

TECHNICAL REPORT

**Eyewear display -
Part 202-40: General information of AR type - Frontal stray lights**

CONTENTS

FOREWORD	2
1 Scope	4
2 Normative reference	4
3 Terms, definitions and abbreviations	4
3.1 Terms and definitions	4
3.2 Abbreviations	4
4 Optical see-through (OST) combiner technologies	5
4.1 General	5
4.2 Half-tone combiner	5
4.3 Polarization combiner	5
4.4 Wavelength-selective combiner	6
4.5 Spatial half-tone combiner	6
5 Frontal stray light	6
5.1 General	6
5.2 Categorization of frontal stray light	6
5.2.1 General	6
5.2.2 Frontal surface reflection	7
5.2.3 Direct transmission	7
5.2.4 Facial reflection	8
5.2.5 Frontal diffraction	8
5.2.6 Frontal reflection	8
5.3 Techniques to reduce frontal stray light	8
5.3.1 Anti-reflection coating	8
5.3.2 Angle adjustment	8
5.3.3 Optical filtering	8
6 Considerations for evaluation methods	8
6.1 General	8
6.2 Environment	9
6.3 2D LMD	9
6.4 Social acceptance	9
6.5 Privacy	10
6.6 Measurement of 2D LMD on 3D surfaces	11
Bibliography	12
Figure 1 – Concept of optical see-through combiners	5
Figure 2 – Schematics of the five types of frontal stray light	7
Figure 3 – Pictures of the five types of frontal stray light	7
Figure 4 – MTF curve of the frontal stray light	10
Table 1 – Luminance of frontal stray light for different viewing angles	9
Table 2 – Area of frontal stray light for different viewing angles	10

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Eyewear display - Part 202-40: General information of AR type - Frontal stray lights

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at <https://patents.iec.ch>. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 63145-202-40 has been prepared by IEC technical committee 110: Electronic displays. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
110/1793/DTR	110/1822/RVDTR

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 Technical Report 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 63145 series, published under the general title *Eyewear display*, 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, or
- revised.

1 Scope

This document provides general information for frontal stray light from optical see-through augmented reality (AR) displays and offers guidance on how to evaluate it. It includes overview of the technology, categorization of the phenomenon, and optical characteristics.

2 Normative reference

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 63145-1-2, *Eyewear display - Part 1-2: Generic - Terminology*

Bibliography

- [1] T. Kohno, J. Kollin, D. Molnar, and F. Roesner, "Display Leakage and Transparent Wearable Displays: Investigation of Risk, Root Causes, and Defenses," Microsoft Research (2015)
 - [2] J. Penczek, "Evaluating Display Ambient Contrast with Self Reflection," IMID 2021 DIGEST (2021)
 - [3] K. Gutttag, "Exclusive: Lumus maximus 2K x 2K Per Eye, >3000 Nits, 50° FOV with Through-the-Optics Pictures," KGOntech (2021).
<https://kgutttag.com/2021/05/24/exclusive-lumus-maximus-2k-x-2k-per-eye-3000-nits-50-fov-with-thought-the-optics-pictures/>
 - [4] Y. Wang, M.R. Luo, M. Wang, K. Xiao, and M. Pointer, "Spectrophotometric measurement of human skin colour," *Color Res. Appl.* 42 (2017)
 - [5] R. E. Rakel, Chapter 12 – Establishing Rapport, "Textbook of Family medicine," W.B.Saunders, 2012, Pages 146-159.
 - [6] H. W. Lim, Y. Song, J. H. Kim, Y. U. Shin, S. J. Hwang, and S. Hong, "Normal Range of Eye Movement and Its Relationship to Age," *investigative ophthalmology & visual science*, Vol. 58(8), 2017.
 - [7] IEC 62977-2-1, *Electronic displays - Part 2-1: Measurements of optical characteristics - Fundamental measurements*
 - [8] IEC TR 62977-2-5, *Electronic displays devices - Part 2-5: Transparent displays - Measurements of optical characteristics*
 - [9] IEC 62715-5-1, *Flexible display devices - Part 5-1: Measuring methods of optical performance*
-