BS IEC 62906-5-5:2022

BSI Standards Publication

Laser displays

Part 5-5: Optical measuring methods of raster-scanning retina direct projection laser displays

Documents
Document Sharing Hub

Full document details: BS IEC 62906-5-5:2022

National foreword

This British Standard is the UK implementation of IEC 62906-5-5:2022.

The UK participation in its preparation was entrusted to Technical Committee EPL/47, Semiconductors.

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

Contractual and legal considerations

This publication has been prepared in good faith, however no representation, warranty, assurance or undertaking (express or implied) is or will be made, and no responsibility or liability is or will be accepted by BSI in relation to the adequacy, accuracy, completeness or reasonableness of this publication. All and any such responsibility and liability is expressly disclaimed to the full extent permitted by the law.

This publication is provided as is, and is to be used at the recipient's own risk.

The recipient is advised to consider seeking professional guidance with respect to its use of this publication.

This publication is not intended to constitute a contract. Users are responsible for its correct application.

© The British Standards Institution 2022
Published by BSI Standards Limited 2022

ISBN 978 0 580 99228 5

ICS 31.260

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 July 2022.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS IEC 62906-5-5:2022

IEC 62906-5-5

Edition 1.0 2022-01

INTERNATIONAL STANDARD

colour inside

Laser displays –
Part 5-5: Optical measuring methods of raster-scanning retina direct projection laser displays

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.260

ISBN 978-2-8322-1068-6

Warning! Make sure that you obtained this publication from an authorized distributor.

® Registered trademark of the International Electrotechnical Commission

Documents
Document Sharing Hub

Full document details: BS IEC 62906-5-5:2022

CONTENTS

FOREWORD 5
1 Scope 7
2 Normative references 7
3 Terms, definitions and abbreviated terms 7
3.1 Terms and definitions 7
3.2 Abbreviated terms 8
4 Standard measuring conditions 9
4.1 Standard measuring environmental conditions 9
4.2 Coordinate system 9
4.3 Standard conditions of RS-RDP laser displays and light measuring devices 10
4.3.1 General 10
4.3.2 Adjustment of RS-RDP laser display 10
4.3.3 Requirements for light measuring device 10
4.4 Laser-safety requirements for measurement 12
5 Optical measuring methods 12
5.1 General 12
5.2 Optical power at the primary colour wavelength 12
5.2.1 General 12
5.2.2 Measurement at exit window (measurement point 1) 12
5.2.3 Measurement at focal point (measurement point 2) 13
5.2.4 Elimination of the effect of other spectral powers 13
5.3 Eye-box 14
5.3.1 General 14
5.3.2 Eye-box measurement by 2D image sensor 15
5.3.3 Eye-box measurement by goniometric spectroradiometer 15
5.4 Field of view 16
5.4.1 General 16
5.4.2 FOV measurement by 2D image sensor 16
5.4.3 FOV measurement by goniometric spectroradiometer 17
5.5 Aspect ratio 17
5.6 Effective angular image resolution 18
5.6.1 General 18
5.6.2 Measuring methods of effective angular image resolution 19
5.7 Retinal free focus range 22
5.7.1 General 22
5.7.2 Retinal free focus range measured by direct method 23
5.7.3 Retinal free focus range measured by imaging method 24
5.8 Retinal white illuminance 24
5.8.1 General 24
5.8.2 Retinal white illuminance measurement using the method in 5.2.3 25
5.8.3 Retinal white illuminance measurement using spectral irradiance meter 25
5.9 Luminance and chromaticity of virtual image 25
5.9.1 General 25
5.9.2 Measurement procedure 25
5.10 White chromaticity nonuniformity 26
5.10.1 General 26
5.10.2 White chromaticity nonuniformity 26

AVA Documents
Document Sharing Hub

5.10.3 Virtual image chromaticity nonuniformity ... 26
6 Report ... 27
Annex A (informative) Structure of RS-RDP laser displays ... 28
A.1 General ... 28
A.2 Example of mechanical structure ... 28
A.3 Example of fundamental electro-optical structure of RS-RDP laser display ... 28
Annex B (informative) Maxwellian view of RS-RDP laser displays ... 30
B.1 General ... 30
B.2 Maxwellian view ... 30
B.3 Pinhole image on the retina in the Maxwellian view ... 31
B.4 Laser image on the retina in the Maxwellian view ... 31
Annex C (informative) Eyeball model and use of planar 2D sensor for measuring optical property ... 32
C.1 Human eyeball structure, its optics and modelling for practical measurement ... 32
C.2 Retinal sensor model ... 36
C.3 Optical measuring method with planar 2D image sensor ... 37
Annex D (informative) Comparison of retinal illuminance with other displays ... 43
D.1 Projected area on retina ... 43
D.2 Retinal illuminance estimation for the conventional displays using natural viewing ... 45
D.3 Retinal illuminance estimation for RS-RDP laser display using Maxwellian viewing ... 46
D.4 Comparison of retinal illuminance between RS-RDP laser displays and the conventional displays ... 46
Bibliography ... 47

Figure 1 – Coordinate system and setup for planar measurements ... 10
Figure 2 – Two measurement points of optical power ... 14
Figure 3 – Measurement geometry of the eye-box ... 16
Figure 4 – Measurement geometry of the FOV ... 17
Figure 5 – Example of beam waist for Maxwellian view at the 2D image sensor plane ... 18
Figure 6 – Example of measurement locations for effective angular image resolution ... 19
Figure 7 – Setup for measuring effective angular image resolution and retinal free focus range ... 20
Figure 8 – Test patterns for resolution measurement ... 21
Figure 9 – Example of contrast modulation plot ... 22
Figure 10 – Example of the measured results of retinal free focus range ... 24
Figure 11 – Nonuniformity measurement locations and box patterns ... 27
Figure A.1 – Example of mechanical structure of RS-RDP laser display ... 28
Figure A.2 – Example of electro-optical structure of RS-RDP laser display ... 29
Figure B.1 – Maxwellian view (a) and normal viewing (b) ... 30
Figure B.2 – Pinhole (a) and laser beam (b) in the Maxwellian view ... 31
Figure C.1 – Cross-sectional human eyeball structure ... 32
Figure C.2 – Schematic of the eye with geometrical and optical information ... 33
Figure C.3 – Calculated refracted beam angle in the eye with respect to incident beam angle for blue (465 nm), green (520 nm) and red (640 nm) ... 33
Figure C.4 – Schematic eye optics ... 33

AVA Documents
Document Sharing Hub
Full document details: BS IEC 62906-5-5:2022

Figure C.5 – Example of beam spot radius calculation for the eye model as a function of incident beam diameter 36
Figure C.6 – Retinal sensor model with curved 2D image sensor 37
Figure C.7 – Geometrical relationship between point A on the retina and B on the fovea plane for the Cartesian coordinate system 38
Figure C.8 – Cross-sectional view of the plane consisting of the z-axis and the line segment OB in Figure C.7 38
Figure C.9 – Schematic diagrams of human eye 39
Figure C.10 – Geometrical relation of points A, B, C, and D 42
Figure D.1 – Projected area on the spherical retina 44
Figure D.2 – Spherical cap cut off by a circular plane, 3D-view (a) and y-z cross-section (b) 44
Figure D.3 – Strip-shaped region S_V cut off by the two spherical caps 45

Documents
Document Sharing Hub
Full document details: BS IEC 62906-5-5:2022

INTERNATIONAL ELECTROTECHNICAL COMMISSION

LASER DISPLAYS –

Part 5-5: Optical measuring methods of raster-scanning retina direct projection laser displays

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62906-5-5 has been prepared by IEC technical committee 110: Electronic displays. It is an International Standard.

The text of this International Standard is based on the following documents:

Draft	Report on voting
110/1374/FDIS	110/1392/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

Documents
Document Sharing Hub

Full document details: BS IEC 62906-5-5:2022

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts of the IEC 62906 series, under the general title *Laser display devices*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

Documents
Document Sharing Hub

Full document details: BS IEC 62906-5-5:2022

LASER DISPLAYS –

Part 5-5: Optical measuring methods of raster-scanning retina direct projection laser displays

1 Scope

This part of IEC 62906 specifies the standard measurement conditions and optical measuring methods for raster-scanning retina direct projection laser displays with light sources such as direct-emitting lasers, optionally equipped with higher-order harmonic generation devices. The hybrid light sources using both lasers and spontaneous-emission-based light sources are not considered.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC TR 60825-14, *Safety of laser products – Part 14*: *A user's guide*

IEC 62595-2-4:2020, *Display lighting unit – Part 2-4: Electro-optical measuring methods of laser module*

IEC 63145-20-10:2019, *Eyewear displays – Part 20-10: Fundamental measurement methods – Optical properties*

IEC 63145-20-20:2019, *Eyewear displays – Part 20-20: Fundamental measurement methods – Image quality*

ISO/CIE 19476, *Characterization of the performance of illuminance and luminance meters*

CIE 233, *Calibration, Characterization and Use of Array Spectroradiometers*

3 Terms, definitions and abbreviated terms

3.1 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:

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

Documents
Document Sharing Hub

Full document details: BS IEC 62906-5-5:2022

3.1.1
raster-scanning retina direct projection laser display
RS-RDP laser display
laser projector projecting images by raster scanning directly on the retina which does not need an external screen or virtual image optics for observation

Note 1 to entry: For an example, see Annex A and [1][1].

3.1.2
Maxwellian view image
<RS-RDP laser display> image projected on the retina using a method of observation in which a converging lens forms an image of the light source in the plane of the eye's pupil of the observer, instead of looking at the source directly

Note 1 to entry: For an example, see Annex B.

3.1.3
effective angular image resolution
<RS-RDP laser display> ability of raster-scanning retina direct projection displays to distinguish details of an image, which are measured using grille patterns and expressed as line pairs per degree

3.1.4
focal point
<RS-RDP laser display> position of the smallest beam spot in the vicinity of the exit of the optical system of the RS-RDP laser display

3.1.5
retinal free focus range
<RS-RDP laser display> length along the eye-axis in which an acceptable value of effective angular image resolution can be obtained

3.1.6
laser multi-meter
light measuring device based on non-spectrometric methods using absorption filters with linear wavelength ramps capable of measuring centroid wavelength and optical power of laser light sources operating in single or multiple longitudinal mode, from which the tristimulus values XYZ are calculated to derive colorimetric and photometric quantities using the CIE colour-matching functions

Note 1 to entry: Also defined in IEC 62595-2-4. See [2].

3.2 Abbreviated terms

CCD	charge-coupled device
CMOS	complementary metal oxide semiconductor
DUT	device under test
FOV	field of view
FWHM	full width at half maximum
IPD	inter-pupillary distance
IR	infrared
LD	laser diode
LMD	light measuring device
MEMS	microelectromechanical system

[1] Numbers in square brackets refer to the Bibliography.

Documents
Document Sharing Hub
Full document details: BS IEC 62906-5-5:2022

RGB	red, green, and blue
ROI	regions of interest
RS-RDP	raster-scanning retina direct projection
SHG	second harmonic generation
2D	two-dimension, two-dimensional
3D	three-dimension, three-dimensional

4 Standard measuring conditions

4.1 Standard measuring environmental conditions

Optical measurements related to RS-RDP laser displays shall be carried out under the following standard environmental conditions:

– temperature: 25 ºC ± 3 ºC,
– relative humidity: 25 % to 85 % RH,
– atmospheric pressure: 86 kPa to 106 kPa.

When different environmental conditions are used, they shall be noted in the report. The dark room illuminance at the focal point shall be less than 0,01 lx, or the luminance contribution from the background in the test room reflected off the measurement space shall be less than 1/20 of the minimum luminance output from the DUT. If the condition is not satisfied, then background subtraction is required, and it shall be noted in the report.

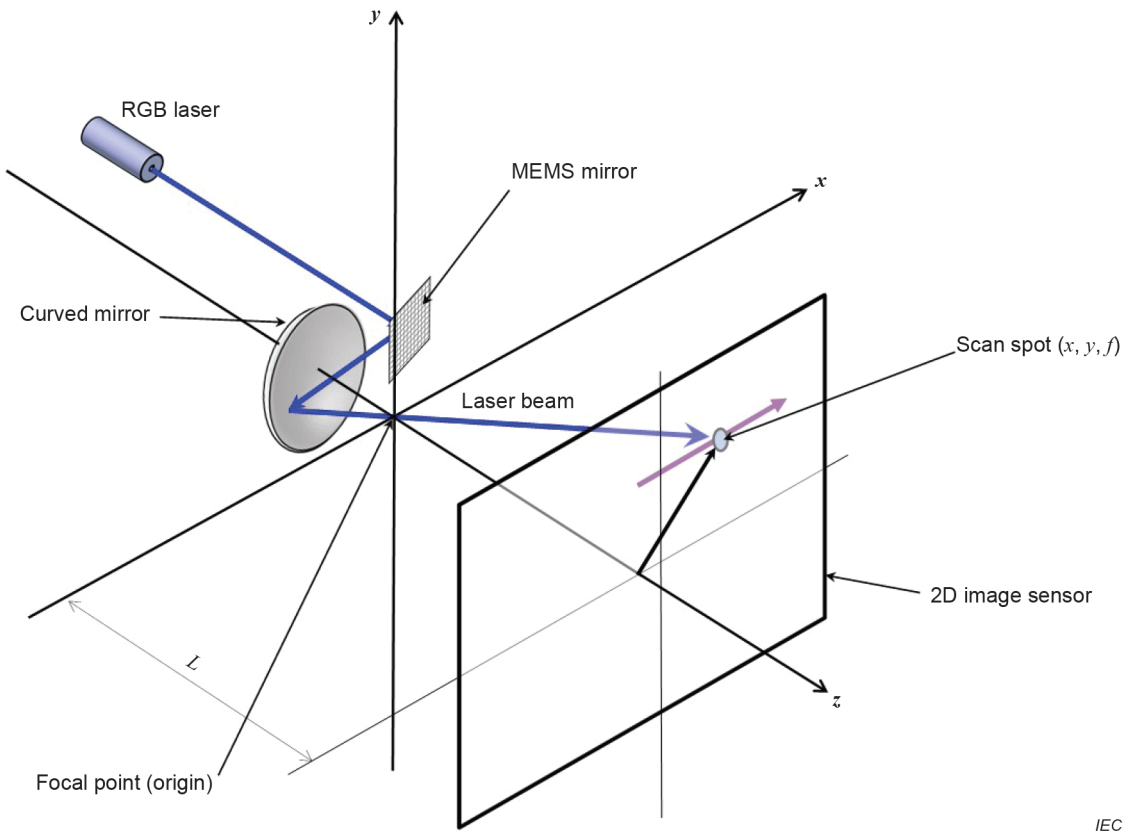
4.2 Coordinate system

The measurement coordinate system is shown in Figure 1 for illuminance or irradiance measurements. The origin of the coordinate system is placed at the focal point of the RS-RDP laser display. In the Cartesian system, the horizontal x axis and the vertical y axis lie on a plane (x-y plane) parallel to the line between the two eyes. The z axis is normal to the x-y plane. The optical measurements shall be carried out on a planar sensor parallel to the x-y plane if noted. The coordinate conversion between the retinal screen and the planar screen is shown in Annex C.

The length from the focal point (origin) to the 2D image sensor L shall be 16,7 mm when the f = 16,7 mm lens is applied in the measurement, reflecting the lens power of the human eye (60 m^{-1}) in air. See Annex C for details. It should be noted that the focal point usually does not coincide exactly with the centre of the pupil and can also be inside the vitreous body.

For spectral radiance and luminance measurements, the lens is not required and the measurement coordinate system with eye rotation described in IEC 63145-20-10 shall be used. In that case, the entrance pupil of the LMD is centred at the focal point and the LMD is pivoted about a point 10 mm behind the entrance pupil when scanning the field of view over the virtual image.

Documents
Document Sharing Hub
Full document details: BS IEC 62906-5-5:2022



NOTE This is an example. Two single-axis MEMS mirrors can be also used.

Figure 1 – Coordinate system and setup for planar measurements

4.3 Standard conditions of RS-RDP laser displays and light measuring devices

4.3.1 General

Measurements shall be started after the DUT (device under test: RS-RDP laser display) and LMD (light measuring device) have gained sufficient stability. All the LMDs shall be suitably calibrated, and the calibration data shall be recorded. Residual infrared (IR) radiation shall be filtered out if a photon up-conversion laser device including SHG (second harmonics generation) is used as a light source (see IEC 62595-2-4:2020, Clause A.5).

4.3.2 Adjustment of RS-RDP laser display

The RD-RDP laser display shall be measured in the default mode unless otherwise specified. All measurements shall be carried out in the same display mode.

4.3.3 Requirements for light measuring device

The requirements for narrow linewidth laser spectra are described in IEC 62906-5-6 [5]. The wavelength accuracy required for a certain chromaticity accuracy is described in IEC 62595-2-4. The LMD performance particularly used for the RS-RDP laser displays shall be as follows.

a) Laser power meter
   1) power range: 10 nW to 1 mW
   2) accuracy: ±5 %
   3) spectral wavelength range: covering at least the R, G, B-LD wavelengths
   4) spectral responsivity: calibrated for a given wavelength
   5) integration time: integral multiples of frame period

Documents
Document Sharing Hub

b) 2D image sensor

1) type of sensor: CMOS or CCD
2) pixel size: < 10 µm
3) pixel number: > 8 mega (3 264 x 2 488) pixels
4) minimum illuminance: 0,01 lx
5) linearity error: < 2 %

   over 5 % to 95 % of the LMD measurement range, particularly for the resolution measurement.

6) AD converter: ≥ 10 bits
7) exposure time: an integer multiple of frame period
8) polarization error: < ±2 %

The 2D image sensor is used for eye-box measurement, FOV measurement, and angular resolution measurement. For the measurement of chromaticity non-uniformity, the 2D sensor should be used only for measuring the relative intensity distribution of monochromatic lasers.

c) Illuminance meter (ISO/CIE 19476)

1) minimum illuminance: 0,01 lx

d) Spectral irradiance meter

1) wavelength range: covering the R, G, B-LD wavelengths
2) spectral bandwidth: ≤ 5 nm (FWHM)
3) wavelength accuracy: ± 0,3 nm
4) polarization error: < ±2 % at R, G, B-LD wavelengths
5) diameter of the measurement area, typically ≤ 4 mm
6) spectral stray light correction recommended

e) Laser multi-meter (see 3.1.6)

1) wavelength range: covering the R, G, B-LD wavelengths
2) power range: zero to the absolute maximum rating
3) wavelength accuracy: ±0,3 nm

f) Spectroradiometer (according to IEC 63145-20-10 and CIE 233)

1) wavelength range: covering the R, G, B-LD wavelengths
2) spectral bandwidth: ≤ 5 nm (FWHM)
3) polarization error: < ±2 % R, G, B-LD wavelengths
4) measurement field angle: ≤ 2°
5) entrance pupil diameter: 2 mm to 5 mm
6) wavelength accuracy: ±0,3 nm
7) spatial variation in entrance pupil response [3]: < 5 %
8) spectral stray light corrected

g) Spectral radiant flux meter (according to CIE 233)

1) integrating sphere with ≥ 4 mm diameter measurement port
2) wavelength range: covering the R, G, B-LD wavelengths
3) spectral bandwidth: ≤ 5 nm (FWHM)
4) wavelength accuracy: ±0,3 nm
5) polarization error: < ±2 % R, G, B-LD wavelengths
6) spectral stray light correction recommended

Documents
Document Sharing Hub

Full document details: BS IEC 62906-5-5:2022

h) 2D imaging LMD (according to IEC 63145-20-20)
   1) entrance pupil diameter: 2 mm to 5 mm
   2) at least four sensor pixels per virtual image sub-pixel
   3) AD converter: ≥ 10 bits
   4) exposure time: an integer multiple of frame period
   5) polarization error: < ±2 %
   6) includes background subtraction, flat field correction, and geometric correction

NOTE LMDs for scanning laser displays are subject to detector saturations errors (see [4]).

4.4 Laser-safety requirements for measurement

The measurement shall be carried out strictly in accordance with the requirements of IEC TR 60825-14.

5 Optical measuring methods

5.1 General

An RS-RDP laser display is a specific type of raster-scanning projector. This document particularly specifies the following optical measurement items:

– optical power at the primary colour wavelength
– eye-box
– field of view
– aspect ratio
– effective angular image resolution
– retinal free focus range
– retinal white illuminance
– luminance and chromaticity of virtual image
– white chromaticity non-uniformity

5.2 Optical power at the primary colour wavelength

5.2.1 General

The measurement of the optical output power of the DUT and of the optical power coupled into an eye through the pupil is very important. It can be classified by the optical power levels of eyewear displays. The optical power of the narrow linewidth spectrum at each R, G, B primary colour wavelength is separately measured for the analysis of the performance of each laser device.

The two points in Figure 2 are appropriate for measuring the optical power. One is the output exit window (measurement point 1) which is closest to the beam spot at the MEMS mirror inside the DUT. The other is the focal point of the power incident to the eye (measurement point 2).

The DUT shall be measured under the dark room conditions specified in 4.1.

5.2.2 Measurement at exit window (measurement point 1)

The exit window is not always accessible because the optical path can be routed inside the DUT housing. Therefore, this measurement may be skipped if it is inaccessible. Otherwise, the measurement shall be carried out.

Documents
Document Sharing Hub
Full document details: BS IEC 62906-5-5:2022

A full-frame scan area at the measurement point 1 is calculated by the scan angle and the distance from the MEMS position. Depending on the DUT design, the full-frame scan area can be larger than the aperture of the optical power meter. In such a case, a centre pattern much smaller than the full-frame scan area should be used to measure the optical power within the aperture of the laser power meter. Any shapes of the centre pattern may be used if the size at the measurement point 1 is smaller than the aperture size of the power meter.

The individual R, G, B laser powers shall be measured as follows:

a) Measure the wavelength λ_R with a spectrometer at the measurement point 1.

b) Check whether spectral output powers other than red are present or not. If present, one of the methods specified in 5.2.4 is applied.

c) Confirm that the laser power meter collects all the optical power.

d) Display a full-screen monochromatic red colour image or a smaller centre monochromatic red colour pattern with the maximum signal coding.

e) Measure the time-averaged optical power P_R for red at the measurement point 1 using a laser power meter, or spectral radiance flux LMD, with ≥ 4 mm aperture without laser beam clipping (4.3.3, a) or g)).

f) Repeat a) to e) for green and blue to obtain (P_G, λ_G) and (P_B, λ_B), respectively.

g) Convert the measured power into the full-screen power by multiplying the scaling factor of the centre pattern and the full-screen area when the smaller centre pattern is used, assuming that the laser power changes linearly with the scan area.

h) Report the power and the centroid wavelength for the red, green, and blue images.

5.2.3 Measurement at focal point (measurement point 2)

The individual R, G, B laser powers shall be measured as follows:

a) Measure the wavelength λ_R with a spectrometer at the measurement point 2.

b) Check whether spectral output powers other than red are present or not. If present, one of the methods specified in 5.2.4 shall be applied.

c) Confirm that the laser power meter collects all the optical power.

d) Display a full-screen monochromatic red colour image with the maximum signal coding.

e) Measure the time-averaged optical power P_R at the measurement point 2 using a laser power meter, or spectral radiance flux LMD, with ≥ 4 mm aperture without laser beam clipping (4.3.3, a) or g)).

f) Repeat a) to e) for green and blue to obtain (P_G, λ_G) and (P_B, λ_B), respectively.

g) Report the power and the centroid wavelength for the red, green, and blue images.

5.2.4 Elimination of the effect of other spectral powers

The optical output power at each primary colour shall be measured and reported. When there is significant spectral output power that can affect the measured power at the intended specific colour wavelength, it shall be eliminated using appropriate optical filters.

The extinction ratio is the optical power ratio of the measured output power P_1 at the specific colour wavelength to the biased level P_0 with zero-input signal at the same wavelength. If the unexpected spectral output power with zero-input signal significantly affects the measured data, it shall be reported. For example, laser diodes are usually biased around the threshold current for high-speed modulation. The bias just above the threshold current sometimes reduces the extinction ratio because of the small output power at the bias level.

The residual IR power shall be also filtered out if a photon up-conversion laser device including SHG is used (see 4.3.1). The IR power shall be measured and reported.

AVA Documents
Document Sharing Hub