users of CIE156 have to specify the additional information, by try and error, and to create their own test method by themselves. With the aforementioned additional report for colour gamut mapping algorithm evaluation method, users who need to apply CIE156 on their products not only save a lot of time and effort, but also get a robust test data when comparing data with different users. It also helps technological improvements in this area.

Japan national body proposes to develop a technical report to enable robust and time efficient colour gamut mapping algorithm evaluation data acquisition for office colour equipment application, in addition to CIE156. This technical report can contain Ink-jet and electro-photographic technologies, but sublimation transfer and other printing technologies should be excluded. This technical report development is within the scope of SC28.

Contents

Foreword

Introduction

1 Scope

2 References

3 Terms

4 Requirements

4.1 General

4.2 Reference Viewing Environments for Softcopy

4.2.1 Reference Display White Point

4.2.2 Contrast Ratio

4.2.3 Ambient Illumination

4.2.4 Softcopy Image Size, Image surround, Border Size and Viewing Distance

4.2.5 Glare

4.2.6 Measurements

4.3 Reference Viewing Environments for Hardcopy

4.3.1 Ambient Illumination

4.3.2 Hardcopy Image Size, Image surround, Border Size and Viewing Distance

4.3.3 Measurements

4.4 Test chart Image Processing

4.4.1 Test Charts

4.4.2 Gamut Mapping

4.5 Experiments

4.5.1 Softcopy to Hardcopy subjective similarity

5 Indicating the Use of Test Method of Colour Gamut Mapping Algorithm for Office Colour Printer

Annex A (informative) Test Chart - Weather

Annex B (informative) Test Chart – Disk

Annex C (informative) Test Chart – Kobayakawa

Annex D (informative) Test chart Image Processing Workflow

Foreword

Introduction

1 Scope

This technical report is designed for equipments specific detailed descriptions and exceptions need to be specified to be applicable to office use colour softcopy to hardcopy gamut mapping algorithm evaluation in addition to CIE156 (Guidelines for the Evaluation of Gamut Mapping Algorithms specified general principles of various colour equipments colour gamut mapping algorithm evaluation method). This technical report defines test charts, test chart image processing workflow, media, viewing conditions, measurements, colour spaces and experimental methods which are either not exist in CIE 156 or different from CIE156. The colour softcopy may be displayed on monitors, incorporating such technologies as CRT and LCD. The colour hardcopy may be produced by non impact colour printers, incorporating such technologies as ink-jet and electro-photography.

2 References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CIE 15.2:1986, Colorimetry, Second Edition

CIE 156:2004, Guidelines for the Evaluation of Gamut Mapping Algorithms, CIE Technical Report

ISO 3664:2000, Viewing conditions — Graphic technology and photography

ISO 12640-2:2003, Graphic technology — Prepress digital data exchange — Standard colour image data — Part 2: XYZ/sRGB encoded image data (XYZ/SCID)

IEC61966-2-1:1999, Multimedia systems and equipment - Colour measurement and management - Part 2-1: Colour management - Default RGB colour space

3 Terms

For the purposes of this document, the following terms and definitions apply.

3.1

Gamut mapping

a mapping of the colour-space coordinates of the elements of a source image to colour-space coordinates of the elements of a reproduction to compensate for differences in the source and output medium colour gamut capability

3.2

Colour gamut mapping

a method for assigning colours from the reproduction medium to colours from the original medium or image (i.e. a mapping in colour space).

3.3

Colour gamut boundary

a surface determined by a colour gamut's extremes.

3.4

Gamut boundary descriptor (GBD)

an overall way of approximately describing a gamut boundary.

4 Requirements

4.1 General

The reproduction intent for the colour reproduction systems in which GMAs will be evaluated in this technical report is defined to be subjective similarity. This subjective similarity intent shall be one which aims at reproducing a given colour image in a way where the reproduction is as close to the original as possible, or the multiple reproductions are as close as possible each other, this similarity is determined psychophysically and the process has no image enhancing aims.

4.2 Reference Viewing Environments for Softcopy

The following reference viewing conditions define the reference viewing environment for subjective accuracy experiment. They are based on conditions for appraisal of images displayed on colour monitors as specified in section 4.5 in ISO 3664:2000.

4.2.1 Reference Display White Point

The reference display white point shall approximate that of CIE standard illuminant D65.

The absolute luminance level of the adapted white in the reference viewing environment shall be greater than or equal to 80cd/m² and should be greater than or equal to 160cd/m².

NOTE The absolute luminance level of 160cd/m² is equivalent to that of a perfect white Lambertian reflector illuminated with 500 lx as specified in ISO 3664 for the practical appraisal of prints.

4.2.2 Contrast Ratio

The contrast ratio shall be the ratio of reference display white point luminance over reference display black point luminance, (Y_W / Y_K), which is TBD (8).

4.2.3 Ambient Illumination

The illumination at the plane of viewing shall approximate that of CIE standard illuminant D50. When measured, with the monitor turned off, at the monitor faceplate, the ambient illumination level shall be equal to 50 lx. When measured, with the monitor turned off, in any plane between the monitor and the observer, the ambient illumination level shall be within the range of 16 to 64 lx. The ambient illumination shall have the same chromaticity as the white point of the display.

4.2.4 Softcopy Image Size, Image surround, Border Size and Viewing Distance

The size of softcopy image on display shall be equivalent to A4 or Letter size. The surround of softcopy image shall be neutral and matt with the lightness shall be equivalent to N2 gray. The border size of softcopy image shall be 5 mm on all sides. The border should have a similar angular substance to that of the hardcopy image, and of the colour of the medium white. The viewing distance of softcopy image should be normal viewing distance or approximately 25 cm.

4.2.5 Glare

The veiling glare in the reference viewing environment shall be included in the display black point, as would result from measurement of the display from the viewer position in the reference viewing environment. Viewing flare that may result in viewing conditions different from the reference viewing conditions shall not be included.

NOTE When positioning a display in a viewing environment, it is important to arrange the ambient lighting so that specular reflections off the display faceplate, as seen from the viewer position, are avoided. This can usually be achieved by placing ambient light sources at an angle of at least 45 degrees relative to the normal to the display faceplate, which is assumed to be the viewer's direction of gaze.

4.2.6 Measurements

Measurements should be taken under conditions described in CIE156 6 Measurement and Appendix B recommended measurement procedures for different media.

4.3 Reference Viewing Environments for Hardcopy

The following reference viewing conditions define the reference viewing environment for subjective accuracy experiment. They are based on conditions for practical appraisal of prints as specified in section 4.3 in ISO 3664:2000.

4.3.1 Ambient Illumination

The illumination at the plane of viewing shall approximate that of CIE standard illuminant D50.

The illuminance of the viewing surface shall be $500 \text{ lx} \pm 125 \text{ lx}$ as specified in ISO 3664 for the practical appraisal of prints.

4.3.2 Hardcopy Image Size, Image surround, Border Size and Viewing Distance

The size of hardcopy image on print shall be equivalent to A4 or Letter size. The surround of soft copy image shall be neutral and matt with the lightness shall be equivalent to N5 gray. The border size of hardcopy image shall be 5 mm on all sides. The viewing distance of softcopy image should be normal viewing distance or approximately 25 cm.

4.3.3 Measurements

Measurements should be taken under conditions described in CIE156 6 Measurement and Appendix B recommended measurement procedures for different media.

4.4 Test chart and Image Processing Workflow

4.4.1 Test Charts

The test charts shall include 4 different images as listed below.

- Ski, in CIE 156 obligatory test image
- N7, in ISO12640-2
- Weather, in Annex A
- Disk, in Annex B

4.4.2 Gamut Mapping

For softcopy to hardcopy sample preparation, test charts are processed with the workflow as shown in Annex D.

The evaluating gamut mapping algorithms shall include Hue-angle preserving minimum ΔE^*_{ab} clipping and Chroma-dependent sigmoidal lightness mapping and cusp knee scaling as described in CIE156 8.1 and 8.2 respectively.

NOTE The role of having these two algorithms is to make it possible to reconcile the different interval scales used in different experiments.

The XYZ values were transformed to the gamut mapping colour space by using CAT + CIELAB and CIECAM02, and the colour values were mapped to the printer gamut. CAT02 matrix was used for chromatic adaptation from display white point to D50. CIELAB and CIECAM02 shall be used as gamut mapping colour space in order to estimate the effect of the hue uniformity of these two colour spaces.

The mapped colours were transformed to the XYZ value by using CIELAB + CAT and CIECAM02, and the printer dependent colours by the each individual printer characterization model prepared by manufacturer. The mapped colours were transformed to the printer dependent colours by the each individual printer characterization model prepared by manufacturer.

The GBD segments used in the gamut mapping calculation shall be greater than or equal to 72 segments. The number of gamut boundary data shall be greater than or equal to 15000. The gamut boundary data can contains both measured data and interpolated data generated from measured data.

NOTE Inappropriate number of GBD segments and gamut boundary data may produce false contour on softcopy and hardcopy which may affect to subjective ratings in 4.5. It is recommended that before processing 4 test charts in 4.4.2, using Kobayakawa test chart in Annex C to confirm no false contour appeared on both softcopy and hardcopy.

4.5 Experiments

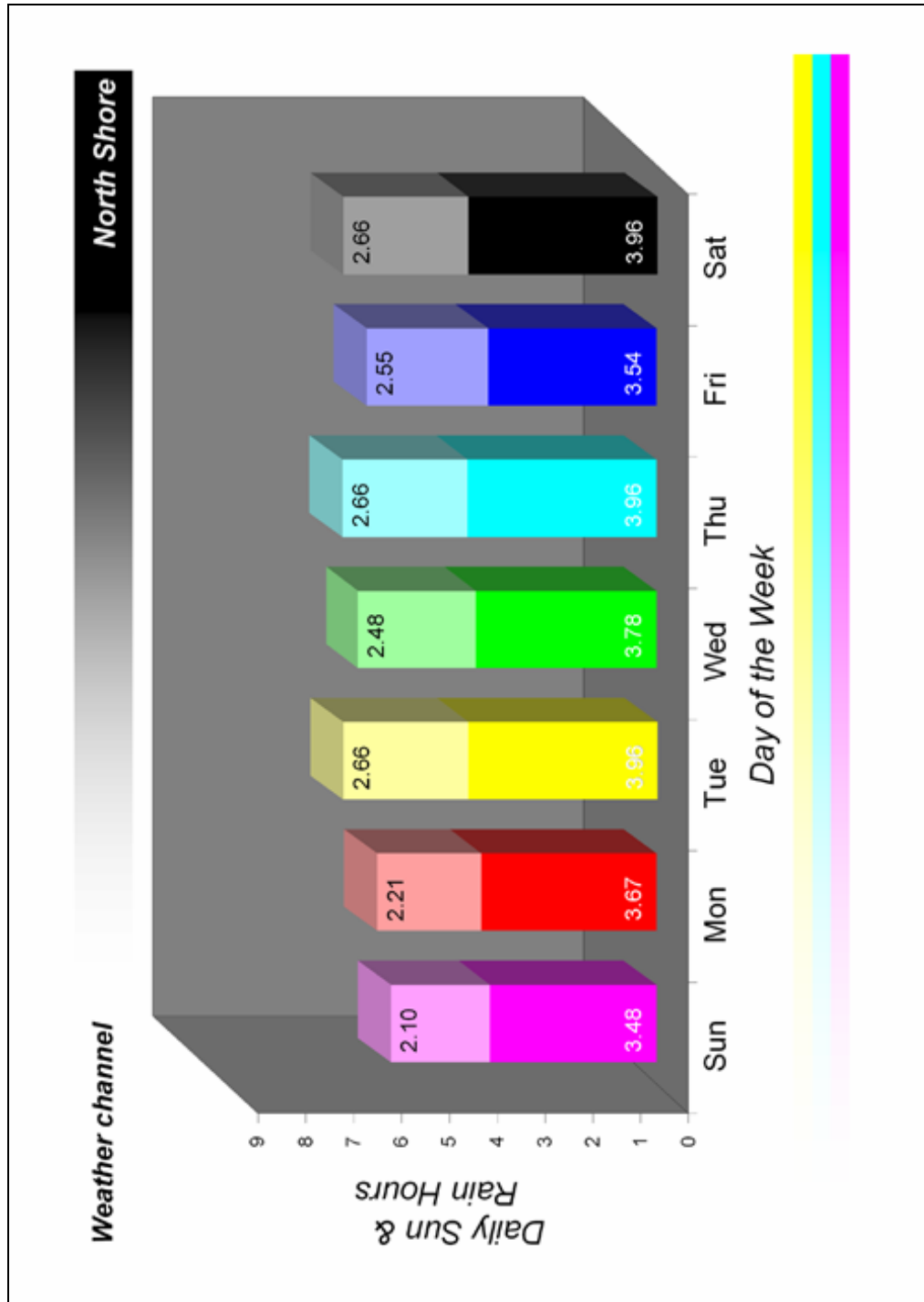
4.5.1 Softcopy to Hardcopy subjective similarity

Experiments involving colour softcopies and hardcopies need to be carried out under the viewing conditions in Section 4.2 for softcopies, and in Section 4.3 for hardcopies. Number of raters for subjective rating experiment shall be at least 15 observers and psychophysical methods shall be category judgement.

5 Indicating the Use of Test Method of Colour Gamut Mapping Algorithm for Office Colour Printer

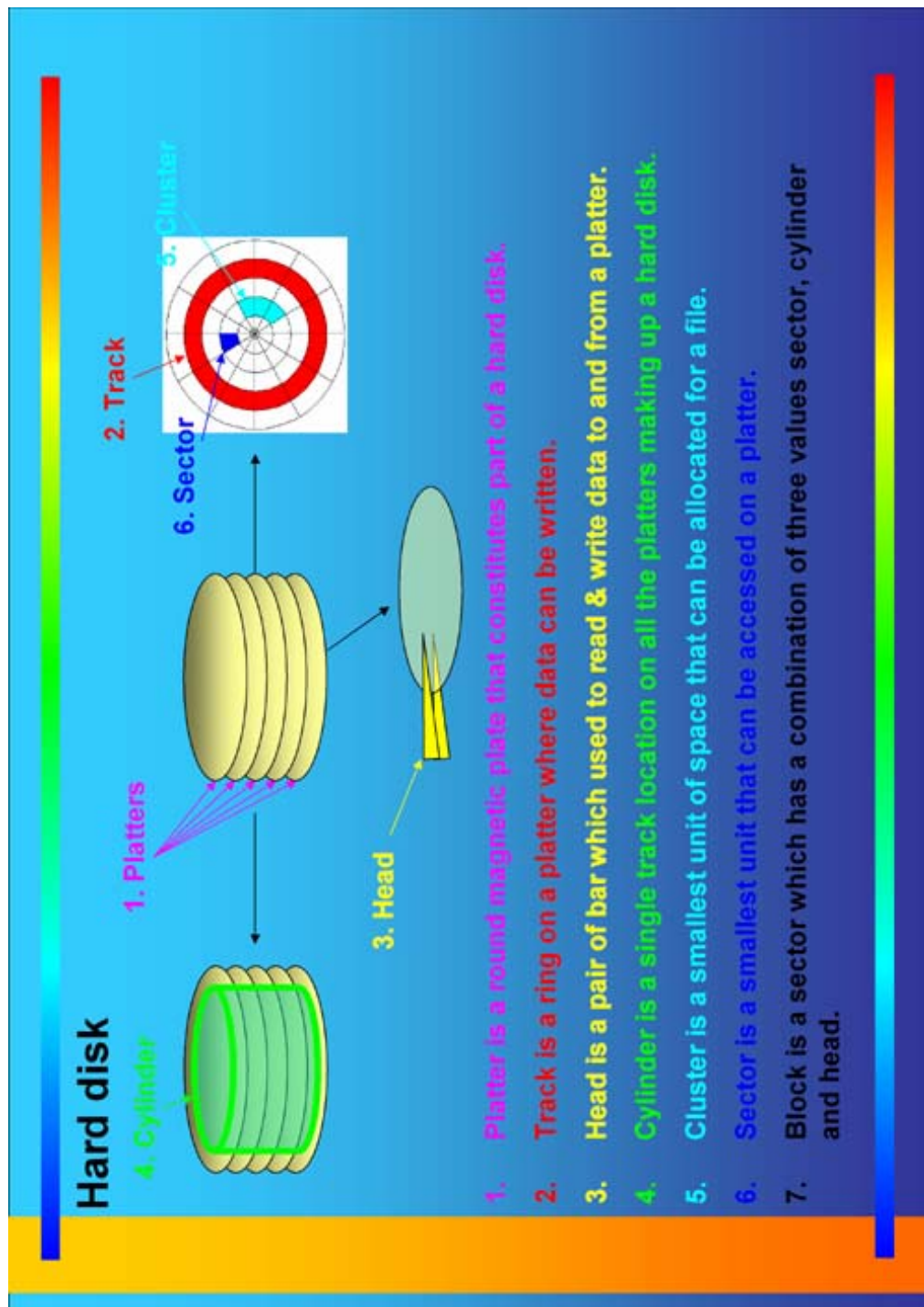
Annex A
(informative)

Test Chart – Weather



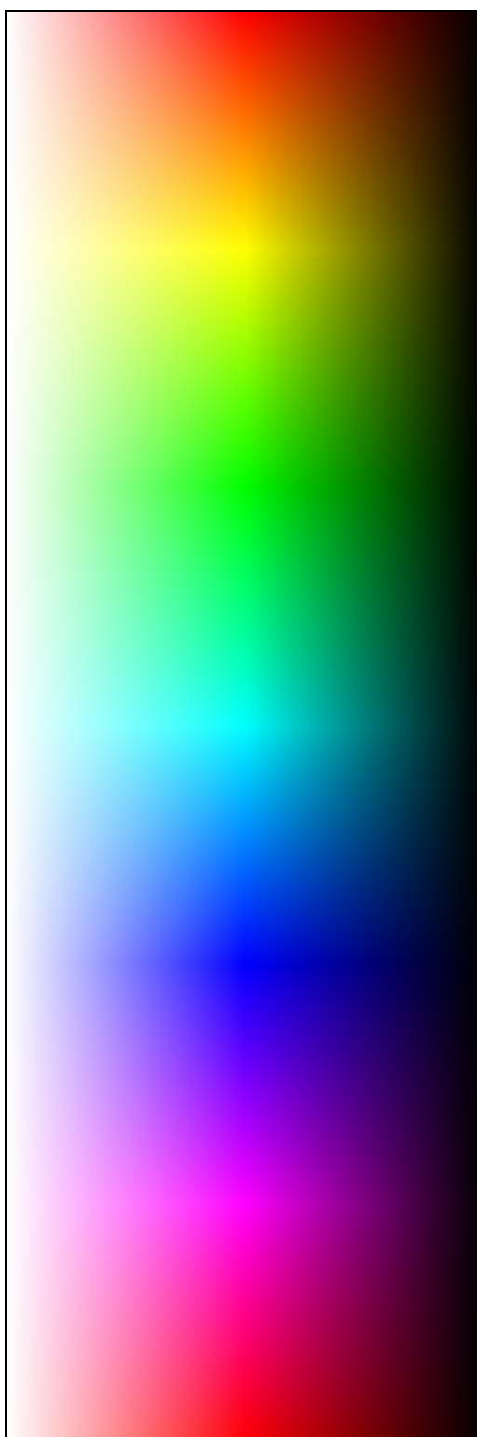
Annex B (informative)

Test Chart – Disk



Annex C
(informative)

Test Chart – Kobayakawa



Annex D
(informative)

Test chart Image Processing Workflow

