Input paper: [[1]](#footnote-1) ENG15-3.1.1.1.1

Input paper for the following Committee(s): check as appropriate Purpose of paper:

**□** ARM **🗹** ENG **□** PAP **🗹** Input

**□** ENAV **□** VTS **□** Information

Agenda item [[2]](#footnote-2) n.n

Technical Domain / Task Number 2 task 2.2.2

Author(s) / Submitter(s) China MSA

Modification Proposal on Definition of Effective Intensity in Draft R0203

# Summary

In Section A4, Annex A of IALA Recommendation Draft R0203, there is a description for the definition of Effective Intensity, that is , When a group of flashes make up a flash character, the reported effective intensity shall be that of the lowest flash effective intensity in the group. This description is not consistent with CIE 229:2018, which is based on the convolution of all flashes with a visual system response function. However, this description in Draft R0203 only considers the convolution of a single flash and visual system response function, but not the interaction among these flashes.

According to Chapter 3 of CIE 229:2018 and the requirement of determination of the specific AtoN light character, the description for the definition of Effective Intensity shall be modified, that is, the reported effective intensity not only be determined by the flash and human visual response, but also the interaction among all flashes. So, the reported effective intensity shall be the minimum value of all pulse peaks in the convolution curve, which is the convolution between all flashes and the visual system response function.

## Purpose of the document

The purpose of this document is to introduce the description for the definition of effective intensity.

## Related documents

CIE 229:2018 Groundwork for Measurement of Effective Intensity of Flashing Lights

Recommendation R0204 MARINE SIGNAL LIGHTS-DETERMINATION AND CALCULATION OF EFFECTIVE INTENSITY

# Background

Effective intensity is a very important technical parameter for AtoN light, by which the luminous range is determined. The IALA recommendation R0204 has introduced the Modified Allard Method for the determination and calculation of effective intensity of a rhythmic light, which is also illustrated in CIE 229:2018. So, it is necessary to consider the calculation method of effective intensity when working on its definition.

# Discussion

According to the Modified Allard Method descripted in R0204, the effective intensity of a finite length flash is determined by the maximum value of the convolution result between the flash profile and the visual system response function.

According to CIE 229:2018, the above equation applies over an infinite time interval for a flashing light or over an effectively finite time interval for a single flash. For practical measurement of flashing lights, the measurement time interval will be a finite time window long enough to approximate the effective intensity, , for the infinite time window.

Figure 1 shows an example of a flashing light and its convolution. The effective intensity, , is given as the peak value of as illustrated in Figure 1. Note that, the convolution of each flash increases slightly as the flash is repeated, due to the long tail of the visual system response function, and converges to a final value at an infinite time interval.

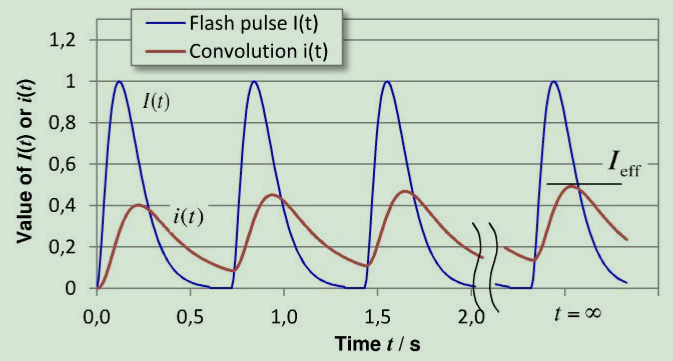


Figure 1 Diagram of convolution in Modified Allard Method

An important effect of this definition is that it accounts for the effect of frequency. The effective intensity should increase if the frequency of the flashing light (consisting of the same individual flashes) increases.

Figure 2 illustrates such an effect of frequency calculated by the MAM, with an example of repeated flashes of 0.1s duration at frequencies of 1Hz (upper figure) and 2 Hz (lower figure). The effective intensity of the first flash is 0.333cd for both cases. The convolution of the second flash starts from the tail of from the first pulse, which creates slightly higher effective intensity for the second pulse, then this is repeated by the third pulse, fourth pulse, and so on. When the frequency is higher (lower figure), the tail of the first flash is much higher than that at a frequency of 1 Hz, creating a higher effective intensity of the second flash than a 1 Hz. The final effective intensity (at infinite interval) is 14% higher at 2 Hz than at 1 Hz.

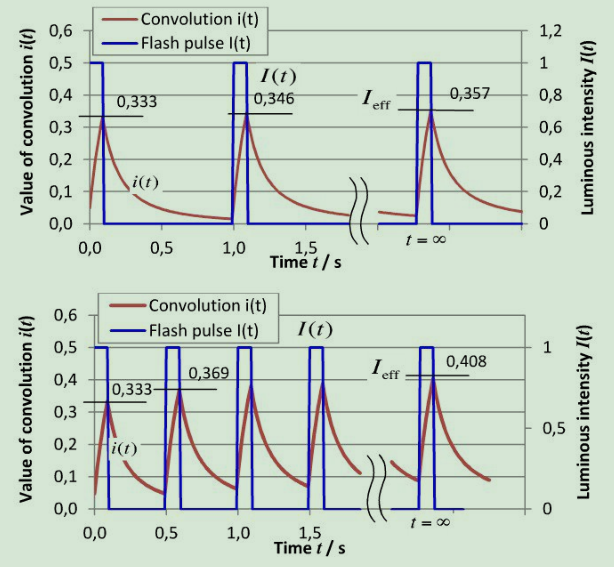


Figure 2 Plots of the convolution curves for repeated flashes at 1 Hz (upper figure) and 2 Hz (lower figure) with the flash duration of 0.1s, illustrating that higher frequency yields higher effective intensity

So all in all , according to the above description, we can know that When a group of flashes make up a flash character, the effective intensity of each single flash should not be calculated separately, because the long tail of the visual impulse response function also contributes to the convolution value, the convolution value of the first pulse at the time when the second pulse starts will be added to the convolution value of the second pulse, then the convolution of each flash increases slightly as the flash is repeated, therefore, the convolution value of the last flash will be maximized. According to the Modified Allard Method, the effective intensity of a finite length flash is determined by the maximum value of the convolution result, so the description of the definition of Effective Intensity in Draft R0203 should be modified, that is, when a group of flashes make up a flash character, the reported effective intensity is not only determined by the single flash, but also the interaction among all flashes.

# 4 request

The committee is requested to consider this modification of definition for effective intensity. If appropriate, please update it to Draft R0203 and R0204.

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-1)
2. Leave open if uncertain [↑](#footnote-ref-2)