International Standard

ISO 20954-1

Digital imaging — Measurement method for image stabilization performance —

Part 1: Optical systems

Imagerie numérique — Méthode de mesure de la perfomance de stabilisation de l'image —

Partie 1: Systèmes optiques

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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 ISO 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).

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

This second edition cancels and replaces the first edition (ISO 20954-1:2019), which was been technically revised.

The main changes are as follows:

— vibration waveform of a roll direction has been added along with the yaw and pitch directions;

— measurement at the 60 % of the image height in addition to centre has been required;

— determination level of image blur has been changed.

A list of all parts in the ISO 20954 series can be found on the ISO website.

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.

Introduction

The image stabilization function is important for digital cameras and has become a selling point in marketing materials. Therefore, the measurement methods and its reporting method are then very important to compare the image stabilization performance among cameras based on their brochures.

The Camera & Imaging Products Association (CIPA) issued CIPA standard DC-011 in 2012 to specify how to measure and describe the optical image stabilization performance of digital cameras. When image stabilization performance is measured and described according to that standard, end users have unbiased and useful information to help them select from a variety of digital cameras (see Bibliography).

This document is based on the CIPA standard, which is referenced in the Bibliography. The standardized measurement method primarily includes performance assessment with simulated handheld camera movements.

In response to subsequent changes in photographic viewing environments, this document has been revised to allow measurement and description of image stabilization performance for vibrations including roll motion, in addition to yaw and pitch motions.

Digital imaging — Measurement method for image stabilization performance —

Part 1: Optical systems

1 Scope

This document defines the measurement method of optical image stabilization performance for still images compensating for handheld blur consisting of three rotational components, yaw, pitch and roll.

It applies to consumer digital cameras with optical image stabilization for still images. Apparatuses such as camcorders and mobile phones with still image shooting functionality are within the scope of this document.

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 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
image stabilization
camera function that prevents *handheld blur* (3.3) by using a means of camera movement detection

Note 1 to entry: Even if a camera function uses a means of camera movement detection, it is not regarded as an image stabilization function if its primary means of blur mitigation is shortening exposure time based on exposure control program optimization.

3.2
optical image stabilization
function that compensates image displacement on the focal plane due to movement of a handheld camera by moving a part or whole of the optical system and/or image sensor, based on a means of camera movement detection

3.3
handheld blur
loss of image sharpness caused by movement of a handheld camera during exposure

3.4
stop
number that expresses a doubling or halving of the amount of light let in when taking a picture and which is typically represented by an exposure value

Note 1 to entry: For instance, the difference between exposure times of 1/1 000 s (Tv10) and 1/500 s (Tv9) or 1/125 s (Tv7) and 1/60 s (Tv6) is one stop.

Note 2 to entry: "Tv*n*" expresses that time value of APEX equals to *n*. See Annex C of Reference [5] for APEX.

3.5
handheld blur threshold
level of *handheld blur* (3.3) at which *image stabilization* (3.1) performance is determined

Note 1 to entry: In this document, this level is 20 µm of motion in the focal plane on one frame of 35 mm film, where one frame means the picture size (24 mm × 36 mm).

3.6
average vibration angle
expected deflection angle of camera rotation under handheld vibration during exposure

Note 1 to entry: The handheld vibration is given as the vibration waveform data that is specified in this document.

Note 2 to entry: The average vibration angles are given as amount of angle in degrees of each exposure time as shown in Figure 13. The values are statistical expectation and are calculated from average of oscillation amplitude from peak to bottom of the vibration waveform when certain exposure time is applied.

3.7
35 mm film equivalent focal length
focal length of a lens attached to a camera with a sensor size of 24 mm × 36 mm (originated from 35 mm film) that produces the same field of view as the camera system with a lens at a given focal length for which the 35 mm sensor equivalent focal length is specified

3.8
image height
<of DSC> distance between an image point and the centre of the imaging area or its relative expression which is the value normalized by one half of the diagonal of the image area

Note 1 to entry: "DSC" is an abbreviation for "digital still camera" or "digital camera".

Note 2 to entry: In this document, the image height is expressed as percentage normalized by the distance from the centre to the corner of the imaging area.

[SOURCE: ISO 17850:2015, 3.2.1, modified —Notes 1 and 2 to entry have been added.]

4 Measurement method

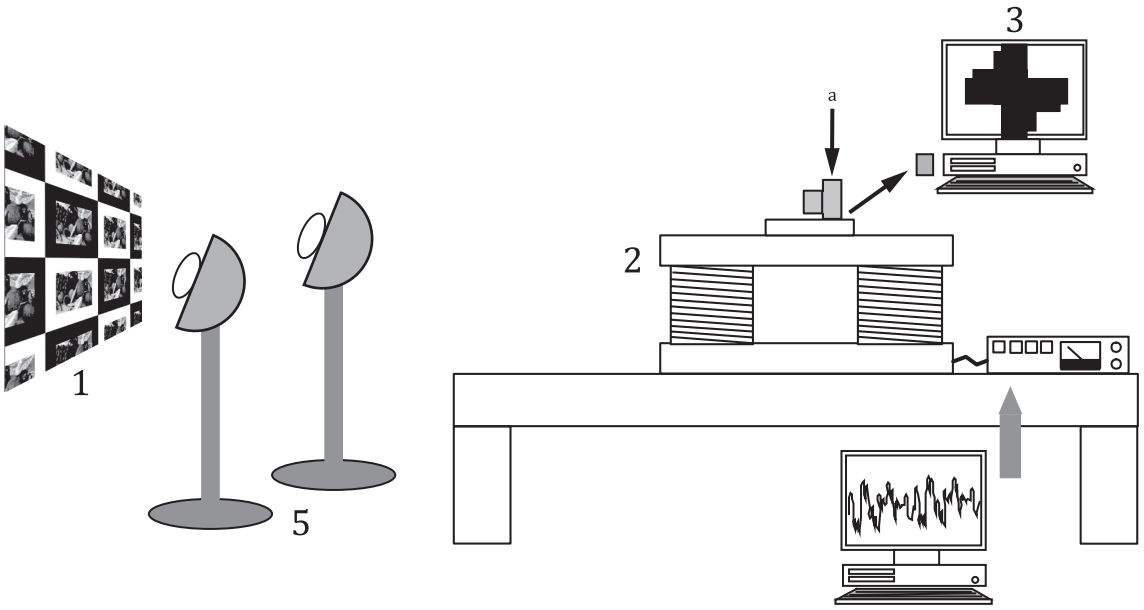
4.1 General

The objective of this document is to specify how to measure optical image stabilization performance of a camera held in the user's hands. Accordingly, a measurement session would better simulate a real shooting situation if the camera was actually held by a test photographer. However, this makes it difficult to eliminate variation among individual photographers or how well the camera is designed for handheld shooting. In order to cancel these effects, the test camera shall be mounted on a vibration generator that shakes the camera with a simulated handheld vibration waveform, and image stabilization performance shall be measured with images of a test chart specified by this document.

This document specifies two waveforms that simulate the important characteristics of how a camera shakes when it is held by hand. These waveforms were developed by analysing extensive measurement data and adding further theoretical observations. Both waveforms contain three rotational components, yaw, pitch and roll.

This document stipulates that, in addition to the evaluation of the image stabilization performance at the centre of the image, where the influence of yaw and pitch blur are primarily observed, the evaluation on the periphery of the image is to be conducted, where the influence of roll blur becomes more significant than at the centre of the image.

Figure 1 shows an overview of the measurement method. Annex E collaterally gives additional explanations for background of specifying measurement method, vibration generator, vibration waveform and reference information.



Key

1	chart
2	vibration generator
3	pc for handheld blur measurement
4	vibration waveform
5	variable brightness
a	Release operation.

Figure 1 — Overview of measurement method

4.2 Equipment and environment for measurement

4.2.1 Test chart

For this document, the test chart shall meet following requirements. Specifications and usage of the test chart are described in Annex B and alternatives are described in Annex C.

a) The chart shall be comprised of measurement locations at the centre of the image and four positions at image height 60 % in the diagonal directions. The chart may optionally include a portion having natural colour images.

b) The ratio of reflectance between the white and black regions of the measurement locations shall be 4:1 or higher, and the white and black region shall be wider than the expected maximum image degradation amount.

c) No particular features are specified for the natural image portion, but the portion preferably contains images similar to real subjects.

4.2.2 Lighting

Lighting shall be flicker-free. The light source should illuminate the chart with minimal direct reflection and illuminance variation.

4.2.3 Temperature and humidity

The temperature and humidity should be (23 ± 2) °C and 30 % to 70 %, respectively.

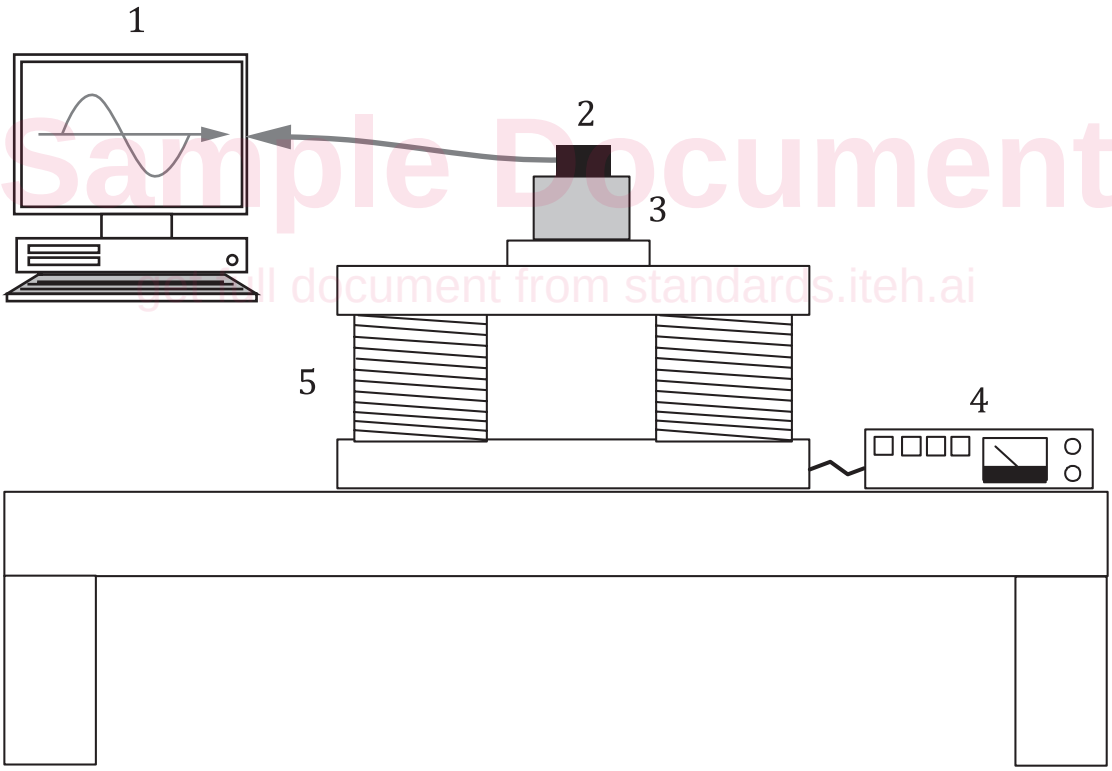
4.2.4 Vibration generator

4.2.4.1 General

For the measurements in this document, a CIPA-certified vibration generator should be used. If a non-certified vibration generator is used, it shall satisfy the amplitude and phase characteristics under the excitation conditions specified in 4.2.4.2.

4.2.4.2 Excitation conditions

This subclause describes the required specifications for the amplitude and phase characteristics of the vibrations generated by the vibration generator excited with sine waves. Table 1 shows the properties of the sine waves that shall be used to measure the amplitude and phase characteristics. Table 2 and 3 respectively show the input sine wave combinations that shall be used to measure the vibration amplitude characteristics and phase characteristics. To measure the amplitude and phase characteristics, the vibration generator shall be excited in yaw, pitch and roll directions simultaneously, carrying a load weighing at least as much as the test objects, i.e. camera, storage media, battery and lens. Figure 2 is an overview of how to verify the vibration generator using these waveforms.



Key

1	vibration measurement
2	measuring device (sensor)
3	weight
4	sine wave vibration
5	vibration generator

Figure 2 — Overview of vibration generator verification scheme

Table 1 — Combinations of sine wave frequency and amplitude for vibration generator verification

	Frequency Hz	Amplitude degree	Angular velocity degree/s
a	0,1	2	1,26
b	0,5	2	6,28
c	1	1	6,28
d	5	0,2	6,28
e	10	0,1	6,28

Table 2 — Yaw, pitch and roll combinations (for amplitude characteristic evaluation)

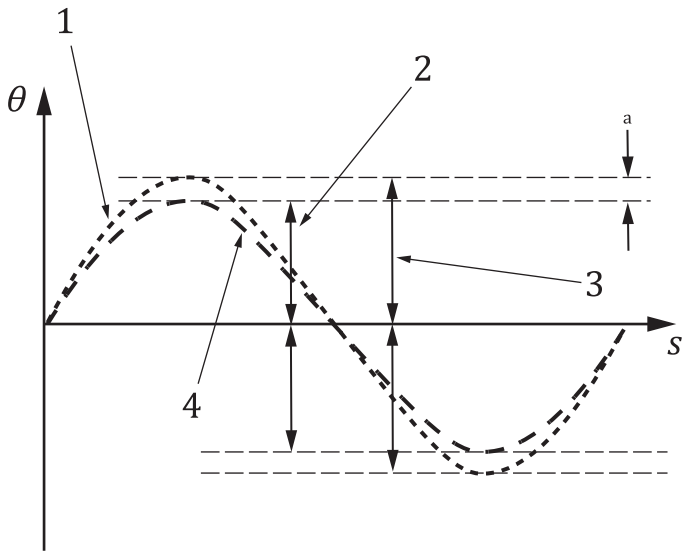
	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 5
Yaw	a	b	c	d	e
Pitch	c	d	e	a	b
Roll	e	a	b	c	d

Table 3 — Yaw, pitch and roll combinations (for phase characteristic evaluation)

	Pattern 6	Pattern 7	Pattern 8	Pattern 9	Pattern 10	Pattern 11
Yaw	c	d	c	d	-	-
Pitch	d	c	-	-	c	d
Roll	-	-	d	c	d	c

4.2.4.3 Amplitude characteristics

The amplitude of the measured vibration from the vibration generator shall be within ±5 %, inclusive, of the amplitude of the input sine wave for all excitation conditions, Patterns 1 through 5, shown in Table 2. See Figure 3.



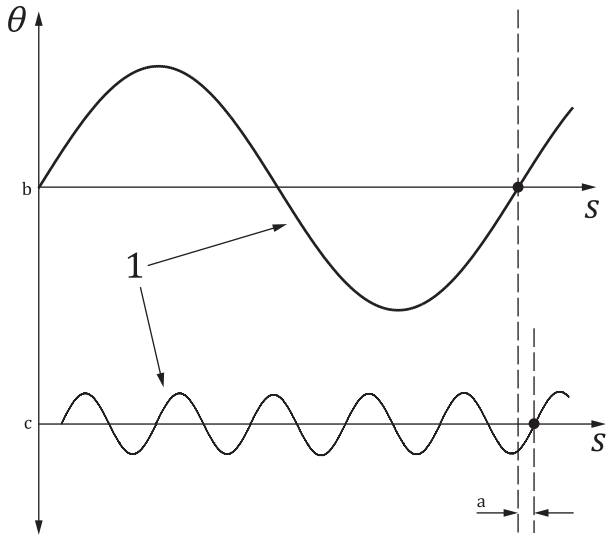
Key

1	measured vibration form vibration generator
2	amplitude of input sine wave
3	amplitude of measured vibration of vibration generator
4	input sine wave
a	Difference in amplitude values.

Figure 3 — Illustration of amplitude differences

4.2.4.4 Phase characteristics

The phase difference between the measured yaw, pitch and roll vibrations shall be 90° or less when the vibration generator is excited by Patterns 6 through 11 in Table 3. See Figure 4. The phase difference between the zero-cross position of the low frequency waveform and the zero-cross position of the high frequency waveform shall be within 90° of high frequency waveform.



Key

1	measured vibration form vibration generator
a	Phase difference.
b, c	Two arbitrary waveforms out of three components, yaw, pitch and roll.

Figure 4 — Illustration of phase differences

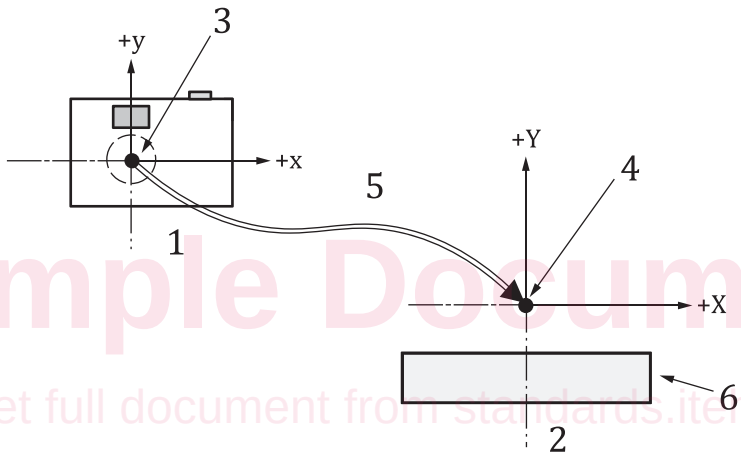
4.2.5 Mounting of camera to be measured on vibratory apparatus

When mounting the camera to be measured on the vibratory apparatus, vibration of the vibratory apparatus and that of the camera to be measured mounted on the vibratory apparatus have to match.

When measuring a camera with a long-barrel lens (e.g. high-powered zoom lens), vibrations of the camera body and the lens may not match due to distortion induced in the lens by excitation preventing the applied vibration from being correctly transmitted to the lens. Thus, given measures are to be taken for such measurements so that lens and camera body vibrations match, such as fixing the lens to the vibratory apparatus in addition to the camera body.

The vibration waveforms adopted in this document are vibrations that rotate on the rotational axes of yaw, pitch, and roll; therefore, the positional relationship between the centre of rotation of the vibratory apparatus and the optical axis of the camera and lens to be measured at the time of mounting affects the vibration measurement results. (Hereafter, camera and lens are abbreviated as camera.)

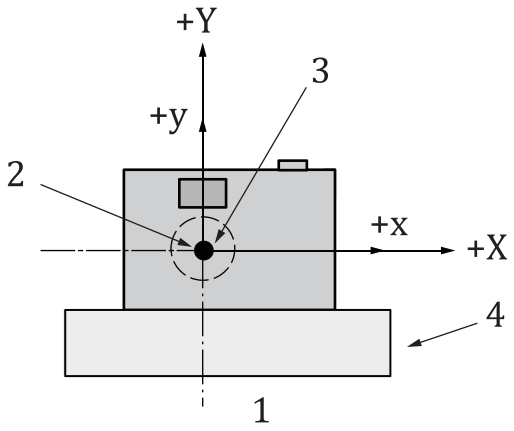
Therefore, to ensure measurement condition alignment, the centre of rotation of the vibration table is preferably aligned with the optical axis of the lens in the horizontal and vertical directions on the plane orthogonal to the optical axis, as shown in Figures 5, 6, and 7.



Key

1	back of camera
2	line of sight in direction of chart for shooting
3	optical axis of imaging lens
4	centre of rotation of vibration table
5	align when fixing camera
6	vibration table

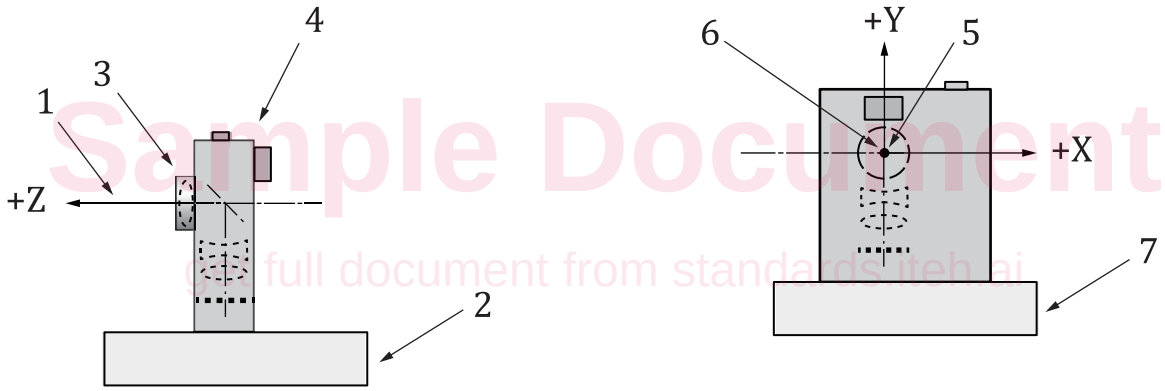
Figure 5 — Centre of rotation of vibration table and optical axis of lens



Key

1	line of sight in direction of chart for shooting
2	optical axis
3	centre of rotation of vibration table
4	vibration table

Figure 6 — Camera fixed with lens optical axis aligned with centre of rotation of vibration table



a) Horizontal direction **b) Chart direction for shooting**

Key

1	optical axis
2	vibration table
3	lens
4	camera
5	centre of rotation of vibration table
6	optical axis
7	vibration table

Figure 7 — Fixed state of camera with bending optical system

4.2.6 Vibration waveform

There are two types of vibration waveforms that shall be used to verify optical image stabilization performance: WB-L and WB-H defined in Annex A. One or both shall be used based on the total mass of the test camera according to the following criteria. Total mass refers to the camera body, including storage media and battery, and lens.

— Selection criterion I: WB-H shall be used for a total mass of 600 g or more.

— Selection criterion II: WB-L shall be used for a total mass of less than 400 g.

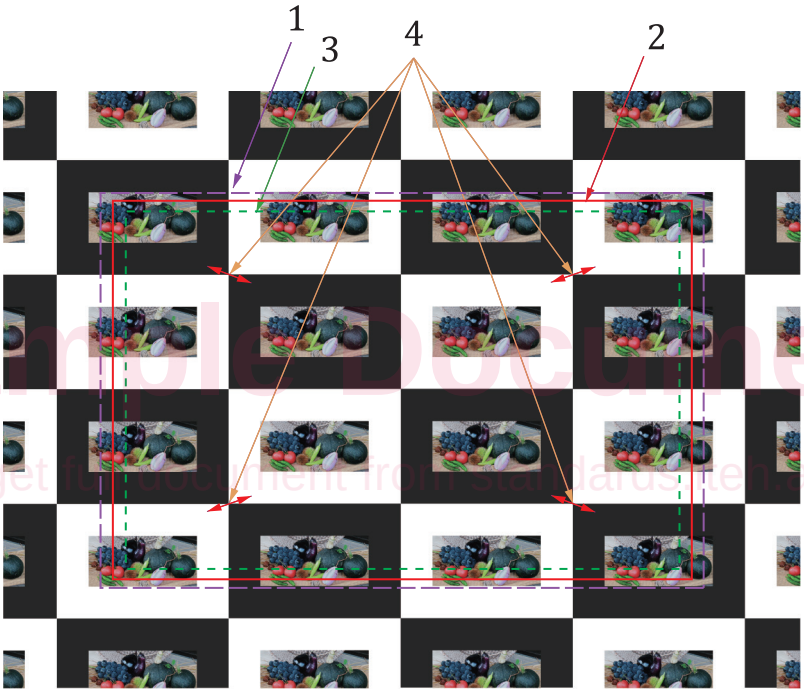
— Selection criterion III: Both WB-L and WB-H shall be used for a total mass of 400 g or more but less than 600 g.

Both waveforms consist of three axis components: yaw, pitch and roll. All components, yaw, pitch and roll shall be excited at the same time (see Annex A).

4.2.7 Shooting distance

The shooting distance shall be adjusted so that the four peripheral measurement features at image height 60 % of the chart are within an image height of 60 ± 3 % in captured image. The vibration generator shall be stopped during the adjustment of the shooting distance.

Figure 8 shows imaging areas with the 60 ± 3 % tolerance for 3:2 aspect ratio on "CIPA test chart" as an example. The CIPA test chart is defined in Annex B. For simplicity, the framing lines for 4:3 and 16:9 aspect ratios are removed in Figure 8.



Key

1	imaging area with peripheral measurement positions of image at image height 57 %
2	imaging area at aspect ratio 3:2 (peripheral measurement positions of image at image height 60 %)
3	imaging area with peripheral measurement positions of image at image height 63 %
4	positions at image height 60 % (peripheral measurement features)

Figure 8 — Shift in imaging area and change in image height at peripheral measurement features

4.3 Settings of camera to be measured

4.3.1 Shooting mode

a) The mode with the shortest latency time should be used given that shooting shall begin within three seconds after shooting is enabled following turning on the camera power. (The shooting modes should retain as many of the settings in 4.3.2 to 4.3.12 as possible after the camera is turned off. It is also convenient to use a mode that allow for easy changing of the exposure time.) For cameras without the capability of changing exposure time, the factory shipping setting should be used.