



BSI Standards Publication

Flexible display devices

Part 5-2: Measuring methods of optical characteristics from the vantage point for curved displays

National foreword

This Published Document is the UK implementation of IEC/TS 62715-5-2:2016.

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 secretary.

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 2016.

Published by BSI Standards Limited 2016

ISBN 978 0 580 89737 5

ICS 31.120

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 30 June 2016.

Amendments/corrigenda issued since publication

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



TECHNICAL SPECIFICATION



**Flexible display devices –
Part 5-2: Measuring methods of optical characteristics from the vantage point
for curved displays**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.120

ISBN 978-2-8322-3300-9

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

CONTENTS

FOREWORD.....	4
1 Scope.....	6
2 Normative references.....	6
3 Terms, definitions and abbreviations	6
3.1 Terms and definitions	6
3.2 Abbreviations	8
4 Standard measuring equipment.....	8
4.1 Video signal generator	8
4.2 Non-contact LMD	8
5 Standard measuring conditions	9
5.1 Standard measuring environmental conditions	9
5.2 Power supply	9
5.3 Warm-up time	9
5.4 Standard measuring dark room conditions	9
5.5 Adjustment of display modules	9
5.6 Measuring geometry for vantage point	10
5.6.1 General	10
5.6.2 Measuring geometry in horizontal vantage point	10
5.6.3 Measuring geometry in vertical vantage point	10
5.7 Measuring layout for viewing position	11
5.7.1 General	11
5.7.2 Measuring layout by moving LMD	11
5.7.3 Measuring layout by rotating the display module	12
5.8 Minimum curvature radius for the measurement	13
5.9 Screen visual angle.....	14
5.9.1 Screen visual angle of a flat display module	14
5.9.2 Screen visual angle of concave type display module	14
6 Measuring methods of optical characteristics.....	15
6.1 General.....	15
6.1.1 Measuring items.....	15
6.1.2 Measuring point locations.....	15
6.1.3 Test pattern	16
6.2 Measuring method.....	17
6.2.1 Measuring method at the screen centre position	17
6.2.2 Measuring method at viewing angle position	18
6.3 Optical characteristics of white box by viewing angle	18
6.3.1 Luminance variation by viewing angle.....	18
6.3.2 Contrast ratio variation by viewing angle.....	19
6.3.3 Chromaticity variation by viewing angle	20
6.4 Optical characteristics of colour box by viewing angle	20
6.4.1 Colour gamut area variation by viewing angle	20
6.4.2 Chromaticity variation and ΔE by viewing angle.....	21
6.5 Uniformity and uniformity variation.....	22
6.5.1 General	22
6.5.2 Luminance uniformity and uniformity variation by viewing angle	23
6.5.3 Chromaticity uniformity and uniformity variation by viewing angle	23

6.6	Half-luminance and half-contrast viewing angle.....	23
6.6.1	Half-luminance viewing angle range	23
6.6.2	Half-contrast viewing angle range.....	24
7	Reporting	24
7.1	Requirements of reporting	24
7.2	Recommendations of measurement results reporting	25
	Bibliography	30
	Figure 1 – Measuring layout for non-contact measurement	9
	Figure 2 – Measuring geometry in horizontal vantage point (top view)	10
	Figure 3 – Measuring geometry in vertical vantage point (side view)	11
	Figure 4 – Measuring geometry by horizontal viewing angles (top view)	12
	Figure 5 – Measuring geometry by horizontal display directions (top view)	13
	Figure 6 – Minimum concave type curvature radius for the measurement (top view)	14
	Figure 7 – Screen visual angle of concave type display device (top view).....	15
	Figure 8 – 9-point locations for vantage-point measurement	16
	Figure 9 – Nine white boxes for vantage-point measurement.....	16
	Figure 10 – Nine measuring points for vantage-point black measurement.....	17
	Figure 11 – Nine-colour boxes of R, G and B for vantage-point measurement	17
	Figure 12 – Measuring directions of 9 vantage points	17
	Figure 13 – Measuring directions (right side) by viewing angle 0°, 15°, 30° and 45°	18
	Figure 14 – Measuring directions (right side) by viewing angle 0°, 15°, 30° and 45° (front upper view).....	18
	Figure 15 – Measuring method for half-luminance viewing angle	23
	Table 1 – Example of measurement results for the optical characteristics.....	26
	Table 2 – Calculation results from the measurement data of Table 1	28

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE DISPLAY DEVICES –**Part 5-2: Measuring methods of optical characteristics
from the vantage point for curved 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.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62715-5-2, which is a technical specification, has been prepared by IEC technical committee 110: Electronic display devices.

The text of this standard is based on the following documents:

Enquiry draft	Report on voting
110/715/DTS	110/739/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62715 series, published under the general title *Flexible display devices*, can be found on the IEC website.

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

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

FLEXIBLE DISPLAY DEVICES –

Part 5-2: Measuring methods of optical characteristics from the vantage point for curved displays

1 Scope

This part of IEC 62715, which is a technical specification, specifies the general rules and the details of optical measuring methods from a fixed point (the so-called vantage point) for curved emissive and transmissive type displays such as OLED and LCD in dark room conditions. This document focuses on concave shape large screen displays (non-portable) around a horizontal and/or vertical axis with fixed or variable curvature radius.

The measuring method stipulated in this technical specification is applied to the curved display modules under the following states:

- vantage-point luminance variation by viewing angles
- vantage-point contrast ratio variation by viewing angles
- vantage-point chromaticity variation of white colour by viewing angles
- vantage-point colour gamut area variation by viewing angles
- vantage-point chromaticity variation of primary colours by viewing angles
- luminance uniformity and its uniformity variation by viewing angles
- chromaticity uniformity and its uniformity variation by viewing angles
- viewing angle of half-luminance
- viewing angle of half-contrast

2 Normative references

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

IEC 62715-1-1, *Flexible display devices – Part 1-1: Terminology and letter symbols*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62715-1-1 as well as the following apply.

3.1.1

curved display

display that has a single curvature radius along the screen horizontally and/or vertically

Note 1 to entry: The curvature radius of each screen position is fixed by the manufacturer or user controllable curvature radius.

Note 2 to entry: The direction of curvature might be concave or convex from the viewer's position.