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TECHNICAL REPORT

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

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Eyewear display -
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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
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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- withdrawn, or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. Guttag, "Exclusive: Lumus maximus 2K x 2K Per Eye, >3000 Nits, 50° FOV with Through-the-Optics Pictures," KGOOnTech (2021). <https://kguttag.com/2021/05/24/exclusive-lumus-maximus-2k-x-2k-per-eye-3000-nits-50-fov-with-though-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*
