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INTERNATIONAL STANDARD

colour inside

Audio, video, and related equipment – Determination of power consumption – Part 3: Television sets

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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AUDIO, VIDEO, AND RELATED EQUIPMENT – DETERMINATION OF POWER CONSUMPTION –

Part 3: Television sets

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International Standard IEC 62087-3 has been prepared by technical area 12: AV energy efficiency and smart grid applications, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

This first edition of IEC 62087-3 cancels and replaces Clauses 6 and 11 and Annex B of IEC 62087:2011. This standard together with IEC 62087-1 to IEC 62087-2 and IEC 62087-4 to IEC 62087-6 cancels and replaces IEC 62087:2011 in its entirety. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to Clauses 6 and 11 and Annex B of IEC 62087:2011.

– For TVs with an automatic brightness control feature, power may now be measured at multiple specific illumination levels.
– A method has been defined for determining the ratio of peak luminance expected in the home versus the peak luminance expected in the retail environment.

– Sections related to general measuring conditions and procedures are now in IEC 62087-1:2015.
– Sections related to signals and media are now in IEC 62087-2:2015.
– The titles have changed in order to comply with the current directives and to accommodate the multipart structure.

The text of this standard is based on the following documents:

FDIS	Report on voting
100/2468/FDIS	100/2498/RVD

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

A list of all parts in the IEC 62087 series, published under the general title *Audio, video, and related equipment – Determination of power consumption*, can be found on the IEC website.

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

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

This standard specifies the determination of the power consumption of television sets for consumer use. It is used in conjunction with IEC 62087-2:2015, which specifies signals and media.

This standard includes measuring procedures for the determination of power consumption in the On (operation) mode, which was identified as “On (average) mode” in previous editions of IEC 62087. Additionally, it specifies measuring procedures for the determination of power consumption in the Off mode and Partial On mode. This standard also defines the determination of the peak luminance ratio for use associated with television set power consumption evaluation as well as the power factor.

A verification procedure to assess product compliance is described in Annex A of IEC 62087-1:2015.

IEC 62087 has been subdivided and currently consists of the following planned or published parts:

– Part 1: General
– Part 2: Signals and media
– Part 3: Television sets
– Part 4: Video recording equipment
– Part 5: Set top boxes
– Part 6: Audio equipment

AUDIO, VIDEO, AND RELATED EQUIPMENT – DETERMINATION OF POWER CONSUMPTION –

Part 3: Television sets

1 Scope

This part of IEC 62087 specifies the determination of the power consumption and related characteristics of television sets. Television sets include, but are not limited to, those with CRT, LCD, PDP, OLED, or projection technologies.

The operating modes and functions, as they specifically apply to television sets, are defined in detail in this part of IEC 62087.

This standard is limited to television sets that can be connected to an external power source. Television sets that include a non-removable, main battery are not covered by this standard. Television sets may include any number of auxiliary batteries.

The measuring conditions in this standard represent the normal use of the equipment and may differ from specific conditions, for example as specified in safety standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62087-1:2015, *Audio, video, and related equipment – Determination of power consumption – Part 1: General*

IEC 62087-2:2015, *Audio, video, and related equipment – Determination of power consumption – Part 2: Signals and media*

IEC 62301:2011, *Household electrical appliances – Measurement of standby power*

3 Terms, definitions, and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms, definitions and abbreviations, in IEC 62087-1:2015, IEC 62087-2:2015, and the following apply.

3.1.1
additional functions
functions that are not required for the basic operation of the device

Note 1 to entry: Examples of additional functions include, but are not limited to, a VCR unit, a DVD unit, an HDD unit, an FM-radio unit, a memory card-reader unit, or an ambient lighting unit.

3.1.2
brightest selectable preset picture setting
user selectable, preset picture setting that produces the highest luminance picture in the home or default configuration

Note 1 to entry: See Figure 1.

3.1.3
conditional access
encryption, decryption, and authorization techniques employed to protect content from unauthorized viewing

3.1.4
conditional access module
plug-in module that enables conditional access

3.1.5
category 5e cable
twisted pair cable used for computer networks

Note 1 to entry: See IEC 61156-5 and IEC 61156-6.

3.1.6
default configuration
configuration for television sets without a forced menu

Note 1 to entry: See Figure 1.

3.1.7
default picture setting
out-of-the-box picture setting for television sets in the home or default configuration

Note 1 to entry: See Figure 1.

3.1.8
forced menu
configuration selection required of the user when a television set is turned on for the first time that forces the user to choose between the home configuration and the retail configuration

Note 1 to entry: See Figure 1.

3.1.9
home configuration
forced menu selection most likely to be chosen for home use

Note 1 to entry: Subclause 4.2.2 describes the selection of home configuration from the forced menu. This configuration selection is generally named “home”, “standard”, or equivalent.

Note 2 to entry: See Figure 1.

3.1.10
neutral density filter
ND filter
optical device that reduces the light intensity in the visible wavelength region

3.1.11
overall brightest preset picture setting
either the retail picture setting or the brightest selectable preset picture setting, whichever produces the highest luminance picture

Note 1 to entry: See Figure 1.

3.1.12
plug-in module
device that plugs into television sets to provide additional functionality

3.1.13
point of deployment module
conditional access module for digital signal reception

3.1.14
quick start
feature that, when enabled, presents sound and picture quickly when switching from Partial On mode to On mode

3.1.15
retail configuration
forced menu selection most likely to be chosen for use in a retail environment

Note 1 to entry: Subclause 4.2.3 describes the selection of retail configuration from the forced menu. This configuration selection is generally recommended by the manufacturer for presentation in a public space when the television set is offered for sale and might be named “retail”, “store”, “shop”, or equivalent.

Note 2 to entry: See Figure 1.

3.1.16
retail picture setting
out-of-the-box picture setting for television sets with a forced menu in the retail configuration

Note 1 to entry: See Figure 1.

3.1.17
selectable preset picture setting
TV picture setting that is selectable by a user from a set of manufacturer-defined picture settings

Note 1 to entry: See Figure 1.

3.1.18
special functions
functions that are related to, but not required for, the basic operation of the device

Note 1 to entry: Examples of special functions include, but are not limited to, special sound processing, power saving functions (e.g. automatic brightness control).

3.1.19
television set
TV
equipment for the reception and display of television broadcast and similar services for terrestrial, cable, satellite and broadband network transmission of analogue and/or digital signals

Note 1 to entry: A television set may include additional functions that are not required for its basic operation.

3.2 Abbreviations

ABC	Automatic Brightness Control
AV	Audio-visual
BD	Blu-ray Disc™ [1]

[1] Blu-ray Disc™ is a trade mark of the Blue-ray Disc Association. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named.

CRT	Cathode Ray Tube
DVD	Digital Versatile Disc
DHCP	Dynamic Host Configuration Protocol
DVI	Digital Visual Interface
FM	Frequency Modulation
HDD	Hard Disk Drive
HDMI®[2]	High Definition Multimedia Interface
IP	Internet Protocol
LAN	Local Area Network
LCD	Liquid Crystal Display
LMD	Luminance Measuring Device
LNB	Low Noise Block
NAT	Network Address Translation
ND	Neutral Density
OLED	Organic Light-Emitting Diode
PC	Personal Computer
PDP	Plasma Display Panel
RF	Radio Frequency
SCR	Silicon Controlled Rectifier
STB	Set Top Box
SSID	Service Set IDentifier
TV	TeleVision set
UUT	Unit Under Test
VCR	Video Cassette Recorder
VGA	Video Graphics Array
WAN	Wide Area Network
WLAN	Wireless Local Area Network
WOL	Wake-On-LAN
WoWLAN	Wake on Wireless LAN
WPA	Wi-Fi Protected Access
WPA2	Wi-Fi Protected Access 2

4 Specification of operating modes and functions

4.1 Table of operating modes and functions

Table 1 describes the various operating modes and functions for television sets.

For all modes, main batteries, if any, shall be removed for the duration of the measurement procedure. (IEC 62087-1:2015, 5.1.1.1.)

[2] HDMI® is a registered trade mark of HDMI Licensing, LLC. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named.

Table 1 – Operating modes and functions

Power	Mode	Sub-mode	Function(s)	Functional description for TV
0 W	Disconnected	Disconnected	– Disconnected from power source	The television set is disconnected or galvanically isolated from all external power sources.
≥0 W	Off	Off	– Off	The television set is connected to an external power source and does not produce picture or sound and does not provide any other function that depends on an external power source. The television set cannot be switched into any other mode with the remote control unit, or an external or internal signal. Note that some power may be consumed if an EMC filter or other components exist on the source side of the power switch.
>0 W	Partial On	Standby-passive	– Wake on • remote control • internal signal	The television set is connected to an external power source and does not provide picture or sound. The television set can be switched into another mode with the remote control unit or an internal signal, but not with an external signal.
		Standby-active, low	– Wake on • remote control • internal signal • external signal	The television set is connected to an external power source and does not provide picture or sound. The television set can be switched into another mode with the remote control unit or an internal signal and can additionally be switched into another mode with an external signal. NOTE When in Standby-active, low mode, a television may be able to be switched into the On mode, the Off mode, the Standby-passive, or the Standby-active, high mode.
		Standby-active, high	– Wake on • remote control • internal signal • external signal – Data communications	The television set is connected to an external power source and does not provide picture or sound. The television set can be switched into another mode with the remote control unit, an internal signal, or an external signal. Additionally, the television set is exchanging/ receiving data with/from an external source. Determination of power consumption in this sub-mode is not specified by this standard.
	On	Operation	– Operation	The television set is connected to an external power source and provides picture and, if possible, sound.

4.2 Configurations and picture settings

4.2.1 Conceptual framework

Figure 1 shows a conceptual framework that includes the various configurations and picture settings for television sets.

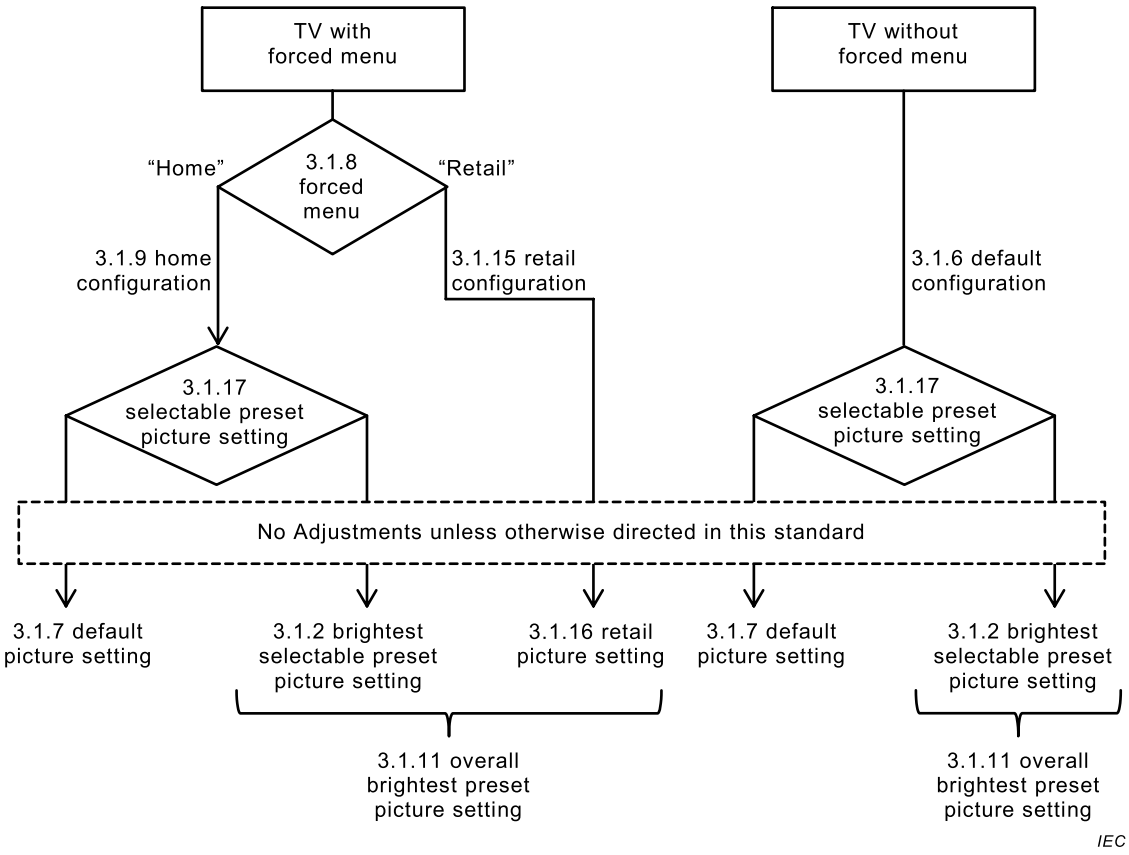

Figure 1 – Configurations and picture settings, conceptual framework

4.2.2 Selection of home configuration

When directed in this standard, the home configuration shall be selected from the forced menu by choosing the configuration that is recommended for normal home use and, if not clearly defined, it shall be selected by choosing the first configuration listed in the forced menu.

If the UUT has no forced menu, it shall remain in the default configuration.

NOTE A factory reset might be required in order to enter the home configuration after the retail configuration has been previously selected.

4.2.3 Selection of retail configuration

When directed in this standard, retail configuration shall be selected from the forced menu by choosing the configuration that, without any other adjustments, results in the highest display luminance.

If the UUT has no forced menu, it shall remain in the default configuration.

NOTE A factory reset might be required in order to enter the retail configuration after the home configuration has been previously selected.

5 Measurement conditions

5.1 General

The measurement conditions clause specifies requirements that are independent of the equipment to be evaluated. When setting up a test laboratory, these requirements shall be taken into account.

The requirements of this clause apply to the procedures specified in Clause 6.

5.2 Power source

Defined in IEC 62087-1:2015, 5.1.1.

5.3 Environmental conditions

Defined in IEC 62087-1:2015, 5.1.2.

5.4 Ambient light conditions

For determining On mode power consumption for television sets with ABC enabled, ≤1 lx shall be confirmed at the surface of the ABC sensor assembly with the light sources (5.6.4, 5.6.5) off and the UUT in the Off or Disconnected mode.

For determining the peak luminance ratio with a non-contact LMD, ≤5 lx shall be confirmed at the nominal centre of the display area of the UUT in Off or Disconnected mode. This requirement applies whether or not a light source (5.6.5) is applied to disable the ABC feature.

A dark room and/or shroud may be necessary in order to achieve the required ambient light conditions.

5.5 Measuring equipment

5.5.1 Power measuring instrument

Defined in IEC 62087-1:2015, 5.1.5.

5.5.2 Luminance measuring device

Defined in IEC 62087-1:2015, 5.1.7.

5.5.3 Illuminance measuring instrument

Defined in IEC 62087-1:2015, 5.1.8.

5.6 Signal generation

5.6.1 Equipment

Defined in IEC 62087-2:2015, 6.1.

5.6.2 Interfaces

Defined in IEC 62087-2:2015, 6.2.

5.6.3 Accuracy

Defined in IEC 62087-2:2015, 6.3.

5.6.4 Light source for specific illuminance levels

The light source used for illuminating the ABC sensor to specific illuminance levels shall use a dimmable halogen lamp in a sealed reflector and shall have a diameter of 120 mm or less. The rated correlated colour temperature shall be 2 800 K ± 300 K at its rated voltage. The front surface of the lamp shall be clear (i.e., not coloured or coated with a spectrum modifying material) and may have a smooth or granular front surface. The lamp assembly shall not modify the spectrum of the halogen source, including the IR and UV bands.

The lamp shall be capable of providing the highest illumination level chosen in 6.2.8 within the range of 70 % to 110 % of its rated voltage when configured as specified in 6.3.8.

For luminance levels below 10 lx, a 2 stop ND filter (3.1.10) shall be used. No ND filter shall be used for luminance levels at or above 10 lx. The ND filter shall be of the absorptive type and shall be large enough to cover the entire light acceptance area of the ABC sensor assembly with a margin of at least 5 mm on all sides. The ND filter shall have an average transmission of 25 % ± 2,5 % within the visible range, which is 400 nm to 700 nm, without selectively absorbing light at specific wavelengths.

Specific illuminance levels shall be obtained by controlling the voltage and/or duty cycle to the above light source.

The model of the lamp used for illuminating the ABC sensor to specific illuminance levels shall be reported.

Some lighting controllers, such as those with SCR-based circuits, may introduce current spikes into the power source. Such controllers should be avoided or otherwise isolated from the power source for the UUT.

5.6.5 Light source for disabling the ABC feature

The light source used for disabling the ABC feature shall use a dimmable halogen lamp in a sealed reflector and shall have a diameter of 120 mm or less. The rated correlated colour temperature shall be 2 800 K ± 300 K at its rated voltage. The front surface of the lamp shall be clear (i.e., not coloured or coated with a spectrum modifying material) and may have a smooth or granular front surface. The lamp assembly shall not modify the spectrum of the halogen source, including the IR and UV bands. The light source shall be capable of providing 300 lx or greater when applied directly to the ABC sensor assembly.

The model of the lamp used for disabling the ABC feature shall be reported.

5.6.6 Networking equipment

For wireless connectivity, a Wi-Fi wireless access point that is compatible with IEEE 802.11-2007 shall be used.

For wired connectivity, a category 5e or better cable and an Ethernet switch or router that supports IEEE 802.3 shall be used. If the UUT supports Energy Efficient Ethernet (IEEE 802.3az-2010), the Ethernet router shall also support IEEE 802.3az-2010. The networking equipment shall support the highest and lowest data speeds of the UUT's network function.

The networking equipment shall not be connected to a wide area network (WAN).

6 Procedures

6.1 Order of activities

The following order of activities is recommended (also represented in Figure 2):

– preparation (6.2),
– initial activities (6.3),
– determination of power consumption, On mode (6.4),
– determination of peak luminance ratio and power factor (6.5),
– determination of power consumption, Partial On mode (6.6),
– determination of power consumption, Off mode (6.7).

The above order is chosen to ensure proper stabilization prior to the taking of each measurement. The technician performing the activities may vary the order as needed. However, the stabilization process prior to the taking of each measurement shall effectively be the same as if the recommended order had been followed.

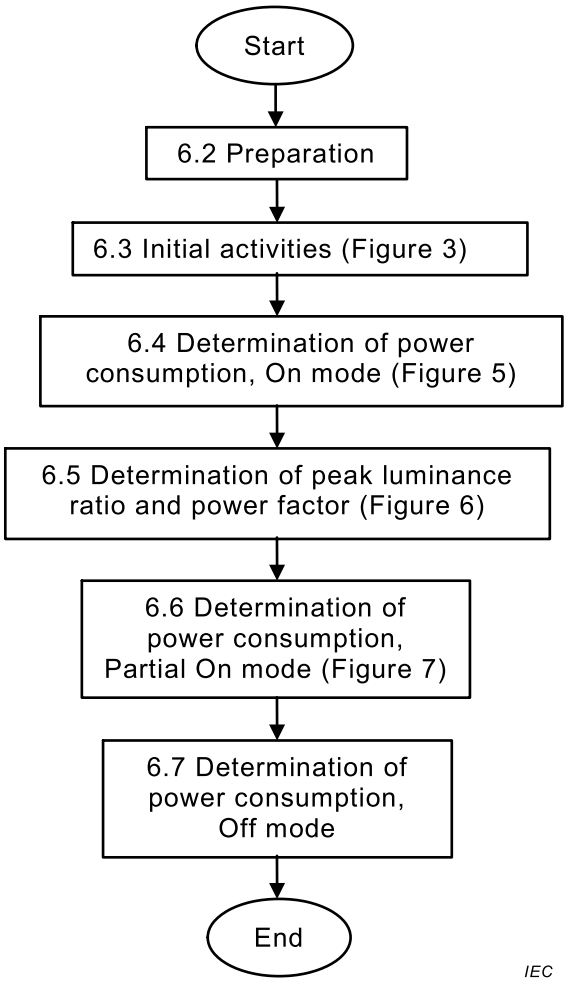

Figure 2 – Recommended order of activities

6.2 Preparation

6.2.1 Measuring plan

Before the UUT has been installed, a measuring plan should be developed based on the specifications of the UUT and the region in which the results are to be reported. The

measuring plan is based on the decision points in 6.2.2 through 6.2.9. These decision points include:

– power source voltage and frequency (6.2.2),
– input terminals (6.2.3),
– video signal, On mode power consumption procedure (6.2.4),
– video signal, peak luminance ratio procedure (6.2.5),
– video format (6.2.6),
– automatic brightness control capabilities (6.2.7),
– automatic brightness control levels (6.2.8),
– network connection capabilities (6.2.9).

When these decisions have been taken, the following activities can be expected to be deterministic.

6.2.2 Power source voltage and frequency

Whether the UUT is to be powered by an included external power supply (IEC 62087-1:2015, 5.1.1.2), mains power (IEC 62087-1:2015, 5.1.1.3), and/or power from other than the mains (IEC 62087-1:2015, 5.1.1.4) shall be determined and shall be described in the report.

The voltage and frequency of the power source shall be reported.

6.2.3 Input terminals

A single set of input terminals shall be selected for use during the procedure. If the power consumption of the UUT is to be determined with multiple video input terminal types for comparison purposes, the entire procedure should be performed multiple times, each time with a single set of input terminals selected, to ensure proper stability under each condition.

If available, an HDMI input shall be selected. Selection of the video input terminal shall be prioritized in the following order: HDMI, component analogue, S-Video, composite analogue, other AV or RF input. DVI, VGA, and other inputs that are primarily used for connections with computers (as compared to AV equipment) shall not be used.

For HDMI inputs, only inputs intended for standard AV sources, such as STBs or BD players shall be used. HDMI inputs intended for other sources, such as “PC” or “Game”, shall not be used.

The selected input terminals shall be reported.

6.2.4 Video signal, On mode power consumption procedure

A video signal shall be selected for use during the On mode power consumption determination procedure. The selection shall be made from one of the three following signals:

– static video signals (IEC 62087-2:2015, 4.1.2),
– dynamic broadcast-content video signal (IEC 62087-2:2015, 4.1.3),
– Internet-content video signal (IEC 62087-2:2015, 4.1.4).

The video signal selected for determining On mode power consumption shall be reported.

NOTE Information regarding the selection of the video signal for the On mode power consumption measurement is available in IEC 62087-2:2015, Annex A.

6.2.5 Video signal, peak luminance ratio determination

A video signal shall be selected for use during the peak luminance ratio procedure. The selection shall be made from one of the following signals:

– three bar video signal (IEC 62087-2:2015, 4.2.2.1),
– box and outline video signal (IEC 62087-2:2015, 4.2.2.2).

The selected video signal for determining the peak luminance ratio shall be reported.

NOTE Information regarding the selection of the video signal for the determination of the peak luminance ratio is available in IEC 62087-2:2015, Annex B.

6.2.6 Video format

The video resolution and frame rate of the signals applied to the UUT during the procedure shall be selected. The selected resolution and frame rate shall be compatible with the input terminal selected in 6.2.3.

The priority order of video resolutions shall be:

– 1 920 × 1 080 interlaced,
– 1 920 × 1 080 progressive,
– 1 280 × 720 progressive,
– standard definition interlaced,
– standard definition progressive.

The maximum resolution of the video signal applied to the UUT shall be 1 920 pixels by 1 080 pixels.

The video frame rate used during the measurements shall be at the standard broadcasting vertical frequency of the country or region in which the power consumption measurement is to be reported.

The selected resolution and frame rate of the input signals shall be reported.

NOTE 1 In the US and Japan a 59,94 Hz frame rate is used; in Europe and Australia a 50 Hz frame rate is used.

NOTE 2 Video with a 59,94 Hz frame rate is often casually referred to as “60 Hz”.

NOTE 3 Because technologies for the distribution of content with a resolution of more than 1 920 pixels × 1 080 pixels are just now emerging, the media available in IEC 62087-2:2015 is available in standard and high definition only. By limiting the video source resolution to 1 920 × 1 080 pixels, this standard ensures that the associated signals will be up-converted by the UUT, avoiding the possibility of varying results from various external up-converters (see 6.3.10.6).

6.2.7 Automatic brightness control capabilities

There are three types of television sets with respect to ABC.

- Television sets that do not have an ABC feature.
- Television sets that have an ABC feature that is not enabled by default.
- Television sets that have an ABC feature that is enabled by default.

The presence of an ABC feature and whether or not the ABC feature is enabled by default shall be reported.

6.2.8 Automatic brightness control levels

The On mode power consumption of television sets with the automatic brightness control disabled by default in the default picture setting shall be determined with the ABC feature disabled.

For television sets with the ABC feature enabled by default in the default picture setting, the On mode power consumption shall be determined with ABC feature enabled and/or manually disabled. If the ABC feature is enabled, the On mode power consumption shall be determined over a minimum of one and a maximum of four different illuminance conditions with respect to the ABC feature.

The state(s) of the ABC feature and the illuminance levels selected to be applied to the ABC sensor shall be reported.

NOTE Information for selecting the illuminance levels at the ABC sensor and the states of the ABC feature is available in Clause A.2.

6.2.9 Network connection capabilities

Network connections should be listed in the user manual of the UUT. If no connections are specified in the user manual, verify that the TV does not have network capabilities by checking for the absence of physical connections or the absence of network settings in the menu. If additional equipment, such as an USB adapter, is required to enable network connectivity, the UUT is considered to be network capable only if that additional equipment is provided with the UUT by default.

The presence of Wi-Fi (IEEE 802.11), Ethernet (IEEE 802.3), and Energy Efficient Ethernet (IEEE 802.3az) in the UUT shall be reported.

6.3 Initial activities

6.3.1 Order of initial activities

Figure 3 shows the order in which the initial activities shall be performed.

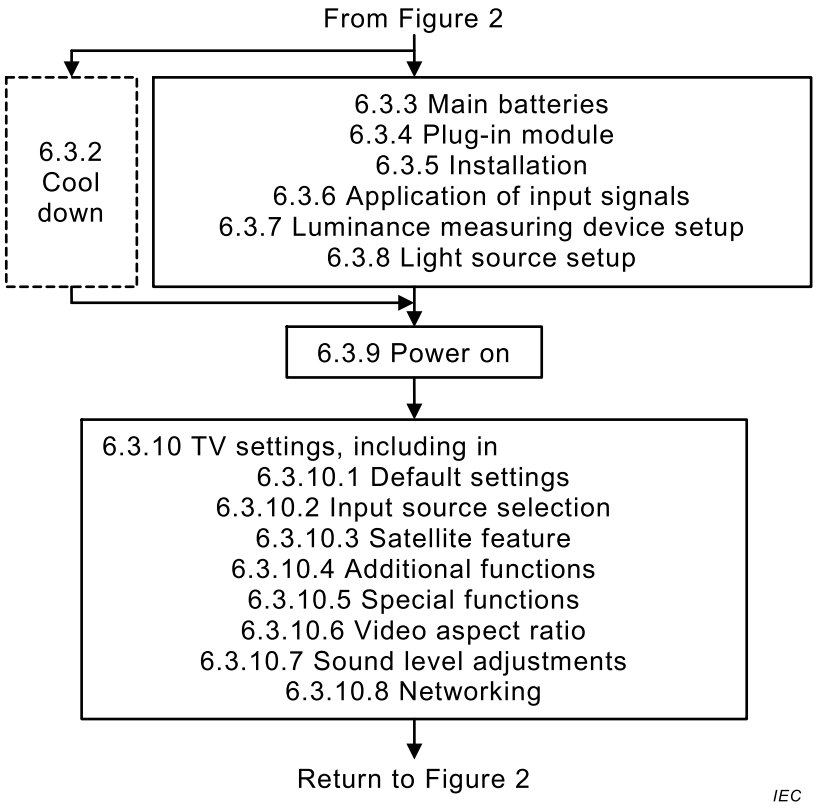

Figure 3 – Order of initial activities

6.3.2 Cool down

The UUT shall be in the Off or Disconnected mode for a minimum of one hour before the UUT is powered on. To optimise the initial activities, 6.3.3 through 6.3.8 may be performed during the cool down period as indicated in Figure 3.

6.3.3 Main batteries

Main batteries, if any, shall be removed for the duration of the measurement procedure.

6.3.4 Plug-in module

No plug-in module, such as a conditional access module or a point of deployment module, shall be connected to the UUT during the measurement procedure, unless the UUT is shipped to the end customer already connected to an included plug-in module. In that case, the plug-in module shall remain connected during the measurement.

6.3.5 Installation

The UUT shall be installed in accordance with the manufacturer's instructions.

In order to simplify alignment of the light source, all four corners of the face of the UUT should be equidistant from a vertical reference plane (e.g., wall) and the bottom two corners of the face of the UUT should be equidistant from a horizontal reference plane (e.g., floor).

The environmental conditions (5.3) and ambient light conditions (5.4) shall be confirmed. If a non-contact LMD is to be used and the ABC feature of the UUT cannot be manually disabled via the on-screen menus of the UUT, ambient light conditions at the nominal centre of the display area shall be confirmed in the Off or Disconnected mode with the light source of 5.6.5 applied to the UUT.

6.3.6 Application of input signals

The video input signal selected in 6.2.4 and the audio signal described in IEC 62087-2:2015, 4.1.5 shall be applied to the respective input terminal(s) selected in 6.2.3. The video signal shall be in the format selected in 6.2.6. In the case of measurement with the static video signals, the full field colour bar video signal shall be used.

6.3.7 Luminance measuring device setup

The LMD (5.5.2) shall be aligned perpendicular to the centre of the display area. If a non-contact LMD is being used for testing, the LMD shall be at a distance capable of achieving the accuracy required in 5.5.2. If a contact LMD is being used, especially with smaller display sizes, it shall be ensured that the display area measured has a diameter at least as large as the LMD sensor area and that the sensor of the contact LMD can be positioned without overlap to neighbouring areas, otherwise a non-contact LMD shall be used.

6.3.8 Light source setup

Aside from the possible use of a 2 stop ND filter when applying low illuminance levels to the ABC sensor assembly of the UUT, there shall be no obstructions (e.g. diffusing media, IR filters, UV filters, etc.) between the lamp and the UUT's automatic brightness control (ABC) sensor assembly during power measurements.

The centre of the light source shall be aligned at a horizontal and vertical angle of 0° ± 5° with respect to the surface of the ABC sensor assembly. The distance between the front of the light source and the surface of the ABC sensor assembly shall be 1,5 m ± 0,1 m.

The ND filter, when used, shall be positioned immediately in front of the ABC sensor assembly. The illumination levels shall be verified with the illuminance measuring instrument positioned immediately in front of the ABC sensor assembly or immediately in front of the ND filter.

No test room surface (i.e. floor, ceiling, and wall) shall be within a 0,5 m hemisphere in front of the centre of the UUT's ABC sensor. However, if the UUT ships with or has a built-in table stand, the UUT may be set upon a table, provided that table does not extend beyond the front edge of the UUT/stand assembly (see Figure 4.) The table should be covered with black felt material.

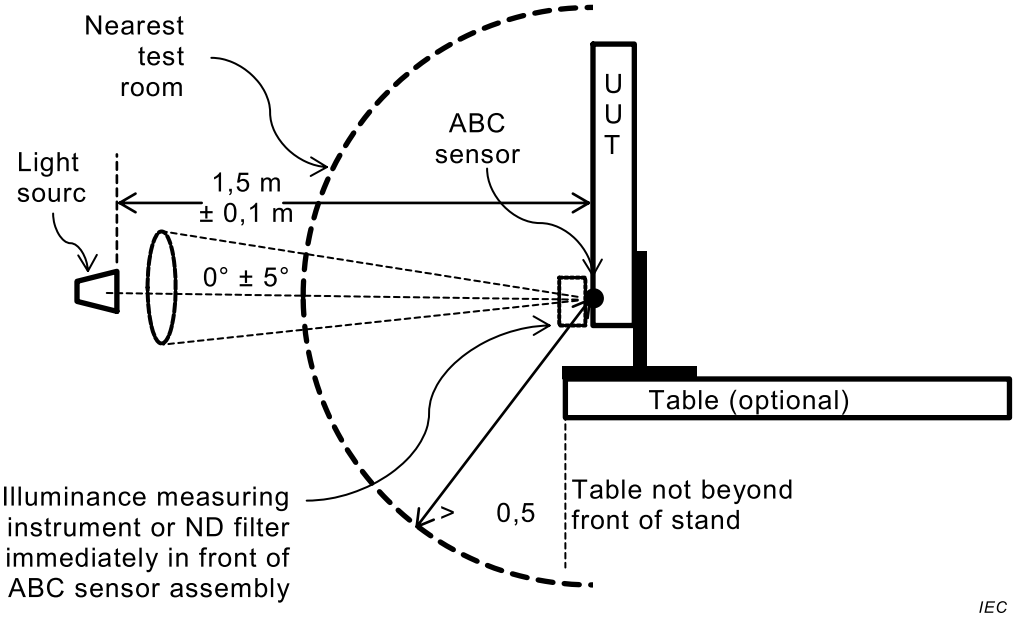

Figure 4 – Light source configuration

The illuminance level shall be varied by changing the voltage, and/or duty cycle of the light source.

In the case of measuring relative peak luminance with a non-contact LMD and simultaneously illuminating the ABC sensor, a black tube or shroud may be used to shield the screen from the light source described in 5.6.5.

If the UUT includes multiple ABC sensors, each sensor shall be illuminated to the same level, within the rated tolerance limits, and multiple light sources may be used.

6.3.9 Power on

The UUT shall be connected to an external power source and shall be set in the On mode. The requirements specified in IEC 62087-1:2015, 5.1.1.5 (On mode) apply.

6.3.10 TV settings

6.3.10.1 Default settings

The UUT shall remain or be set as originally shipped in manufacturer default settings. For television sets with a forced menu, home configuration shall be selected. The UUT shall remain in the default picture setting throughout the procedure except when this standard directs otherwise.

Within the context of the home configuration, if the user is prompted by the forced menu to enable or disable the quick start feature, the power consumption in Standby-passive (6.6.4) shall be determined with quick start disabled. The power consumption in Standby-passive may be determined again with quick start enabled via the on-screen menus. If the quick start feature is not offered in the forced menu, the quick start feature shall remain in the default setting throughout the procedure.

Also within the context of the home configuration, if the user is prompted by the forced menu to enable or disable the ABC feature, the power consumption in On mode (6.4) shall be determined with ABC disabled. The power consumption in On mode may be determined again with ABC enabled via the forced menu selection. If the ABC feature is not prompted in the

forced menu, it shall remain in the default setting throughout the procedure, except where otherwise directed.

The selection(s) made within the forced menu, if it exists, shall be reported.

6.3.10.2 Input source selection

The input terminals chosen in 6.2.3 shall be selected as the active source of picture and sound generated by the UUT.

6.3.10.3 Satellite feature

If the UUT includes a satellite dish LNB power supply, it shall be turned off, if possible, during the measurement process.

6.3.10.4 Additional functions

Additional functions shall be turned off during the measurement process in the cases that those functions can be turned on and off by the end user.

6.3.10.5 Special functions

Special functions not otherwise mentioned in Clause 6 shall be in the position adjusted by the manufacturer for shipment to the end user.

6.3.10.6 Video size, aspect ratio, and resolution

The UUT shall be set in such a manner that the active area of the video input signal fills the entire display area.

In case the UUT has a display with a resolution higher than 1 920 pixels by 1 080 pixels and the UUT cannot be adjusted in such a manner that the video input signal fills the entire display area, an external player with an up-conversion function should be used in order to fill the entire display area.

If any setting of the UUT is changed from the default in order to fill the entire display area, the changed settings shall be reported. The player used and its related settings shall be reported.

6.3.10.7 Sound level adjustments

The volume control shall be adjusted to a level at which the sound output is just audible. If audibility cannot be confirmed, visual indication of the volume level on the on-screen-display shall be set within 8 % and 12 % of its maximum.

NOTE The intent of the above requirement is to ensure that the sound circuitry in the UUT is active while keeping sound pressure levels from the UUT low.

6.3.10.8 Networking

All Ethernet terminals and Wi-Fi adapters shall remain disconnected from the UUT throughout the procedure except when otherwise directed. Networking functions in the UUT shall be disabled throughout the procedure except when otherwise directed.

6.4 Determination of power consumption, On mode

6.4.1 Order of activities

To determine power consumption in the On mode, the order of activities shown in Figure 5 shall be followed.

Within the context of the home configuration, if the user is prompted by the forced menu to enable or disable the ABC feature (6.3.10.1), the procedure in 6.4 shall be performed once as if the ABC feature were disabled by default (6.4.3) and may be performed again as if the ABC feature were enabled by default (6.4.4). For the optional second application of the procedure of 6.4, stabilization (6.4.2) does not need to be repeated.

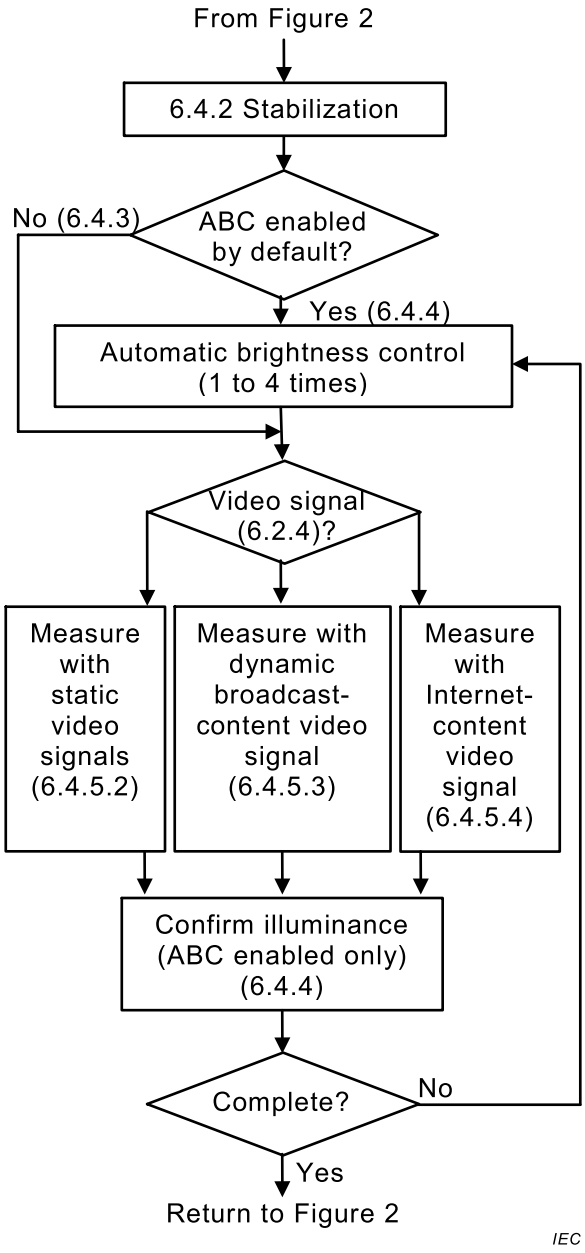

Figure 5 – Order of activities for determining power consumption, On mode

6.4.2 Stabilization

In the case that ABC is disabled by default in the default picture setting, ABC shall be disabled for the stabilization period. In the case that ABC is enabled by default in the default picture setting, ABC shall remain enabled and 300 lx or greater shall be applied directly to the ABC sensor using the light source of 5.6.5 for the duration of the stabilization period.

After the steps in 6.3 have been completed, the measurements shall be made after the UUT has been in the On mode for a minimum stabilization period of one hour and shall be completed before a maximum of three hours in the On mode. The video signal selected in

6.2.4 shall be displayed during the entire duration of the stabilization period and On mode power measurement (6.2.5). For television sets that are known to stabilize within one hour, these durations may be reduced if the resulting measurement can be shown to be within 2 % of the results that would otherwise be achieved using the durations described herein.

6.4.3 Television sets without automatic brightness control enabled by default

For television sets that do not have an automatic brightness control feature, or that have automatic brightness control that is disabled by default, the power measurement (6.4.5) shall be made once with the ABC feature disabled for the entire duration of the measurement.

6.4.4 Television sets with automatic brightness control enabled by default

For television sets with automatic brightness control enabled by default, the power measurement (6.4.5) shall be performed as selected in 6.2.8. If the ABC conditions include the case that the ABC feature is to be manually disabled, that case shall come first in the order. Disabling ABC shall be done from the on-screen menu system. If not possible, ABC shall be disabled by applying 300 lx or greater at the ABC sensor assembly. The conditions with ABC enabled shall be applied in descending order with the highest level of illuminance applied first and the lowest level of illuminance applied last.

The light source setup shall comply with 6.3.8. Illuminance levels shall be determined with the illuminance measuring instrument (5.5.3) positioned immediately in front of the ABC sensor assembly of the UUT and manually aimed directly at the light source. For illuminance levels of less than 10 lx, the illuminance shall be set to four times the intended illuminance and a 2 stop ND filter (5.6.4) shall be placed immediately in front of the ABC sensor assembly of the UUT during the power measurement. The illuminance measuring instrument shall be moved away from the ABC sensor during the power measurement.

For each illuminance level, the illuminance shall be set within the required tolerance prior to the power measurement and shall be confirmed to be within tolerance after the power measurement.

NOTE See Annex A for more information regarding selection of ABC lighting conditions and weighting factors.

6.4.5 Power measurement

6.4.5.1 General

Depending on the video signal type selected in 6.2.4, one of the following procedures (6.4.5.2, 6.4.5.3, or 6.4.5.4) shall be performed.

The ABC conditions and corresponding On mode power consumption shall be reported.

6.4.5.2 Measurements using static video signals

In the case that the static signals were selected in 6.2.4, On mode power consumption shall be determined using the four static test signals described in IEC 62087-2:2015, 4.1.2.

For the static video signal case, the On mode power consumption of the UUT shall be determined as follows:

$$P_{o\_static} = ((P_b + P_w)/2 + P_c + P_t)/3$$

where

P_{o_static} is the On mode power consumption using static signals (W);

P_b is the power measured using the black video signal (W);

P_w is the power measured using the white video signal (W);

P_c is the power measured using the full field colour bar video signal (W);

P_t is the power measured using the three bar video signal (W).

Depending on the state and illuminance level at the ABC sensor, the P_{o_static} values shall be recorded as follows:

$P_{o\_static\_ABC\_Off}$: ABC feature disabled;

$P_{o\_static\_ABC\_x}$: ABC feature enabled where '*x*' indicates the illuminance level in lux.

6.4.5.3 Measurements using the dynamic broadcast-content video signal

In the case that the dynamic broadcast-content video signal was selected in 6.2.4, On mode power consumption shall be determined using the dynamic broadcast-content video signal described in IEC 62087-2:2015, 4.1.3. The signal shall be generated from one of the video content sources available from IEC in a format compatible with the input terminal type under test.

The average power consumed over the full, 10 min duration of the dynamic broadcast-content video signal shall be measured over ten consecutive minutes to determine

$P_{o\_broadcast}$: On mode power consumption using dynamic broadcast-content video signal (W).

Depending on the state and illuminance level at the ABC sensor, the $P_{o\_broadcast}$ values shall be recorded as follows:

$P_{o\_broadcast\_ABC\_Off}$: ABC feature disabled;

$P_{o\_broadcast\_ABC\_x}$: ABC feature enabled where '*x*' indicates the illuminance level in lux.

6.4.5.4 Measurements using the Internet-content video signal

In the case that the Internet-content video signal was selected in 6.2.4, On mode power consumption shall be determined using the Internet-content video signal described in IEC 62087-2:2015, 4.1.4.

The full duration of the Internet-content video signal is used for measuring TV power consumption when the UUT is used for viewing Internet content. The measurement shall be the average power consumed over ten consecutive minutes.

The Internet-content video signal shall be generated from video content available from IEC in a format compatible with the input terminal type under test. There are 100 images. The images shall be displayed at a rate of 6 s per image for a total duration of 10 min.

The Internet-content video signal images should be scaled as necessary to cover the entire display area without cropping.

$P_{o\_Internet}$: On mode power consumption using Internet-content video signal (W)

Depending on the state and illuminance level at the ABC sensor, the $P_{o\_Internet}$ values shall be recorded as follows:

$P_{o\_Internet\_ABC\_Off}$: ABC feature disabled;

$P_{o\_Internet\_ABC\_x}$: ABC feature enabled where '*x*' indicates the illuminance level in lux.

6.5 Determination of peak luminance ratio and power factor

6.5.1 General

6.5.1.1 Introductory remark

The ratio of peak luminance produced between the default picture setting and the overall brightest preset picture setting shall be determined. The related methods in 6.5 shall be limited to determining the peak luminance ratio between picture settings and should not be used for determining absolute screen luminance.

The peak luminance determination procedure shall be started within 10 min after determination of On mode power consumption (6.4.5) or within 10 min after the stabilization period specified in 6.4.2.

6.5.1.2 Automatic brightness control

The ABC feature shall be in the disabled state throughout 6.5.1.3, 6.5.1.4, 6.5.1.5, and 6.5.2.3.

If the ABC feature is not disabled by default in the selected picture setting, ABC shall be disabled manually by means of the on-screen-menu of the UUT. If it is not possible to manually disable the ABC feature, it shall be disabled by applying the light source of 5.6.5 with an illuminance of 300 lux or greater at the ABC sensor assembly while meeting the ambient light condition requirements (5.4).

6.5.1.3 Stabilization

Stabilization shall be performed in the picture setting to be evaluated with the ABC feature disabled for a minimum of 10 min while displaying the dynamic broadcast-content video signal (IEC 62087-2:2015, 4.1.3).

6.5.1.4 Normal measurement

The video signal selected in 6.2.5 shall be applied to the UUT within 30 s after stabilization (6.5.1.3). Peak luminance at the nominal centre of the display area shall be measured 30 s ± 5 s after the video signal is initially displayed using the luminance measuring device as specified in 6.3.7.

6.5.1.5 Quick measurement

The quick measurement method is used when determining which configuration and picture setting produces pictures with the highest peak luminance. The video signal selected in 6.2.5 shall be applied to the UUT. The stabilization procedure in 6.5.1.3 shall not be performed between measurements in the various configurations and picture settings.

Peak luminance at the nominal centre of the display area shall be measured using the luminance measurement device as specified in 6.3.7 during the interval from 5 s to 30 s after the configuration or picture setting becomes effective.

6.5.2 Activities for peak luminance ratio and power factor determination

6.5.2.1 Order of activities

Figure 6 shows the order in which the activities for determining the peak luminance ratio shall be performed.

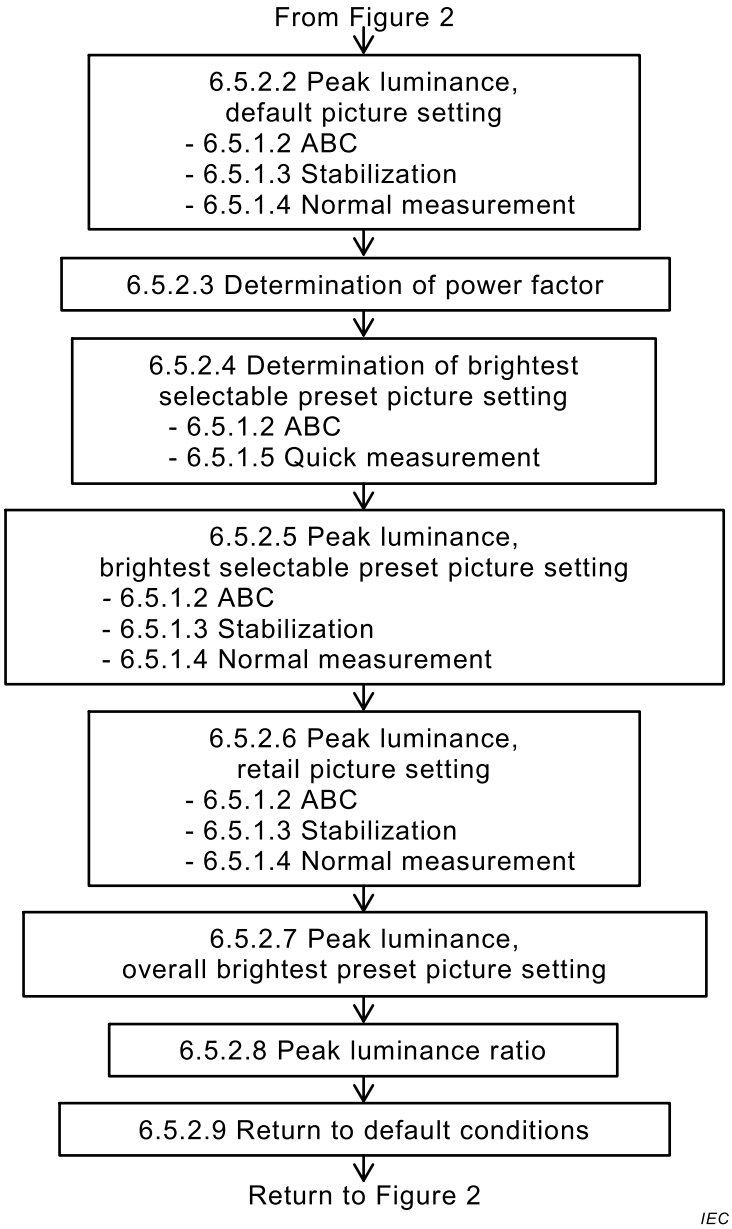

Figure 6 – Order of activities for determining peak luminance ratio and power factor

6.5.2.2 Peak luminance, default picture setting

The UUT shall be in the default picture setting. The ABC feature shall be disabled (6.5.1.2). The UUT shall stabilize (6.5.1.3). The peak luminance in the default picture setting, $L_{default}$, shall be measured (6.5.1.4).

6.5.2.3 Determination of power factor

The video signal selected in 6.2.5 shall remain applied to the UUT. The UUT shall remain in the default picture setting. The ABC feature shall remain disabled (6.5.1.2). The power factor shall be measured. The value, Power_factor, shall be reported as a percentage with an accuracy of 1 decimal point, i.e. xx,x %.

6.5.2.4 Determination of brightest selectable preset picture setting

If the UUT includes selectable preset picture settings, the UUT shall be switched into a selectable preset picture setting other than the default picture setting. The ABC feature shall be disabled (6.5.1.2). Peak luminance at the nominal centre of the display area shall be measured using the quick measurement method (6.5.1.5).

The process in the above paragraph shall be repeated for all selectable preset picture settings. The picture setting associated with the highest peak luminance value shall be known as the brightest selectable preset picture setting.

The manufacturer's name or label associated with the brightest selectable preset picture setting shall be reported.

6.5.2.5 Peak luminance, brightest selectable preset picture setting

The UUT shall be in the brightest selectable preset picture setting. The ABC feature shall be disabled (6.5.1.2). The UUT shall stabilize (6.5.1.3). The peak luminance in the brightest selectable preset picture setting, $L_{brightest\_selectable}$, shall be measured (6.5.1.4).

6.5.2.6 Peak luminance, retail picture setting

If the UUT can enter the retail picture setting, the UUT shall be in the retail picture setting. This might require a factory reset. If a factory reset was applied, the UUT shall be configured to comply with the settings in 6.3.10.2 through 6.3.10.8.

The ABC feature shall be disabled (6.5.1.2). The UUT shall stabilize (6.5.1.3). The peak luminance in the retail picture setting, L_{retail}, shall be measured (6.5.1.4).

If the UUT cannot enter the retail picture setting, L_{retail}, shall be zero.

6.5.2.7 Peak luminance, overall brightest preset picture setting

$L_{brightest}$ shall have a value equal to that of $L_{brightest\_selectable}$ or L_{retail}, whichever is greater.

Whether $L_{brightest\_selectable}$ or L_{retail} is greater shall be reported.

6.5.2.8 Peak luminance ratio

The peak luminance ratio is calculated as follows:

$$L_{ratio} = L_{default} / L_{brightest}$$

The peak luminance ratio (L_{ratio}) shall be reported as a percentage with an accuracy of 1 decimal point, i.e. xx,x %.

6.5.2.9 Return to default conditions

If the UUT was set in the retail configuration during 6.5.2.6, the UUT shall be set in the home configuration and the activities in 6.3.10.1 through 6.3.10.8 shall be applied.

6.6 Determination of power consumption, Partial On mode

6.6.1 General

Power consumption in the Partial On sub-modes shall be determined as specified in IEC 62301:2011 except as prescribed otherwise in this standard. The power source shall comply with the requirements of IEC 62087-1:2015, 5.1.1.6.

6.6.2 Order of activities

Figure 7 shows the order in which the activities for determining the power consumption in the Partial On sub-modes shall be performed.

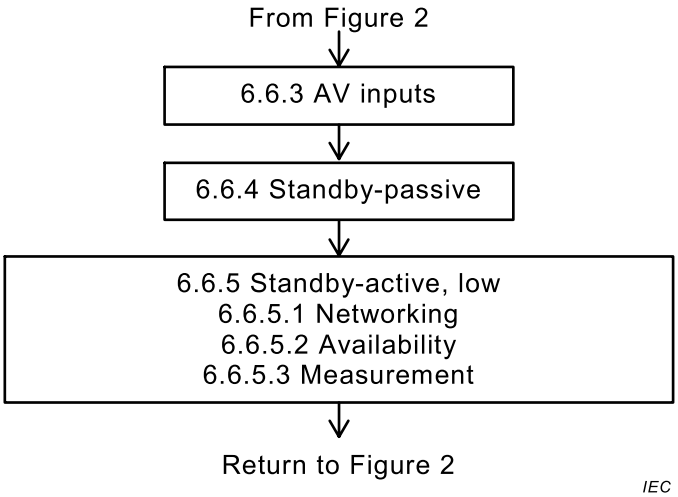

Figure 7 – Order of activities for determining the power consumption, Partial On mode

6.6.3 AV inputs

All cables to AV input terminals shall be disconnected from the UUT.

6.6.4 Standby-passive

The UUT shall be in the default conditions (6.5.2.9). The UUT shall be switched into the Standby-passive sub-mode. Networking functions shall remain disabled (6.3.10.8) while measuring the power consumption in the Standby-passive sub-mode.

Power consumption in the Standby-passive sub-mode ($P_{standby\text{-}passive}$) shall be measured and reported.

Within the context of the home configuration, if the user is prompted by the forced menu to enable or disable the quick start feature (6.3.10.1), quick start may be enabled via the on-screen menu selection and a second value, ($P_{standby\text{-}passive\_quick\text{-}start}$), may be measured and reported. If this optional measurement is performed, quick start shall be disabled after completion of the measurement.

6.6.5 Standby-active, low

6.6.5.1 Networking

If the UUT has Wi-Fi capabilities, the UUT shall be in the vicinity of a Wi-Fi wireless access point (5.6.6), the Wi-Fi networking feature shall be enabled, and the initial connection shall be established through the TV's menu system. The Wi-Fi access point should be configured with a SSID named randomly with 4 text characters, the so named SSID should be secured via a 13 character, randomly assigned WPA2 pre-shared key passcode and run over a mixed g/n/ac network running on both 5 GHz and 2,4 GHz frequency bands with the channel selection set to auto or randomly chosen if auto is not available. Choose default options otherwise for any other required setting in the wireless access point.

If the UUT has Ethernet capabilities but no Wi-Fi capabilities, the UUT shall be connected to an Ethernet switch or router (5.6.6), the Ethernet port and networking feature shall be enabled, and the initial connection shall be established.

The address layer of the protocol shall be configured to complete the connection to the wireless local area network (WLAN) or wired local area network (LAN). The network shall not be connected to a wide area network (WAN). Note the following:

- Internet Protocol (IP) v4 and Internet Protocol (IP) v6 have IP/neighbour discovery and will generally configure a limited, non-routable connection automatically.
- The IP address may be configured using auto IP, dynamic host configuration protocol (DHCP), or manually, using an address in the 192.168.1.x network address translation (NAT) address space.

The network shall be configured to support the NAT address space and/or auto IP.

6.6.5.2 Availability

The availability of Standby-active, low shall be verified by either one of the following methods.

a) Switch the UUT to Standby-active, low. Confirm that the UUT IP address layer is configured to establish the connection to the WLAN or LAN using a network scanner application or other software application. The scanner of choice shall confirm the IP address is associated with the unit under test and is active during the time the TV is in Standby-active, low.

EXAMPLE The Fing application (iOS or Android) is an example network scanner mobile application which will satisfy this requirement.

b) Switch the UUT to Standby-active, low. Confirm that the UUT can be switched into the On mode with a Wake-on-LAN (WOL) or Wake on Wireless LAN (WoWLAN) network signal.

EXAMPLE The Magic Packet™[3] is a network signal often used for the Wake-on-LAN function.

The availability of the Standby-active, low sub-mode in the UUT shall be reported.

NOTE If additional network traffic exists, the UUT may be in the Standby-active, high sub-mode.

6.6.5.3 Measurement

If Standby-active, low is available, the UUT shall be switched into the Standby-active, low sub-mode, and power consumption in the Standby-active, low sub-mode ($P_{\text{standby-active, low}}$) shall be measured and reported.

NOTE Not all television sets are guaranteed to allow Standby-active, low to be explicitly enabled from the menus. Though television sets may have their networking connected and enabled in the On mode, it is not guaranteed that the manual or user interface will explicitly or accurately describe the network state when in the Partial On mode.

6.7 Determination of power consumption, Off mode

6.7.1 Connections and networking

If the UUT is capable of being set in the Off mode, all electrical connections to the UUT except the power cable shall be disconnected and networking features shall be disabled.

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3 Magic Packet™ is a trademark of Advanced Micro Devices, Inc.

6.7.2 Availability

The UUT shall be switched into the Off mode. Off mode shall be confirmed by attempting to switch the UUT into another mode using the remote control. If the UUT does not switch into another mode, it is Off mode capable.

The availability of Off mode in the UUT shall be reported.

6.7.3 Measurement

If Off mode is available, the UUT shall be switched into the Off mode. Power consumption in the Off mode (P_{off}) shall be determined as specified in IEC 62087-1:2015, Clause 6. The power source shall comply with the requirements of IEC 62087-1:2015, 5.1.1.6. P_{off} shall be reported.

Annex A
(informative)

Considerations for On mode television set power measurements

A.1 General

This annex applies only to the measurement of television set On mode power consumption.

A.2 Illuminance levels for automatic brightness control

In IEC 62087:2008 and IEC 62087:2011, automatic brightness control was evaluated at 0 lx and ≥ 300 lx. The maintenance team has determined that measurement at only these two points may not be adequate for predicting real world power consumption.

Measurements with the ABC feature disabled or at ≥300 lx with the ABC feature enabled are effective at predicting worst case power consumption levels in the default picture setting.

Measurements with ABC enabled with 0 lx at the sensor are simple. This emulates viewing in dark conditions.

According to the CEA Home Luminance Study (CEA-TR-1), CEA found that the most likely viewing condition in the US is around 12 lx, which emulates prime time viewing. A measurement at 35 lx might also be effective for emulating daytime viewing under moderately bright conditions.

Typical home illuminance may vary in different regions of the globe.

A.3 Weighting of automatic brightness control levels

In IEC 62087:2008 and IEC 62087:2011, the approach was to measure power with ABC disabled (if it was not possible to manually disable ABC, the ABC sensor was effectively disabled with by applying ≥300 lx to the ABC sensor assembly), and then with ABC enabled and 0 lx applied. The power savings between ABC disabled and enabled with 0 lx was scaled and subtracted from the power measured with ABC disabled.

$$P_{ABC} = P_{ABC\_Off} - (P_{ABC\_Off} - P_{ABC\_0}) \times A_a$$

where

P_{ABC} is the On mode power consumption with power saving functions (W);

P_{ABC_Off} is the On mode power consumption with ABC disabled or effectively disabled (W);

P_{ABC_0} is the On mode power consumption with ABC enabled with 0 lx applied (W);

A_a is the power saving functions weighting factor.

The need for measuring with ABC disabled is questionable as it does not reflect an out-of-the-box condition. Such a measurement made sense for IEC 62087:2008 and IEC 62087:2011 as that standard allowed for savings due to either ABC or some “other” power savings function, whichever was greater, to reduce the overall power consumption number of the television set. In this standard, the savings for the “other” power savings function has been eliminated, so measuring with ABC disabled may no longer be needed. The possibility of measuring with ABC disabled is retained for backward compatibility.

A.4 Calculating On mode power consumption

In the case of television sets with ABC disabled by default in the default picture setting,

$P_{os\_static} = P_{o\_static\_ABC\_Off}$

$P_{os\_broadcast} = P_{o\_broadcast\_ABC\_Off}$

$P_{os\_Internet} = P_{o\_Internet\_ABC\_Off}$

In the case of television sets with ABC enabled by default in the default picture setting,

$$P_{os\_static} = P_{o\_static\_ABC\_x1} \times A_{ABC\_x1} + P_{o\_static\_ABC\_x2} \times A_{ABC\_x2} + P_{o\_static\_ABC\_x3} \times A_{ABC\_x3} + P_{o\_static\_ABC\_x4} \times A_{ABC\_x4} \cdot$$

$$P_{os\_broadcast} = P_{o\_broadcast\_ABC\_x1} \times A_{ABC\_x1} + P_{o\_broadcast\_ABC\_x2} \times A_{ABC\_x2} + P_{o\_broadcast\_ABC\_x3} \times A_{ABC\_x3} + P_{o\_broadcast\_ABC\_x4} \times A_{ABC\_x4} \cdot$$

$$P_{os\_Internet} = P_{o\_Internet\_ABC\_x1} \times A_{ABC\_x1} + P_{o\_Internet\_ABC\_x2} \times A_{ABC\_x2} + P_{o\_Internet\_ABC\_x3} \times A_{ABC\_x3} + P_{o\_Internet\_ABC\_x4} \times A_{ABC\_x4} \cdot$$

where

P_{os_static} is the On mode power consumption with ABC power saving functions, using static signals (W);

$P_{os\_broadcast}$ is the On mode power consumption with ABC power saving functions, using the dynamic broadcast-content video signal (W);

$P_{os\_Internet}$ is the On mode power consumption with ABC power saving functions, using the Internet-content video signal (W);

$P_{o\_static\_ABC\_x}$ is the On mode power consumption measured with ABC in the related *x* conditions, using static signals (W);

$P_{o\_broadcast\_ABC\_x}$ is the On mode power consumption measured with ABC in the related *x* conditions, using the dynamic broadcast-content video signal (W);

$P_{o\_Internet\_ABC\_x}$ is the On mode power consumption measured with ABC in the related *x* conditions, using the Internet-content video signal (W);

A_{ABC_x} is the weighting factor with ABC in the related *x* condition.

To ensure proper weighting, the sum of A_{ABC_x1}, A_{ABC_x2}, A_{ABC_x3}, and A_{ABC_x4} should equal unity.

NOTE 1 "*x*1", "*x*2"," *x*3" and "*x*4" embedded in the variable names above represent the various ABC lighting conditions in lux.

NOTE 2 In the US, On mode power is determined with ABC at 100, 35, 12, and 3 lx. Equal weighting of A_{ABC_100}, A_{ABC_35}, A_{ABC_12}, A_{ABC_3}, is used, based on the results of the CEA Home Luminance Study (CEA-TR-1). Appropriate illuminance levels and weighting factors may vary in other regions, depending on typical lighting and viewing habits.

A.5 Picture level adjustments

Manufacturers are recommended to allow the end user of the television set to easily restore the picture level adjustments and other settings into the out-of-the-box condition.

Manufacturers are encouraged to configure the picture level adjustments in the default picture setting to provide a comfortable viewing experience as intended for the normal home environment.

Annex B
(normative)

Test report

The following items shall be reported when applicable:

- description/identification of the UUT;
- the date and location of the measurements;
- the name of the person/people who executed the measurements;
- the ambient temperature (IEC 62087-1:2015, 5.1.2);
- the model of the lamp used for illuminating the ABC sensor to specific illuminance levels (5.6.4);
- the model of the lamp used for disabling the ABC feature (5.6.5);
- the power source used (included external power supply, mains power, and or power from other than the mains) (6.2.2);
- the voltage and frequency of the power source (6.2.2);
- the selected input terminals (6.2.3);
- the selected video signal for measuring On mode power consumption (6.2.4);
- the selected video signal for measuring the peak luminance ratio (6.2.5);
- the selected resolution and frame rate of the input signals (6.2.6);
- the presence of an ABC feature and whether or not the ABC feature is enabled by default (6.2.7);
- the state(s) of the automatic brightness control feature and the illuminance levels selected to be applied to the ABC sensor (6.2.8);
- the presence of Wi-Fi (IEEE 802.11), Ethernet (IEEE 802.3), and Energy Efficient Ethernet (IEEE 802.3az-2010) (6.2.9);
- the selection(s) made within the forced menu, if it exists (6.3.10.1);
- if any setting of the UUT is changed from the default in order to fill the entire display area, the changed settings shall be reported (6.3.10.6);
- the player used and its related settings shall be reported (6.3.10.6);
- the On mode power consumption per illumination level (6.4.5.1), with an accuracy as specified in IEC 62087-1:2015, 5.2;
- Power_factor as a percentage with an accuracy of 1 decimal point (6.5.2.3);
- the manufacturer's name or label associated with the brightest selectable preset picture setting (6.5.2.4);
- whether $L_{brightest\_selectable}$ or L_{retail} is greater (6.5.2.7);
- the peak luminance ratio, L_{ratio} as a percentage with an accuracy of 1 decimal point (6.5.2.8);
- the power consumption in the Standby-passive sub-mode, $P_{standby\text{-}passive}$ (6.6.4), with an accuracy as specified in IEC 62087-1:2015, 5.2;
- the availability of the Standby-active, low sub-mode (6.6.5.2);
- if available, power consumption in the Standby-active, low sub-mode, $P_{standby\text{-}active,\ low}$ (6.6.5.3), with an accuracy as specified in IEC 62087-1:2015, 5.2;
- the availability of Off mode (6.7.2);
- if available, power consumption in the Off mode, P_{off} (6.7.3), with an accuracy as specified in IEC 62087-1:2015, 5.2.

NOTE Informative Annex ZA (Test report template) in European standard EN 50564:2011 can be used for reporting purposes in Europe.

Annex C
(informative)

Example test report template

The following form is for guidance. Use of this reporting format is not compulsory.

Product under test				
Brand name, as identified on product				
Organisation taking responsibility for the product	Name		Address	
Product description				
Model identification				
Version or serial number				
Firmware or software version				

Test Laboratory Details			
Name of test laboratory			
Address of test laboratory			
Certification body (if appropriate)			
Test report number		Test date	
Prepared by		Approved by	

Applicant/Client Details	
Name of applicant/client	
Address of applicant/client	
Regulatory reference	

Test Equipment				
Test equipment	Manufacturer of Test Instrument	Model designation	Serial Number	Calibration Due Date
Light source used for illuminating the ABC sensor to specific illuminance levels				
Light source used for disabling the ABC feature				
Luminance measuring device				
Illuminance measuring instrument				
Power supply / Voltage source				
Player / Source(s) for test signals				
Instrument used for measuring power consumption				
Wi-Fi access point (IEEE 802.11-2007)				

Ethernet switch / router (IEEE 802.3 or IEEE 802.3az-2010)				

Test Conditions			
Ambient temperature (°C)			
Description of test set-up used at each test condition			
Test supply voltage (V)		Fluctuation [max. ±2 %] (%)	
Test frequency (Hz)		Fluctuation [max. ±2 %] (%)	
Total harmonic distortion of supply voltage waveform [max. ±5 %] (%)			
Input terminal selected at UUT			

Video signal selected for measuring On mode power consumption		Resolution and frame rate selected		Settings changed from default in order to fill entire display area	Signal source: UUT:
Video signal selected for measuring the peak luminance ratio		Resolution and frame rate selected		Settings changed from default in order to fill entire display area	Signal source: UUT:

Test Results					
TV settings selected	Forced menu, home configuration	☐ yes ☐ no ☐ n.a.	Manufacturer default settings	☐ yes ☐ no	
	Quick start feature selectable at home configuration menu?			☐ yes ☐ no	
Presence of ABC feature	☐ yes ☐ no	ABC feature enabled by default		☐ yes ☐ no ☐ n.a.	
ABC feature	disabled	enabled			
Illuminance level applied ABC sensor (lux)		1	2	3	4
On mode power consumption (W, accuracy)					
Power factor [ABC feature disabled] (% with accuracy of 1 decimal point)					
Brightest selectable preset picture setting (manufacturer name or label)		Is $L_{brightest\_selectable}$ greater than L_{retail}?		☐ yes ☐ no	
Peak luminance (cd/m^2) (optional)	Default picture setting		Brightest selectable preset picture setting		Retail picture setting	
Peak luminance ratio (%, accuracy of 1 decimal point)					

<table>
<tr><td>Standby-passive power consumption [default or quick start feature disabled]
(W, accuracy)</td><td colspan="2"></td><td colspan="2">Standby-passive power consumption [Quick start enabled], optional
(W, accuracy)</td><td colspan="2"></td></tr>
<tr><td>Availability of network connectivity</td><td>Wi-Fi
(IEEE 802.11)</td><td>☐ yes
☐ no</td><td>Ethernet
(IEEE 802.3)</td><td>☐ yes
☐ no</td><td>Energy Efficient Ethernet
(IEEE 802.3az-2010)</td><td>☐ yes
☐ no</td></tr>
<tr><td>Availability of Standby-active, low sub-mode</td><td colspan="2">☐ yes ☐ no</td><td colspan="3">Standby-active, low power consumption (W, accuracy)</td></tr>
<tr><td>Availability of Off mode</td><td colspan="2">☐ yes ☐ no</td><td colspan="3">Off mode power consumption
(W, accuracy)</td></tr>
</table>

Bibliography

IEC 61156-5, *Multicore and symmetrical pair/quad cables for digital communications – Part 5: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz-horizontal floor wiring – Sectional specification*

IEC 61156-6, *Multicore and symmetrical pair/quad cables for digital communications – Part 6: Symmetrical pair/quad cables with transmission characteristics up to 1 000 MHz – Work area wiring – Sectional specification*

IEC 62087:2008 (second edition), *Methods of measurement for the power consumption of audio, video and relateed equipment*[4]

IEC 62087:2011 (third edition), *Methods of measurement for the power consumption of audio, video and relateed equipment*[4]

IEC 62087 (all parts), *Audio, video, and related equipment – Determination of power consumption*

IEC 62087-4, *Audio, video, and related equipment – Determination of power consumption – Part 4: Video recording equipment*

IEC 62087-5, *Audio, video, and related equipment – Determination of power consumption – Part 5: Set top boxes*

IEC 62087-6, *Audio, video, and related equipment – Determination of power consumption – Part 6: Audio equipment*

IEC 62542:2013, *Environmental standardization for electrical and electronic products and systems – Glossary of terms*

EN 50564:2011, *Electrical and electronic household and office equipment – Measurement of low power consumption*

CEA-2037-A, *Determination of Television Average Power Consumption*

CEA-TR-1, *Home Luminance Study, June 2012*

NOTE CEA standards are available from http://www.ce.org/Standards/Standard-Listings.aspx

IEEE 802.11-2007, *IEEE Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications*

IEEE 802.3az-2010, *IEEE Standard for Information technology – Local and metropolitan area networks – Specific requirements – Part 3: CSMA/CD Access Method and Physical Layer Specifications, Amendment 5: Media Access Control Parameters, Physical Layers, and Management Parameters for Energy-Efficient Ethernet*

NOTE IEEE standards are available from http://www.techstreet.com/ieeegate.html

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4 The former editions of IEC 62087 are given for the sake of backwards traceability.

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