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TECHNICAL NOTE

Guidance on the Measurement of Temporal Light Modulation of Light Sources and Lighting Systems

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Summary

New regulations are coming into force in several regions with respect to temporal light modulation of lighting products. However, standardized test methods and even basic understanding of requirements are largely lacking in the area. Newly introduced metrics, like the stroboscopic visibility measure, are used in these regulations without the existence of standardized measurement methods.

This document sets the stage for an understanding of these new metrics and provides guidelines for the correct measurement of them. The document at hand is meant to provide respective recommendations, which do not imply any kind of standardization.

1 Introduction

1.1 Background

In 2016 CIE TN 006 "Visual Aspects of Time-Modulated Lighting Systems – Definitions and Measurement Models" (CIE 2016) was published. CIE TN 006 describes measurement principles to characterize the visibility of temporal light artefacts (TLA) of light sources.

The term "temporal light modulation" (TLM) is used for any measurable change of the light level or the spectral distribution of light over time. The term "temporal light artefacts" (TLA) is only used for the human visual perception of these modulations. The most important reason to have a measurement method for TLM is that exposure to light modulation may cause undesired effects on human perception (TLA), health, performance and safety.

After the introduction of LEDs to lighting products, the measurement of light modulation has become more and more important. Although LEDs do not intrinsically produce TLM, they do have a fast reaction time to the driving current. This means that any associated waveform, whether intentional or unintentional, changes from the electrical input (e.g. control gear or direct mains) can also result in a change in the output of the LEDs and the perception of these changes.

Currently there is a wide variety of quantities for TLM and TLA. The most commonly used ones are summarized in Clause 3.

1.2 Scope

This document provides recommendations on measurement protocols to measure periodic waveforms and light modulations. The recommendations should enable measurement laboratories to apply the same measurement methodology and to report the results in a consistent and reproducible way.

This document covers methods of measurement for TLM and TLA of lighting equipment. Its primary application is for general lighting purposes; however, the principles can be applied to other fields (e.g. display equipment, or facade lighting), though these generally require different input optics for the measurement equipment.

The recommendations given in this document can be used to measure non-periodic signals, but there might be specific aspects of these signals that will not be covered in this document (e.g. signal-triggering).