



# Global LEAP Off-Grid Television Test Method

Version 1 (2016-08)

## 1 Scope

This document establishes methods to measure the performance, quality, and durability of televisions (TVs) intended to be used with off-grid energy systems (e.g. standalone solar home systems, mini-grids).

The following test conditions are defined for the evaluation of product suitability for use in off-grid applications:

- **Nominal conditions;**
- **Voltage fluctuation conditions**, which simulate performance during over-voltage and under-voltage conditions.
- **Harsh environment exposure conditions**, which simulate exposure to high temperature and humidity environments. Procedures are adopted from *IEC 60068-2-78: Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state* (2012).

The following test procedures are then defined for the evaluation of product performance under the above test conditions:

- A procedure for measuring **on mode power consumption** adapted from *IEC 62087 Ed 3.0: Methods of measurement for the power consumption of audio, video and related equipment* (2011).
- A procedure for measuring **standby mode power consumption** adapted from *IEC 62301 Ed 2.0: Household electrical appliances – Measurement of standby power* (2011).
- A procedure for measuring **screen luminance** adapted from the *ENERGY STAR® Program Requirements Product Specification for Televisions Test Method* (2011)<sup>1</sup>.
- A procedure for evaluating **physical ingress protection** adapted from *IEC TS 62257-9-5:2013: Recommendations for small renewable energy and hybrid systems for rural electrification: Integrated system – Selection of stand-alone lighting kits for rural electrification*.
- A procedure for measuring **viewing angle** adapted from *IEC 60107-7:1997: Methods of measurement on receivers for television - Part 7: HDTV displays*.

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<sup>1</sup> [http://www.energystar.gov/sites/default/files/specs//ENERGY\\_STAR\\_TV\\_TestMethod\\_Aug-2011.pdf](http://www.energystar.gov/sites/default/files/specs//ENERGY_STAR_TV_TestMethod_Aug-2011.pdf)

## 2 Definitions

### 2.0 On Mode

The power mode in which the TV is connected to a power source, has been activated, and is providing one or more of its principal functions.

### 2.1 Standby Mode

The power modes where the TV is connected to a power source and offers one or more of the following user oriented or protective functions which usually persist

- to facilitate the activation of other modes (including activation or deactivation of active mode) by remote switch (including remote control), internal sensor, timer;
- continuous function: information or status displays including clocks;
- continuous function: sensor-based functions.

### 2.2 Screen Area

The viewable screen area of the product, calculated by multiplying the viewable image width by the viewable image height.

### 2.3 Luminance

The photometric measure of the luminous intensity per unit area of light traveling in a given direction, expressed in units of candelas per square meter ( $\text{cd}/\text{m}^2$ ).

### 2.4 Viewing Angle

The maximum angle at which the television can be viewed with acceptable visual performance, expressed in degrees (e.g.  $120^\circ$ ).

## 3 Test Conditions

### 3.1 Test Setup

The test shall be set up using a power cable included in the product package.

- If a DC cable is provided with the product, use the DC cable and DC power supply for testing.
- If only an AC/DC converter is provided with the product, use the AC/DC converter and AC power supply for testing.

The type of power cable and power supply used during the tests shall be documented in the test report.

### 3.2 Nominal conditions

Nominal conditions are defined as follows:

Parameter	Value
Input voltage	Nameplate voltage (e.g. 12 VDC) +/- 2%
Temperature	25°C +/- 5°C
Relative humidity	20% to 80%

### 3.3 Voltage fluctuation conditions

Over-voltage conditions are equivalent to Nominal conditions, except that Input voltage is increased by 15% from Nameplate voltage.

Under-voltage conditions are equivalent to Nominal conditions, except that Input voltage is decreased by 15% from Nameplate voltage.

### 3.4 Harsh environment exposure conditions

Harsh environment exposure conditions are equivalent to Nominal conditions, except that products are exposed to 40°C ± 2°C temperature and 93% ± 3% relative humidity<sup>2</sup> for a minimum of 24 hours prior to testing.

## 4 Test Sequence

The following sequence should be followed when carrying out the tests:

- 1) Conduct initial Overall Quality Inspection procedures (5.1.1, 5.1.2, 5.1.3, 5.1.4, 5.1.6).
- 2) Measure On Mode Power Consumption and Luminance in Nominal conditions – both as delivered settings and max power/luminance settings (3.2, 5.3, 5.4)
- 3) Measure On Mode Power Consumption and Luminance in Over-voltage and Under-voltage conditions (3.3., 5.3, 5.4)
- 4) Measure Standby Mode Power Consumption in Nominal conditions (3.2, 5.2)
- 5) Measure Standby Mode Power Consumption in Over-voltage and Under-voltage conditions (3.3, 5.2)
- 6) Conduct Viewing Angle Test (5.6)
- 7) Conduct Low Voltage Disconnect Test (5.7)
- 8) Expose TV to Harsh Environment conditions (3.4)
- 9) Measure On Mode Power Consumption and Luminance in Nominal conditions (3.2, 5.3, 5.4)
- 10) Measure Standby Mode Power Consumption (3.2, 5.2)
- 11) Conduct Physical Ingress Protection test (5.5)
- 12) Conduct remaining Overall Quality Inspection procedures (5.1.5, 5.1.6)

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<sup>2</sup> Per IEC 60068-2-78: *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

## 5 Test Procedures

### 5.1 Overall Quality Inspection

- 5.1.1 Review product packaging for necessary information (e.g. manufacturer name, product name, model number, trademark, product color, gross weight, package dimension, precaution text or signage, date of manufacture and applicable standards).
- 5.1.2 Review the product nameplate for necessary information (e.g. input voltage, TV size, and standby power).
- 5.1.3 Review TV instructions, user manual and warranty information.
- 5.1.4 Take photographs of the TV, including front view, side view, and nameplate.
- 5.1.5 Inspect the TV components (including but not limited to enclosure, screen, wirings, fittings, and connections) for quality and workmanship and note any visible defects.
- 5.1.6 Document findings in test report.

### 5.2 Standby Mode Power Consumption

- 5.2.1 Ensure the product is in its as-shipped (factory default) settings. If necessary, reset the product to its factory defaults.
- 5.2.2 Prepare the product for testing in accordance with Clause 4 (*General conditions for measurements*) of IEC 62301 Ed. 2.0, with the exception of any required Test conditions as specified in Section 3 of this test method.
- 5.2.3 Measure Standby mode power consumption in accordance with Clause 5.3.2 (*Sampling reading method*) of IEC 62301 Ed. 2.0.
- 5.2.4 Document findings in test report.

### 5.3 Luminance

- 5.3.1 Ensure the product is in its as-shipped (factory default) settings. If necessary, reset the product to its factory defaults.
- 5.3.2 Prepare the product for testing in accordance with Clause 5 (*General conditions for measurements*) of IEC 62087 Ed. 3.0, with the exception of any required Test conditions as specified in Section 3 of this test method.
- 5.3.3 Measure default Luminance in accordance with Clause 6.2 (*Luminance testing*) of the ENERGY STAR Televisions Test Method – 2011.
- 5.3.4 Using the product user interface, select the brightest-selectable preset picture mode.
- 5.3.5 Measure Luminance in accordance with Clause 6.2 (*Luminance testing*) of the ENERGY STAR Televisions Test Method – 2011.
- 5.3.6 Document findings in test report.

## 5.4 On Mode Power Consumption

- 5.4.1 Ensure the product is in its as-shipped (factory default) settings. If necessary, reset the product to its factory defaults.
- 5.4.2 Using the product user interface, adjust TV volume to 50% of its maximum-selectable volume.
- 5.4.3 Prepare the product for testing in accordance with Clause 5 (*General method of measurement*) and Clause 11 (*Measuring conditions for television sets in On (average) mode*) of IEC 62087 Ed. 3.0, with the exception of any required Test conditions as specified in Section 3 of this test method.
- 5.4.4 Measure Average On mode power consumption in accordance with Clause 11.6 (*On (average) mode testing using dynamic broadcast-content video signal*) of IEC 62087 Ed. 3.0.
- 5.4.5 Using the product user interface, select the brightest-selectable preset picture mode and set the volume to 100% of its maximum-selectable volume. In case where there is no preset mode available, adjust brightness (and backlight if setting is available) to 100% of its maximum-selectable brightness. Measure Maximum On mode power consumption in accordance with Clause 11.6 (*On (average) mode testing using dynamic broadcast-content video signal*) of IEC 62087 Ed 3.0.
- 5.4.6 Document findings in test report.

## 5.5 Physical Ingress Protection Test

- 5.5.1 Ensure the product is in its as-shipped condition.
- 5.5.2 Visually inspect the product for protection against ingress of solid foreign objects to determine whether the product meets IP20, IP30, and IP40 requirements, in accordance with Clause U.4.2 (*IP preliminary inspection for ingress of solid foreign objects*) of IEC TS 62257-9-5:2013.
- 5.5.3 Document findings in test report.

## 5.6 Viewing Angle Test

- 5.6.1 Ensure the product is in its as-shipped condition.
- 5.6.2 Prepare and conduct the viewing angle test in accordance with Clause 4.4.2 (*Viewing angle and dependence of luminance uniformity on the angle*) of IEC 60107-7:1997.
- 5.6.3 Measure the vertical and horizontal viewing angles at which the luminance measured at the center of the screen decreases to one-half, one-third, and one-tenth of the value measured perpendicular to the center of the screen.
- 5.6.4 Document these viewing angles and any additional observations regarding viewing angles in the test report.

## 5.7 Low Voltage Disconnect Test

- 5.7.1 Ensure the product is in its as-shipped (factory default) settings. If necessary, reset the product to its factory defaults.
- 5.7.2 Supply the TV unit with Nominal voltage and then reduce voltage supply until the TV switches off. This test determines whether low voltage disconnect (LVD) & reconnect (LVR) circuit, or similar automatic shutdown mechanism, is available to protect batteries from unintended drainage.
- 5.7.3 Document findings in test report.