Global LEAP Off-Grid TV Test Method Development Process

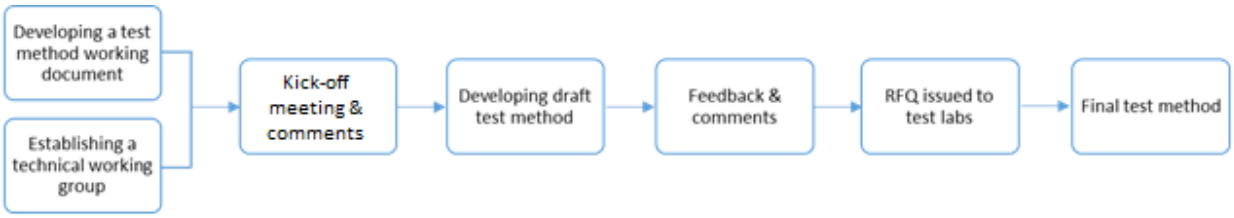
Version 1 (2016-08)

Televisions (TVs) are one of the appliance categories in the highest demand in un- and under-electrified regions where off-grid energy systems are used. A serious issue in the off-grid television market is the presence of low-quality, inefficient, expensive products that spoil the end-user experience and raise the cost of off-grid energy services, thereby creating significant barriers to market development.

In response to this challenge, and to enable improved comparison of off-grid TVs, Global LEAP collaborated with off-grid energy industry stakeholders, appliance manufacturers, policymakers, and test facilities to develop a test method to evaluate the quality, durability, energy performance, and off-grid market appropriateness of TVs. The Global LEAP Off-Grid TV Test Method is available here.

Test Method Development Process

The test method was developed through a rigorous research, consultation, and review process as illustrated below.



CLASP initially developed a working document that highlighted product characteristics and performance parameters to be evaluated by the test method, and proposed methods for testing. The proposed methods leveraged existing internationally-recognized test methods, particularly *IEC 62087: Methods of measurement for the power consumption of audio, video and related Equipment*, *IEC 62301: Household electrical appliances – Measurement of standby power*, and *ENERGY STAR Program Requirements for Televisions – Test Method* (Rev. Aug-2010).

To develop the most suitable test method for off-grid TVs, a 10-member technical working group was established to guide the test method development process. Technical and off-grid market experts, including appliance manufacturers, test laboratories, policymakers, and NGOs were invited to join the working group and to provide their feedback and comments on the proposed test method.

The working group was convened in April 2015 and the off-grid TV test method working document was shared with all working group members, who were invited to provide feedback and comments. Following receipt of comments, a draft test method was developed and sent for review on 27 May 2015. A request for quotation (RFQ) from test laboratories was issued on 10 June 2015, requesting laboratories' estimates related to testing costs and run-time as well as input into the design of the test method. Test laboratory responses and comments from the working group were received by 26 June 2015. Following the final comments from the working group members, a final test method for off-grid TVs was developed and published online on 24 August 2015.

From August 2015 to June 2016, CLASP engaged several test laboratories and testing experts around the world to continue refining the components in the off-grid TV test method. A summary table, on page 4, documents the comments by test experts and revisions made to the test method.

As off-grid markets and their needs evolve, this test method will undoubtedly need to be revised. Global LEAP welcomes continued feedback on this test method from all interested parties. Please send comments, questions, or criticisms via email to info@GlobalLEAP.org.

The Global LEAP Off-Grid Appliance Test Methods were developed using funding from the United States Department of Energy, which leads the Clean Energy Ministerial's Global LEAP initiative.

Global LEAP Off-Grid TV Test Method Working Group Members

Hans Peter Birkhofer
Mr. Birkhofer is the Technical Director of the Global Off-Grid Lighting Association (GOGLA). He is in charge of all issues related to quality assurance and standards and is also coordinating the respective working group. Having worked in the lighting industry for more than 30 years, Hans Peter is a true expert for technical standards related to lighting products. Throughout his long lighting career, Hans Peter held several leading positions. Before going into business as an independent consultant, he was the Head of Business Development within Global Project and Sales at OSRAM focusing on LED & Lighting Electronics. He has also been the Chairman of AG DALI (Digital Addressable Lighting Interface) that initiated and promoted the new Lighting Control Standard, for more than a decade. His vast practical experience is completed by his strong educational background: He holds a Physics Diploma from the University of Freiburg, Germany and the University of Washington, Seattle.

Saurabh Diddi
Mr. Diddi is Energy Economist at the Bureau of Energy Efficiency of India. His specialty includes energy efficiency, energy management and the power sector.

Ershadullah Ershad
Mr. Ershad is a Senior System Engineer of MAKS Renewable Energy Company Limited. He is a technical expert of renewable energy products, such as LEDs, solar charge controller, DC-DC converters, sunlight tracker and solar pump. MAKS Renewable Energy is a growing renewable energy service provider which offers commercial and residential renewable energy systems for on-grid and off-grid applications.

Jon Fairhurst
Mr. Fairhurst is the Head of CE Standards at Sharp Labs of America. He is a TV expert with more than 15 years of experience in TV testing.

Stephen Fernandes
Mr. Fernandes is a consultant engineer at Intertek Testing Services. Mr. Fernandes is an experts of TV testing. He represents BSI as UK Principal Expert on Measurement of low power, External Power Supplies and Television energy consumption - contributing to European Standards supporting the ErP regulations for the European Commission at CENELEC level and International Standards. He also conducts technical audits of compliance laboratories for energy related measurements.

Daniel Goldbach
Mr. Goldbach is the Head Technical Manager of Fosera GmbH&Co. KGaA. He is an expert in pico solar system and he leads the new product development at Fosera. Fosera offers high quality pico solar home systems for light generation, phone charging, powering of radios and TVs.

Arne Jacobson
Dr. Jacobson is Director of the Schatz Energy Research Center and Associate Professor in the Environmental Resources Engineering department at Humboldt State University. He has a Ph.D. from the Energy and Resources Group at the University of California, Berkeley, a master's degree focused on Environmental Resources Engineering (Humboldt State University), and a bachelor's degree in physics (Earlham College). His areas of research and work interest include renewable energy technologies, energy access in off-grid areas, and clean energy deployment policy. Arne's work is interdisciplinary, combining renewable energy engineering, energy policy, and a social geography based approach to international development studies. He has extensive international work experience in Africa, South Asia, and Latin America. Arne currently serves as the technical lead for product quality assurance for Lighting Global, which is associated with the Lighting Africa and Lighting Asia programs. He is also a member of Technical Committee 82 (solar photovoltaic technologies) of the International Electrotechnical Commission (IEC), an international standards body.

Md. Ashrafuzzaman Khan
Mr. Khan is the Divisional Manager of Grameen Shakti, the largest implementing partner of IDCOL's solar home system program in Bangladesh. Mr. Khan is solar home system market expert who is responsible for Grameen Shakti's sales, recovery, inventory, and office & field management in 12 regions of Bangladesh.

Fahim Mahmud
Mr. Mahmud is a Senior Product Development Officer at Rahimafrooz Renewable Energy Limited. He is a technical expert in renewable energy products. Rahimafrooz is one of Bangladesh's leading solar energy solution companies.

Won Young Park
Mr. Park is a researcher at Lawrence Berkeley National Laboratory (LBNL). He has been working on technical analysis for energy efficiency improvement in televisions, computer monitors, and other appliances for the Super-efficient Equipment and Appliance Deployment (SEAD) Initiative. In the studies, he assesses energy savings potential in efficiency improvement options, evaluates cost effectiveness of key technologies, and provides technical information and recommendations for policies and programs designed to accelerate the adoption of efficient technologies. Prior to LBNL, he worked at Samsung SDI which focused its efforts on digital display technology and the alternate energy business. He received a Bachelor of Science in Physics from Yonsei University, Korea, and a Master of Public Policy from UC Berkeley's Goldman School of Public Policy.

Amendment to Global LEAP Off-Grid TV Test Method (21 September 2015)

TV Viewing Angle Testing Based on feedback from laboratories, redundant viewing angle tests have been removed to ensure cost-effectiveness.

Amendment to Global LEAP Off-Grid TV Test Method (1 June 2016)

Original Clause in the Test Method	Comment	Comment Made By (Date)	Revision to the Test Method
3.4 Harsh environment exposure conditions Harsh environment exposure conditions are equivalent to Nominal conditions, except that products are exposed to 40 °C temperature and 95% relative humidity for a minimum of 24 hours prior to testing.	According to the options given in the test standard IEC 60068-2-78, the harsh environment exposure conditions should be quoted as "subject television to 40 °C ± 2°C and 93% ± 3% relative humidity for 24 hours."	Stephen Fernandes, Intertek UK (11/10/2016)	Revised the test conditions in the Clause 3.4 to "40 °C ± 2°C and 93% ± 3% relative humidity, as specified in the test method IEC 60068-2-78 *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state.*
4 Test Sequence (6) Measure Standby mode power consumption, Luminance, and On mode power consumption (5.2, 5.3, 5.4).	After the product is placed in the Environmental Chamber, the 4 main tests must be repeated (Clause 4.6 in the Global Leap method). It is unclear whether these tests are only repeated for the Nominal condition.	Malini Kannan, Schatz Energy Research Center (10/30/2016)	Revised the Clause 4 (6) to specify that the tests should be conducted in the Nominal condition.
4 Test Sequence	In order to comply with the sample preparation and procedure requirements of the standard (IEC 62087 Ed 3.0: Methods of measurement for the power consumption of audio, video and	Stephen Fernandes, Intertek UK (3/31/2016)	Revised Clause 4 to reflect the revised test sequence proposed by Intertek.

	related equipment), Intertek proposed a revised test sequence that are more practical and time saving. Intertek's test sequence only requires one warm up period of 1 hour before the first 'on-mode' test. The other 'on-mode' tests and luminance level tests are then all completed sequentially – within the two hours following the warm up hour. This complies with the IEC 62087 Ed 3.0 requirements. The three standby power tests are then completed sequentially. The viewing angle tests are undertaken together as a batch, after all the sets have had all their power tests completed prior to the harsh environment tests. This is far more practical than testing the sets individually during their power testing sequence.		
5.1 Overall Quality Inspection (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.	The samples cannot be dismantled before testing is completed as this would invalidate any test results.	Stephen Fernandes, Intertek UK (3/16/2016)	Revised Clause 4 Test Sequence and moved 5.1 (5) to the last step in the sequence.
5.1 Overall Quality Inspection (4) Review the TV and determine whether low voltage disconnect (LVD) & reconnect (LVR) circuit or similar automatic shutdown	The presence of a "circuit" or specific chip does not guarantee LVD/LVR has been implemented correctly. A test (reduction of voltage until switch-off) is more appropriate.	Stephen Fernandes, Intertek UK (3/16/2016)	Modified the Clause to include a description of the proper test process for LVD and LVR.

mechanism, is available to protect batteries from unintended drainage.			
5.2 Overall Quality Inspection (4) Review the TV and determine whether low voltage disconnect (LVD) & reconnect (LVR) circuit or similar automatic shutdown mechanism, is available to protect batteries from unintended drainage.	This test should be moved to its own test section, e.g., the “low voltage disconnect test.”	Stephen Pantano, CLASP (5/31/2016)	Added a new Clause 5.7 for Low Voltage Disconnect test.
5.2 Standby mode power consumption: (3) Measure Standby mode power consumption in accordance with Clause 5.3.3 (Average reading method) of IEC 62301 Ed.2.0.	The test method (IEC 62301) suggests that "sampling method is the preferred method of measurement for all modes and product types under this standard."	Malini Kannan, Schatz Energy Research Center (10/30/2016)	Revised the Clause 5.2 (3) to use Sampling Method (IEC 62301 5.3.2) instead of Average Reading Method (IEC 62301 5.3.3).
5.4 On mode power consumption: (5) Using the product user interface, select the brightest-selectable picture mode.	The test method for On mode power consumption (Clause 5.4 of the Global LEAP Method) indicates that the TV should be set to the brightest setting, We [the Schatz Energy Research Center] have observed that increasing the volume to 100% increases the power consumption significantly, by about 5% of the total power consumption. For maximum On mode power consumption measurement, we recommend adding volume settings.	Malini Kannan, Schatz Energy Research Center (11/16/2015)	Revised the test method to specify volume adjustment in 5.4 (5). Increase volume to 100% selectable volume.

5.5 Physical ingress protection test (2) Prepare and conduct the physical ingress protection test in accordance with Clause U.4.3 (Simplified IP inspection for ingress of solid foreign objects) of IEC 62257-9-5:2013.	CLASP is advised to double check whether the referenced IEC standard is correctly cited and is the latest version. KTC's suggestion is to revise it to IEC/TS 62257-9-5: 2013 4.2.3.3 or preferably IEC 60529:1989/AMD2:2013 13. *Tests for protection against solid objects indicated by the first characteristic numeral* on which the physical ingress test sections in IEC 62257 documents are based.	Jun Young Park, Korea Testing Certification (9/6/2015) Won Young Park, Lawrence Berkeley National Laboratory (9/25/2015)	Revised the test method to reference the IEC TS 62257-9-5:2013, Clause U.4.2 (IP preliminary inspection of ingress of solid foreign objects).
5.6 Viewing angle test: (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.	In IEC 60107-7:1997 section 4.4.2, the method describes to perform the test for the angles at which 1/2, 1/3 and 1/10 of the maximum luminance are achieved.	Malini Kannan, Schatz Energy Research Center (11/16/2015)	Added a new clause 5.6 (3) to specify that the viewing angles should be measured in terms of horizontal and vertical viewing angles and report viewing angles based oat which maximum luminance drops to 1/2, 1/3 and 1/10.
5.6 Viewing angle test: (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 maximum value.	In 5.6.3) Ideally the maximum value will be perpendicular to the screen but this may not always be the case, so it's correct to say, "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 ~~maximum~~ **value measured perpendicular to the center of the screen**".	Stephen Fernandes, Intertek UK (3/16/2016)	Revised the test method to accept the changes.