



Global LEAP Off-Grid Television Test Method

Version 1.1 (2020-01)

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)¹.
- 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*.

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.

¹ http://www.energystar.gov/sites/default/files/specs//ENERGY_STAR_TV_TestMethod_Aug-2011.pdf

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 (cd/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°).

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 $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$ temperature and $93\% \pm 3\%$ relative humidity² 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, 5.1.4, 5.1.5, 5.1.2, 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)

² 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 Take photographs of product packaging and any documentation included with the product: product specification sheets, product installation instructions, user manuals, and warranty information.
- 5.1.2 Take photographs of the TV, including front view, side view, and nameplate.
- 5.1.3 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, and date of manufacture).
- 5.1.4 Review the product nameplate for necessary information (e.g. input voltage, TV size, and standby power).
- 5.1.5 Review TV instructions, user manual and warranty information.
- 5.1.6 Inspect the TV components (including but not limited to enclosure, screen, wirings, fittings, and connections) for quality and workmanship and note any visible defects.
- 5.1.7 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.

5.5 Maximum On Mode Power Consumption

- 5.5.1 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.
- 5.5.2 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.
- 5.5.3 Document findings in test report.

5.6 Physical Ingress Protection Test

- 5.6.1 Ensure the product is in its as-shipped condition.
- 5.6.2 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.
- 5.6.3 Take photographs of IP testing and document findings in test report, e.g. IP numbers, whether each is a pass or fail, and if fail, describe points of failure.

5.7 Viewing Angle Test

- 5.7.1 Ensure the product is in its as-shipped condition.
- 5.7.2 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.
- 5.7.3 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.
- 5.7.4 Document these viewing angles and any additional observations regarding viewing angles in the test report.

5.8 Low Voltage Disconnect Test

- 5.8.1 Ensure the product is in its as-shipped (factory default) settings. If necessary, reset the product to its factory defaults.
- 5.8.2 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.
- 5.8.3 Document findings in test report.