



IEC 62715-6-22

Edition 1.0 2023-03

INTERNATIONAL STANDARD



**Flexible display devices –
Part 6-22: Crease and waviness measurement methods**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.120

ISBN 978-2-8322-6628-1

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

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms, definitions and abbreviated terms	8
3.1 Terms and definitions.....	8
3.2 Abbreviated terms.....	8
4 Standard atmospheric conditions	8
5 Preparation of specimen for measurement.....	9
5.1 General.....	9
5.2 Visual examination.....	9
5.3 Specimen preparation	9
5.4 Measurement location.....	12
5.4.1 General	12
5.4.2 Crease.....	12
5.4.3 Waviness.....	12
6 Measurement methods	12
6.1 General.....	12
6.2 Purpose	13
6.3 Non-contact topography	13
6.3.1 General	13
6.3.2 Test apparatus	13
6.3.3 Measurement procedure	17
6.3.4 Data analysis and report.....	17
6.4 Non-contact profilometry	20
6.4.1 General	20
6.4.2 Test apparatus	21
6.4.3 Measurement procedure	22
6.4.4 Data analysis and report.....	23
6.5 Contact profilometry.....	24
6.5.1 General	24
6.5.2 Test apparatus	24
6.5.3 Measurement procedures	26
6.5.4 Data analysis and report.....	26
Bibliography.....	27
Figure 1 – Step 1: Preparing the components of the specimen.....	10
Figure 2 – Step 2: Turning the back of the panel to face upward	10
Figure 3 – Step 3: Turning over the base plate and attaching it to the back of the panel	10
Figure 4 – Step 4: Turning over the base plate with the panel attached.....	11
Figure 5 – Example of measuring area.....	12
Figure 6 – Example of measurement system.....	14
Figure 7 – Analysis flow chart for PMD	14
Figure 8 – Surface normal vector N , sight ray of a camera p and reflected ray r	15
Figure 9 – Osculating circle and curvature	16

Figure 10 – Example of data distribution in the crease measuring area	17
Figure 11 – Example of data grouping on the vertical direction with folding axis.....	18
Figure 12 – Example of the N^{th} profile data	18
Figure 13 – Example of data distribution in the waviness measuring area	19
Figure 14 – Concept of filtering profile	20
Figure 15 – Schematic of the result of laser scanning	21
Figure 16 – Schematic diagram of the laser scanning apparatus	21
Figure 17 – Example of position 1 and position 2 in the crease measuring area	23
Figure 18 – Schematic diagram of the contact profilometry apparatus.....	24
Figure 19 – Schematic diagram of the motion of probe.....	25
Table 1 – Example of specimen preparation condition.....	11
Table 2 – Example of crease data report using the PMD method	19
Table 3 – Example of reporting waviness data	20
Table 4 – Example of laser scanning apparatus condition	22
Table 5 – Example of reporting crease data by the laser scanning method	24
Table 6 – Example of stylus condition	25

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FLEXIBLE DISPLAY DEVICES –

Part 6-22: Crease and waviness measurement methods

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 62715-6-22 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
110/1491/FDIS	110/1503/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.

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/publications.

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 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.

INTRODUCTION

The market for foldable display devices is growing rapidly, as shown in the new form factors for portable devices. It is expected that various foldable display devices will be released in the near future.

Typically, the cover for rigid displays is made of glass. A rigid glass cover protects the display panel from external shock and produces a surface uniformity without visual distortion. In order to utilize a foldable display, a thin and flexible cover is preferred rather than the thick general rigid cover. Although cover materials like thin films or plastics can be flexible, their surface is rougher and can crease more easily. Based on this expectation, there is an anticipation to standardize the measurement of surface creasing and waviness due to folding in order to evaluate the surface quality of foldable displays.

There is a wide variety of ways to analyse the surface of an object, and many of them are already standardized, [1] to [9]¹. In this document, two of the non-contact methods and one contact method using a probe are described, and the manner in which to report the values of crease and waviness of foldable displays from the measured data is specified.

¹ Numbers in square brackets refer to the Bibliography.

FLEXIBLE DISPLAY DEVICES –

Part 6-22: Crease and waviness measurement methods

1 Scope

This part of IEC 62715 specifies the standard measurement conditions and methods for determining the surface crease and waviness for the evaluation of foldable displays. The measurement methods are used to specify the extent of geometrical distortions in foldable display surfaces. This document applies to foldable display panels and modules (e.g. in-folding and out-folding) with one axis.

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 60050-845, *International Electrotechnical Vocabulary (IEV) – Part 845: Lighting* (available at <<http://www.electropedia.org>>)

IEC 62341-1-2, *Organic light emitting diode (OLED) displays – Part 1-2: Terminology and letter symbols*

IEC 62341-6-2:2015, *Organic light emitting diode (OLED) displays – Part 6-2: Measuring methods of visual quality and ambient performance*

IEC 62715-5-3, *Flexible display devices – Part 5-3: Visual assessment of image quality and defects*

IEC 62715-6-1, *Flexible display devices – Part 6-1: Mechanical test methods – Deformation tests*

ISO 4287, *Geometrical Product Specifications (GPS) – Surface texture: Profile method – Terms, definitions and surface texture parameters*

ISO 16610-21, *Geometrical product specifications (GPS) – Filtration – Part 21: Linear profile filters: Gaussian filters*

ASME B46.1-2019, *Surface Texture (Surface Roughness, Waviness, and Lay)*