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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Lighting equipment – Non-active mode power measurement

Appareils d'éclairage – Mesure de puissance en mode non actif

IEC 63103:2020-07(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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LIGHTING EQUIPMENT – NON-ACTIVE MODE POWER MEASUREMENT

FOREWORD

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The text of this International Standard is based on the following documents:

FDIS	Report on voting
34/698/FDIS	34/709/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
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- amended.

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INTRODUCTION

The first edition of this document specifies uniform requirements for measuring non-active mode power consumption for all lighting equipment. Present performance standards for controlgear (IEC 62442 (all parts)) and luminaires (IEC 62722-1), already include some descriptions for measuring standby power. It is expected that these standards will be amended, accordingly.

In addition to an illumination function, today's lighting equipment can execute a variety of additional non-illumination functions, for example through integrated surveillance cameras, noise detectors, occupancy counters, vehicular and pedestrian traffic detection, weather detection, smoke detection, visible light communication and proximity or location devices. During the execution of these functions, the (multi-function) lighting equipment can operate in many different (active and non-active) modes. Non-active mode power consumption of (multi-function) lighting equipment, i.e. the power consumed when the illumination function is off, is an important aspect of lighting equipment and is becoming more important with the emergence of connected lighting.

This document defines and describes methods of measurement of electrical power consumption in non-active mode(s) for lighting equipment. The document is organized into two main clauses: Clause 4 "General test conditions" and Clause 5 "Measurements".

Clause 4 contains specifications on the general conditions for making the measurements. Subclauses 4.1 through 4.4 cover conditions for setting up the laboratory, selecting a supply voltage and suitable instruments for the power measurement. Subclause 4.5 covers aspects which should be considered when the lighting equipment is connected to a network to work properly. Subclause 4.5.2 is for wired networks and 4.5.3 and 4.5.4 give setups for wireless networks using conducted or radiated connections, respectively. These setups for wireless networks are harmonized with ETSI Standard EN 300 328 and modified for lighting equipment.

Clause 5 details the procedures for making measurements of the equipment under test (EUT). Subclause 5.1 gives general instructions for setting the EUT into the possible non-active mode(s). Subclause 5.2 details the large variety of EUTs. These EUTs can be placed into two categories: illumination-only (5.2.2) and multi-function (5.2.3) lighting equipment. Traditional lighting equipment with an illumination-only function is summarized in 5.2.2, Table 1. Multi-function lighting equipment having additional non-illumination functions is addressed in 5.2.3. A standardized form for reporting the measured result according to the functions and modes of the multi-function lighting equipment under test is specified in 5.2.3, Table 2. Table 2 is a central feature of this document that will enable all users to report their non-active power results in a consistent manner.

Subclause 5.3 specifies procedures for preparing the EUT to make measurements of the input power. Instructions for EUTs containing battery charging functions are found in 5.3.2. Subclause 5.3.3 gives procedures for EUTs having no network provision and 5.3.4 covers networked EUTs whether wired or wireless.

The measurement procedure is specified in 5.4 and offers three alternative methods and the specific stability conditions required for each. These methods are adapted for lighting equipment from IEC 62301:2011. The direct meter method specified in 5.4.2 has the most limited applicability. It can only be used when the power reading is stable. In cases of discrepancy, the average reading method (5.4.3) or sampling method (5.4.4) have precedence. The average reading method is suitable only for EUTs having stable modes whereas the sampling method is suited for cyclic or unstable modes and if the mode is of limited duration.

Informative annexes are included to illustrate various measurement setups (Annex B and Annex C) and Annex D provides practical examples of controlgear, for example involving lighting equipment having a digital addressable lighting interface network in accordance with IEC 62386 (all parts), and of luminaires.

The methods defined and described in this document are not intended to be used to measure power consumption of (multi-function) lighting equipment during active mode(s) (also called "on mode(s)"), as these are generally covered by IEC standards or other product standards.

This document provides methods of measurement for lighting equipment. However, the methods specified in this document could also be used to measure lighting system models. A system model is a full-size portion of the lighting system containing specific functions and can set every mode of a portion of the system. The system models should be scalable to the entire lighting system additively. Thus, the total non-active mode power consumption of the system should equal the summation of power measured in each system model.

Using an adaptive roadway and pedestrian lighting system as an example for illustration, the following three system models could be present:

– (A) five luminaires connected to one daylight sensor; illuminate to compensate daylight;
– (B) a luminaire with a pedestrian sensor, a daylight sensor, connected to a crosswalk illumination; illuminate the crosswalk upon sensing a pedestrian when needed;
– (C) a dimmable luminaire with a vehicle detector; illuminate upon sensing a vehicle when needed.

Assume the lighting system comprises 50 A-, 10 B-, and 20 C-system models, then the total power consumption for a specified mode of the system would be Power(mode) = 50 × power(A) + 10 × power(B) + 20 × power(C). Table 2 (5.2.3) could be used to specify the measurement of a system model set in various combinations of modes. In this way, the system is evaluated in measurable pieces (system models) set to function interactively as the entire system is intended for each mode.

LIGHTING EQUIPMENT – NON-ACTIVE MODE POWER MEASUREMENT

1 Scope

This document specifies methods of measurement of electrical power consumption in non-active mode(s), as applicable for electrical lighting equipment. This includes electrical lighting equipment incorporating non-illumination components.

This document specifies neither performance requirements nor limits on power consumption.

This document applies to lighting equipment connected to a supply voltage up to 1 500 V DC or up to 1 000 V AC.

This document is intended to be referenced by lighting equipment product standards for the measurement of non-active mode power consumption. Details for the non-active mode power consumption measurement and data presentation are specified in the product standards.

NOTE Annex A provides guidance on details specified in product standards.

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 – Part 845: Lighting (available at http://www.electropedia.org)*

IEC 62504, *General lighting – Light emitting diode (LED) products and related equipment – Terms and definitions*

IEC TS 63105*, Lighting systems and related equipment – Vocabulary*[1]

ETSI EN 300 328 V2.1.1 (2016-11), *Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU*

3 Terms and definitions

For the purposes of this document the terms and definitions given in IEC 60050-845, IEC 62504 and IEC TS 63105 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

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1 Under preparation. Stage at the time of publication IEC CDTS 63105:2020.

3.1
lighting equipment
assembly of components used for the primary function of providing illumination, or any component thereof

EXAMPLE Integrated lamp, non-integrated lamp plus controlgear, luminaire, controlgear, luminaire with camera.

Note 1 to entry: Lighting equipment can also include non-illumination components that offer non-illumination functions.

Note 2 to entry: Within the primary function of illumination, applications like horticultural, UV disinfection, etc. are included.

3.2
component
constituent part which cannot be physically divided into smaller parts without losing its function

EXAMPLE Light source, power supply, control unit.

[SOURCE: IEC 60050-151:2001, 151-11-21, modified – "of a device" and "particular" deleted.]

3.3
supply voltage
SV
<of lighting equipment> voltage applied by electric connection to provide electric energy

EXAMPLE 110 V AC, 230 V AC, 24 V DC, power over Ethernet.

[SOURCE: IEC 61347-1:2015, 3.5, modified – Definition adapted for lighting and examples added.]

3.4
network
communication infrastructure with a topology of links, an architecture, including the physical components, organizational principles, communication procedures and formats (protocols)

3.5
function
<of equipment> predetermined operating characteristic

EXAMPLE Illuminating, battery charging, wireless routing, auxiliary power output.

Note 1 to entry: Functions can be either on, off, in standby or networked standby.

Note 2 to entry: Typically, instructions for use specify which functions can be turned off and how.

3.6
mode
<of lighting equipment> distinct configuration of the status of functions

3.7
active mode
<of lighting equipment> mode with the illumination function on

3.8
non-active mode
<of lighting equipment> mode with the illumination function off

EXAMPLE Standby mode, networked standby mode, off mode, no-load mode.

3.9
off mode
<of lighting equipment> mode with all functions off

Note 1 to entry: An indicator that only shows the user that the lighting equipment is in the off state is included within the classification of off mode.

3.10
standby mode
<of lighting equipment> mode when the equipment is connected to a supply voltage with the illumination function off, while capable of being activated by an external trigger not being a trigger from a network

Note 1 to entry: Examples of external triggers are sensing or timing.

3.11
networked standby mode
<of lighting equipment> mode when the equipment is connected to a supply voltage with the illumination function off, while capable of being activated by an external trigger being a trigger from a network

3.12
no-load mode
<of lighting equipment> mode when the equipment is connected to a supply voltage where the illumination function is switched off or disconnected at the output circuit of the controlgear

3.13
charging maintenance mode

mode to maintain the battery in a fully charged condition

Note 1 to entry: Power consumption of emergency lighting equipment is called emergency lighting charging power.

3.14
instructions for use
information that is provided by the manufacturer or responsible vendor for users of the equipment

Note 1 to entry: Instructions for use would include a user manual and may be in paper or electronic form. Instructions for use do not include any special directions provided by the equipment supplier to the test laboratory especially for testing purposes.

[SOURCE: IEC 62301:2011, 3.12, modified – "by the manufacturer or responsible vendor" added and "product" replaced with "equipment".]

3.15
equipment under test
EUT
equipment as specified in the scope of this document subjected to non-active mode power consumption assessment

EXAMPLE Illumination-only lighting equipment or multi-function lighting equipment.

3.16
power boundary
perimeter surrounding the equipment under test through which all forms of energy flow and at which the sum of power is measured

3.17
packet error rate
PER
ratio of the number of packets incorrectly received to the total number of packets sent expressed as a percentage

4 General test conditions

4.1 General

Unless otherwise specified in relevant product standards or instructions for use, measurements on the equipment under test (EUT) shall be made under the test conditions and with measuring instruments specified in 4.2 to 4.5.

4.2 Laboratory and environmental conditions

The test shall be carried out at a room temperature of (25 ± 5) °C.

4.3 Supply voltage

4.3.1 Supply voltage and frequency

Tests shall be carried out at the rated voltage and at the rated frequency.

In the case where a rated voltage range is specified, tests shall be carried out at the minimum and maximum value of that specified voltage range.

In case of alternative rated voltages, tests shall be performed separately for each rated voltage.

In case of alternative rated AC frequencies or a rated frequency range, tests shall be performed at the minimum and maximum frequency.

The supply voltage and the frequency shall be maintained constant within ±1 % during the test.

4.3.2 Supply voltage waveform

In case of AC supply voltage, the total harmonic distortion (THD), up to and including the 13th harmonic, of the supply voltage when supplying the EUT in the specified mode, shall not exceed 3 %. THD is the ratio of the RMS value of the sum of the harmonic components (in this context, harmonic current components I_h of orders 2 to at least 13) to the RMS value of the fundamental component, expressed as a percentage. The power supply shall not produce inter-harmonics when operating in the power range of interest. In addition to the above, the ratio of peak value to RMS value of the AC test voltage (i.e. crest factor) when supplying the EUT shall be between 1,34 and 1,49.

In case of DC supply voltage, the ripple factor of the supply voltage shall be lower than 0,5 %.

4.4 Power measurement accuracy and uncertainty

For measurement accuracy, uncertainty and traceability see ISO/IEC Guide 98-3 and IEC Guide 115.

4.5 Network aspects

4.5.1 General

When the external trigger to change between active mode and non-active mode originates from a network connection, care shall be taken to ensure that the network in question is properly configured and connected to the EUT, to obtain an accurate measure of power consumption. Where the use of additional products/components is needed for the measurement of the EUT care shall be taken in the selection and characterization of these items such that they are fully representative to the degree that the measurement accuracy for the EUT is not adversely affected. The instructions for use shall contain information about which functions can be turned off for the measurement and how to turn them off.

Care shall be taken as several power levels can be possible (e.g. power can be affected by network connection quality, connection speed or the number and type of network connections). The power consumption can also cycle in these modes.

For non-active mode power consumption measurements, the network functionality shall be limited to setting the (non-active) mode of the EUT, such that no additional power consumption is induced to the EUT beyond the need to set and maintain the non-active mode.

To test an EUT connected to a wired network, guidance is given in 4.5.2.

For a wireless network, there can be a difference in power consumption between the wireless device looking for a connection (listening) and where the network connection is established. It is important to consider that in a network, the energy consumption of the EUT can be affected by its design, the environment and user interaction as well as network interaction.

When an EUT has the capability to connect to multiple wireless networks, non-active mode power shall be determined for all networks independently.

An EUT connected to a wireless network can be configured either with an antenna connector or an integrated antenna. In the case where the EUT has antenna connectors, the EUT can be tested either by using a cabled connection (see 4.5.3) or by using the integrated antenna (for direct radiating measurements, see 4.5.4).

NOTE In the case of a network receiver that is only waiting for trigger signal and where the power does not change due to the quality of the network, there is no need to establish networks in accordance with 4.5.3 and 4.5.4.

4.5.2 Wired networks

Wired networks can induce power consumption by the EUT which is not linked to the intended function to change modes of the lighting equipment. During measurements in non-active mode, the EUT and a suitable controller shall be the only devices being connected to the bus. Communication in such wired network shall be limited to what is needed to switch the EUT from non-active mode to active mode within the time specified. During measurements, the high voltage level of the communication bus (representing one logic state) shall be set to the rated value with a tolerance of ±2 %. If a rated voltage range is specified, the middle value of the range shall be set with a tolerance of ±2 %. The low voltage level of the bus shall be negligibly low.

4.5.3 Wireless networks: conducted connection for testing

For an EUT whose ports are equipped with antenna connectors, testing shall be performed using conducted measurements in accordance with the test setup shown in Figure 1 or in accordance with 4.5.4.

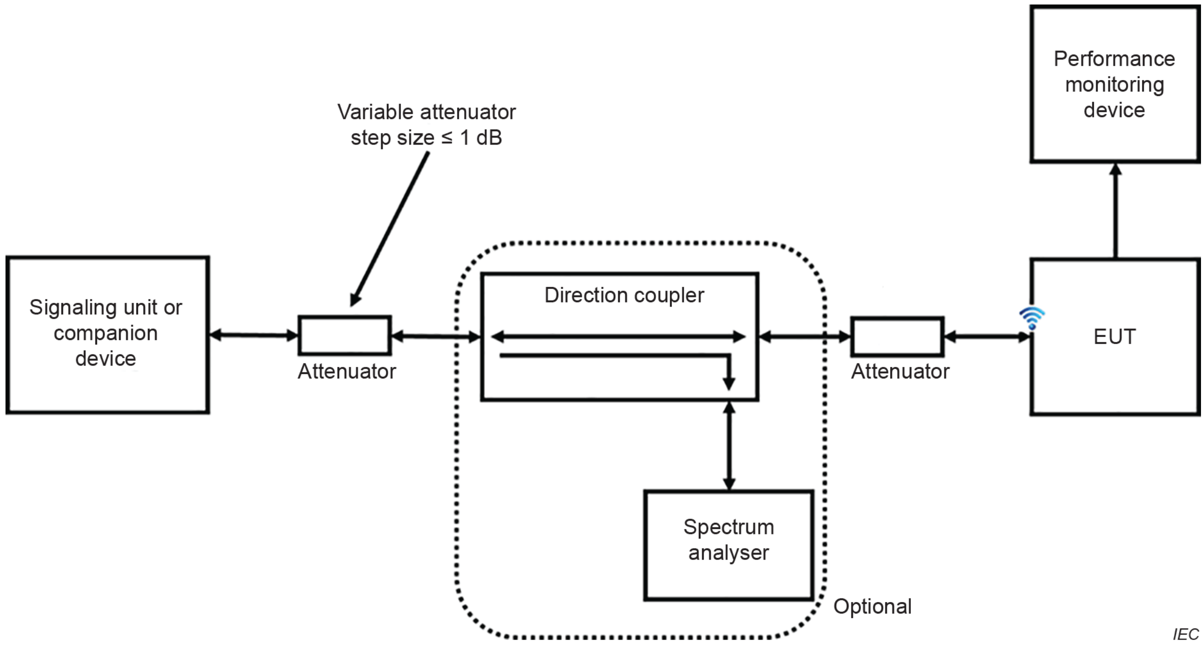

Figure 1 – Test setup for non-active mode power consumption measurement of conducted connected EUT

When this test method is selected, the following steps shall be employed to prepare the EUT for measurement:

– For a frequency hopping EUT, operating channel variation is accepted as is.

– For a non-frequency hopping EUT, the EUT shall be set to an operating channel that will be employed when the EUT is used for its intended application. The operating channel frequency shall be recorded.

– A communication link is established between the EUT and the associated companion device using the test setup shown in Figure 1. The attenuation of the variable attenuator shall be increased in 1 dB steps to the maximum value at which the packet error rate (PER) remains less than or equal to 10 %. The manufacturer may specify an alternative PER if appropriate for the intended use of the EUT. The resultant signal level at the input of the EUT is then P_{min} and shall be recorded.

– Set the wireless network command refreshment rate at 1 kHz, or at a relevant rate provided by the manufacturer.

4.5.4 Wireless networks: radiated connection for testing

For an EUT with integral antennas, i.e. without antenna connectors, testing shall be performed using radiated measurements in accordance with the test setup shown in Figure 2.

When this test method is selected, the following steps shall be employed to prepare the EUT for measurement:

– A test site as described in Annex B of ETSI standard EN 300 328 V2.1.1 (2016-11) and applicable measurement procedures as described in Annex C, Clauses C.1 to C.4 inclusive of the same standard shall be used.

– The test setup shall take the form shown in Figure 2.