



BSI Standards Publication

Graphic technology and photography — Colour characterization of digital still cameras (DSCs)

Part 5: Colour targets including saturated colours for colour characteristic evaluation test for colorimetric image capture

National foreword

This Published Document is the UK implementation of ISO/TR 17321-5:2021.

The UK participation in its preparation was entrusted to Technical Committee CPW/42, Photography.

A list of organizations represented on this committee can be obtained on request to its committee manager.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

© The British Standards Institution 2021
Published by BSI Standards Limited 2021

ISBN 978 0 539 14406 2

ICS 37.040.10

Compliance with a British Standard cannot confer immunity from legal obligations.

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 31 January 2021.

Amendments/corrigenda issued since publication

Date	Text affected
------	---------------

TECHNICAL
REPORT

ISO/TR
17321-5

First edition
2021-01

**Graphic technology and
photography — Colour
characterization of digital still
cameras (DSCs) —**

Part 5:

**Colour targets including saturated
colours for colour characteristic
evaluation test for colorimetric
image capture**

*Technologie graphique et photographie — Caractérisation de la
couleur des appareils photonumériques —*

*Partie 5: Cibles de couleurs incluant des couleurs saturées pour l'essai
d'évaluation des caractéristiques chromatiques pour la capture
d'images en mode colorimétrique*



Reference number
ISO/TR 17321-5:2021(E)

© ISO 2021



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Highly-saturated colour targets	2
4.1 General.....	2
4.2 Extension of real existing spectra using eigenvector method.....	2
4.2.1 General.....	2
4.2.2 Selection of spectra database.....	2
4.2.3 Spectral reconstruction from the eigenvectors.....	3
4.3 Artificial (LED-based) spectra whose wavelength peak is on colour-difference-sensitive wavelength (CDSW).....	4
4.3.1 General.....	4
4.3.2 The method to define the colour-difference-sensitive wavelength (CDSW).....	4
4.3.3 Selection of LED for CDSW targets.....	6
5 FOM metric for evaluation of overall sensor spectral sensitivities, used in the digital cameras	8
5.1 General.....	8
5.2 Evaluation metrics for OSSS.....	8
5.3 Advantages and disadvantages of ΔE (delta E) evaluation.....	9
5.4 How 17321-5 datasets can be used for FOMs.....	9
5.5 Worked examples.....	11
Annex A (informative) Selection and eigenvectors of spectral distribution set	13
Annex B (informative) Colour gamut of boundary colour	15
Annex C (informative) Worked example of spectral distribution generation of Pointer's surface colours	16
Annex D (informative) Background information for defining CDSW	26
Annex E (informative) Additional 10nm to colour-difference-sensitive wavelengths (CDSW)	29
Annex F (informative) Colour differences of patches of CDSW target	30
Annex G (informative) Spectral distribution of CDSW target for ITU-R BT.2020	31
Annex H (informative) Spectral distribution dataset for users to download	34
Bibliography	35

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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 ISO documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 42, *Photography*.

A list of all parts in the ISO 17321 series can be found on the ISO website.

Introduction

There are many application areas such as medical imaging, cosmetics, e-commerce, sales catalogue, fine art reproduction, art archive etc. where colorimetric image capture and colorimetric image reproduction are desired. When precise colorimetric reproduction is required for the subjects that include highly-saturated colours, it is desirable that overall sensor spectral sensitivities are close to linear combinations of CIE 1931 colour matching functions.

On the other hand, real DSCs have overall sensor spectral sensitivities that deviates from linear combination of CIE 1931 colour matching functions, and yet reproduces reasonable colours for general low-saturated colour objects. This is because most of spectral distribution of real-existing objects are well self-correlated in the wavelength direction. This is also true for the frequently-used colour target such as X-rite colour checker classic.

Therefore, when the precise colour reproduction is required for highly-saturated colour objects, it is important to use spectral distribution that are less self-correlated in the wavelength direction, for the evaluation of overall sensor spectral sensitivities.

For this purpose, [Clause 3](#) proposes two methods for generating highly-saturated colour targets. The first method is statistical extension of existing objects spectra, and the second one is selection from artificial (LED-based) spectra.

[Clause 4](#) then describes how these highly-saturated colour targets can be used for goodness evaluation of overall sensor spectral sensitivities. Applicability of several existing evaluation metrics (such as Vora's μ -factor and Sharma's FOM) are compared, using highly-saturated targets generated by the methods proposed in [Clause 4](#).

[Annex B](#) gives details on colour gamut of boundary colour and [Annex F](#) gives more information on colour differences of patches of CDSW target.

Graphic technology and photography — Colour characterization of digital still cameras (DSCs) —

Part 5:

Colour targets including saturated colours for colour characteristic evaluation test for colorimetric image capture

1 Scope

This document describes sample methods to generate spectra for colour targets comprised of highly saturated colours for colour characteristic evaluation of colorimetric image capture capability of digital still cameras (DSCs).

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 colour-difference-sensitive wavelength CDSW

wavelength sensitive to colour difference

3.2 colour matching functions

tristimulus values of monochromatic stimuli of equal radiant power

[SOURCE: CIE Publication 17.4, 845-03-23]

3.3 digital still camera DSC

device which incorporates an image sensor and produces a digital signal representing a still picture

[SOURCE: ISO 12232:2012, 3.40, modified — Notes 1 and 2 to entry have been deleted.]

3.4 light-emitting diode LED

semiconductor diode that emits non coherent optical radiation through stimulated emission resulting from the recombination of electrons and photons, when excited by an electric current

[SOURCE: IEC 60050-521, 521-04-39]