



**[6450-01- P]**

**DEPARTMENT OF ENERGY**

**10 CFR Part 430**

**[Docket No. EERE-2010-BT-TP-0026]**

**RIN: 1904-AC29**

**Energy Conservation Program: Test Procedure for Television Sets**

**AGENCY:** Office of Energy Efficiency and Renewable Energy, Department of Energy.

**ACTION:** Notice of proposed rulemaking.

**SUMMARY:** The U.S. Department of Energy (DOE) proposes to establish a new test procedure for television sets (TVs). DOE repealed the prior Federal test procedure for TVs on October 20, 2009, due to petitions from the California Energy Commission (CEC) and the Consumer Electronics Association (CEA). CEC and CEA petitioned for the repeal in light of the June 13, 2009, Federal Communications Commission (FCC) transition from analog to digital broadcast transmissions for TVs. In their petitions, the CEC requested repeal of the regulatory provisions establishing the test procedure and defining “television set,” and the CEA petitioned for DOE’s adoption of the International Electrochemical Commission’s (IEC’s) test procedure IEC Standard 62087-2008, “Methods of measurement for the power consumption of audio, video and related equipment.” DOE is proposing a new test procedure for TVs that was developed from existing industry test procedures including those by IEC, Environmental Protection Agency (EPA), and CEA. Additionally, DOE will hold a public meeting to receive and discuss comments on the proposal.

**DATES:** DOE will hold a public meeting on a date that is to be determined, from 9 a.m. to 4 p.m., in Washington, DC. Once a public meeting date is selected, that date can be found at: [http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). The meeting will also be broadcast as a webinar. See section V, “Public Participation,” for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

DOE will accept comments, data, and information regarding this notice of proposed rulemaking (NOPR) before and after the public meeting, but no later than **[INSERT DATE 75 DAYS AFTER FEDERAL REGISTER PUBLICATION]**. See section V, “Public Participation,” for details.

**ADDRESSES:** The public meeting will be held at the U.S. Department of Energy, Forrestal Building, 1000 Independence Avenue, SW, Washington, DC 20585. To attend, please notify Ms. Brenda Edwards at (202) 586–2945. Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. Any foreign national wishing to participate in the meeting should advise DOE as soon as possible by contacting Ms. Brenda Edwards at (202) 586-2945 to initiate the necessary procedures.

Any comments submitted must identify the Notice of Proposed Rulemaking (NOPR) for the TV Test Procedure, and provide docket number EERE-2010–BT–TP–0026 and/or regulatory information number (RIN) number 1904-AC29. Comments may be submitted using any of the following methods:

1. Federal eRulemaking Portal: <http://www.regulations.gov>. Follow the instructions for submitting comments.
2. E-mail: [Televisions-2010-TP-0026@ee.doe.gov](mailto:Televisions-2010-TP-0026@ee.doe.gov) Include the docket number EERE-2010-BT-TP-0026 and/or RIN 1904-AC29 in the subject line of the message.
3. Mail: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE-2J, 1000 Independence Avenue, SW, Washington, DC, 20585-0121. If possible, please submit all items on a CD. It is not necessary to include printed copies.
4. Hand Delivery/Courier: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza, SW, Suite 600, Washington, DC, 20024. Telephone: (202) 586-2945. If possible, please submit all items on a CD. It is not necessary to include printed copies.

For detailed instructions on submitting comments and additional information on the rulemaking process, see section V, “Public Participation,” of this document.

Docket: The docket is available for review at [regulations.gov](http://www.regulations.gov), including Federal Register notices, framework documents, public meeting attendee lists and transcripts, comments, and other supporting documents/materials. All documents in the docket are listed in the [www.regulations.gov](http://www.regulations.gov) index. However, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

A link to the docket web page may be found at:

[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). This web page will contain a link to the docket for this notice on the regulations.gov site. The regulations.gov web page will contain simple instructions on how to access all documents, including public comments, in the docket. See section V for information on how to submit comments through regulations.gov.

**FOR FURTHER INFORMATION CONTACT:**

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Ms. Celia Sher, U.S. Department of Energy, Office of the General Counsel, GC-71, 1000 Independence Avenue, SW, Washington, DC, 20585-0121. Telephone: (202) 287-6122. E-mail: [Celia.Sher@hq.doe.gov](mailto:Celia.Sher@hq.doe.gov).

**SUPPLEMENTARY INFORMATION:**

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## **I. Authority and Background**

### A. General

Title III of the Energy Policy and Conservation Act (42 U.S.C. 6291, *et seq.*; “EPCA” or, “the Act”) sets forth a variety of provisions designed to improve energy efficiency. (All references to EPCA refer to the statute as amended through the Energy Independence and Security Act of 2007 (EISA 2007), Pub. L. 110-140 (Dec. 19, 2007)). Part B of Title III (42 U.S.C. 6291–6309), which was subsequently redesignated as Part A for editorial reasons, establishes the “Energy Conservation Program for Consumer Products Other Than Automobiles.” This includes television sets (TVs), the subject of this notice. (42 U.S.C. 6292(a)(12))

Under EPCA, this program consists essentially of three parts: (1) testing, (2) labeling, and (3) Federal energy conservation standards. The testing requirements consist of test procedures that manufacturers of covered products must use (1) as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA, and (2) for making representations about the efficiency of those products. Similarly, DOE must use these test requirements to determine whether the products comply with any relevant standards promulgated under EPCA.

## B. Test Procedure Rulemaking Process

In 42 U.S.C. 6293, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered products. Specifically, if DOE determines that a test procedure should be prescribed or amended, it must publish the proposed test procedure in the Federal Register and give interested parties an opportunity to provide public comment on the procedures. (42 U.S.C. 6293(b)(2)) EPCA also provides that the test procedure shall be reasonably designed to produce test results which measure energy efficiency, energy use, or estimated annual operating cost of a covered product during a representative average use cycle or period of use, and shall not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

EISA 2007 amended EPCA to require DOE to implement a standby and off mode energy consumption measurement, if technically feasible, in test procedures where not previously present. Otherwise, DOE must prescribe a separate standby and off mode energy test procedure, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)) EISA 2007 also requires any final rule to establish or revise a standard for a covered product, adopted after July 1, 2010, to incorporate standby mode and off mode energy use into a single amended or new standard, if feasible. (42 U.S.C. 6295(gg)(3)(A)) DOE recognizes that the standby and off mode conditions of operation apply to the product covered by this rulemaking. In response to this requirement, DOE proposes adopting provisions in the test procedures to address standby and off mode as discussed in section III.E.5 of this proposed rulemaking.

### C. Rulemaking Background

DOE adopted a test procedure for TVs on June 29, 1979, codified at 10 CFR part 430, subpart B, appendix H. 44 FR 37938. In May 2008, DOE received petitions from both the California Energy Commission (CEC) and the Consumer Electronics Association (CEA), which were drafted in light of the June 13, 2009, Federal Communications Commission (FCC) transition from analog to digital broadcast transmissions for TVs<sup>1</sup>. As of June 12, 2009, the Digital Transition and Public Safety Act of 2005 required that all broadcasting stations transmit in digital to make analog frequencies available for public safety communications<sup>2</sup>. Both the CEC and the CEA petitioned for repeal of the regulatory provisions establishing the test procedure. CEC's petition stated that the old test procedure was not capable of accurately measuring the energy consumption of modern TVs because TV broadcasting is no longer transmitted via an analog signal<sup>3</sup>. In addition, the CEA petitioned for DOE's adoption of the International Electrochemical Commission's (IEC) test procedure IEC 62087-2008, "Methods of measurement for the power consumption of audio, video and related equipment." 74 FR 53641. In light of these petitions, and the fact that the previous test procedure was largely obsolete for today's products because of the mandated transition from analog to digital signal transmission, DOE repealed the test procedure on October 20, 2009. The test procedure DOE is proposing today seeks to rectify the problem with the old test procedure by allowing for accurate measurement of the energy consumption of modern TVs.

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<sup>1</sup> Energy Conservation Program: Repeal of Test Procedures for Televisions. 74 FR 53640 <[http://www1.eere.energy.gov/buildings/appliance\\_standards/pdfs/74fr53640.pdf](http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/74fr53640.pdf)>

<sup>2</sup> Digital transition mandated by Public Safety Act of 2005 <<http://www.fcc.gov/cgb/consumerfacts/digitaltv.html>>

<sup>3</sup> Chamberlain, William M., "Petition of the California Energy Commission to Repeal the Test Method for Television Sets in 10 C.F.R. Part 430 Subpart B." May 23, 2008. <[http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-05-15\\_workshop/other/Petition\\_of\\_The\\_CEC\\_To\\_Repeal\\_The\\_Test\\_Method\\_For\\_Television\\_Sets\\_In\\_10\\_CFR\\_Part\\_430\\_Subpart\\_B.pdf](http://www.energy.ca.gov/appliances/2008rulemaking/documents/2008-05-15_workshop/other/Petition_of_The_CEC_To_Repeal_The_Test_Method_For_Television_Sets_In_10_CFR_Part_430_Subpart_B.pdf)>

DOE notes that the National Technology Transfer and Advancement Act of 1995 (Pub. L. 104–113) directs Federal agencies to use voluntary consensus standards in lieu of Government standards whenever possible. Consequently, as described in today’s NOPR, DOE incorporates by reference in its test procedures the generally accepted test procedures or recognized industry standards, such as those issued by the IEC, the Environmental Protection Agency (EPA), or the CEA, that provide either specific aspect(s) of the test procedure, or complete test procedures, for the specified modes.

As the first step in this rulemaking to establish a new test procedure, DOE published a Request for Information on September 3, 2010, 75 FR 54048, (the 2010 RFI) requesting stakeholders to provide information and views on DOE utilizing both the IEC 62087-2008 and the ENERGY STAR Program Requirements for Televisions, Version 4.1 (ENERGY STAR v. 4.1) as reference standards for the basis of a new DOE test procedure<sup>4</sup>. DOE also solicited comments on the key issues affecting the development of a new test procedure including the following:

- 1) An appropriate method for ensuring screen brightness,
- 2) Utilizing the nine point video signal,
- 3) An appropriate method for measuring screen luminance,
- 4) Requiring testing on all preset viewing modes,

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<sup>4</sup> When the RFI was published, the most current version of EPA’s test procedure was ENERGY STAR v. 4.1 and the most recent version of the IEC-62087 was 2008. Since then, EPA has published an updated version, “ENERGY STAR Program Requirements for Televisions, Version 5.3” and the IEC has published an updated version, “IEC 62087-2011”

- 5) Testing multiple illuminance levels (specifically 10, 100, 150 and 200 lux),
- 6) An appropriate method for generating illuminance,
- 7) The best possible signal source and connection to that signal source,
- 8) An appropriate stabilization time for luminance and power measurements,
- 9) An appropriate method of testing 3D energy consumption,
- 10) Measuring download acquisition mode (DAM) power,
- 11) Measuring internet connectivity power,
- 12) Measuring power saving technology energy (including presence sensors, display power management systems (DPMS), and high-definition multimedia interface consumer electronic controls (HDMI-CEC)), and
- 13) The scope of coverage for the rulemaking. 75 FR 54048.

## **II. Summary of the Notice of Proposed Rulemaking**

In today's NOPR, DOE is proposing a new test procedure for determining the energy use of TVs. The proposed test procedure includes measuring screen luminance and testing energy consumption for active (on mode), standby, and off modes.

The luminance test is proposed to be performed by measuring the screen luminance while the TV is displaying the IEC 62087-2011 three bar video signal in both the home and retail picture settings. The luminance test is being proposed to allow the ENERGY STAR program to utilize the measurement. The on mode test will measure on mode energy consumption when the TV is displaying the IEC 62087-2011 dynamic broadcast-content video signal. If the TV is

shipped with an automatic brightness control (ABC) sensor enabled by default, on mode will be tested at various room illuminance levels. If the TV does not have an ABC sensor or the sensor is disabled by default, the test would be performed while the TV is in the home picture setting.

DOE's proposed standby test procedure incorporates both IEC 62087-2011 "Methods of measurement for the power consumption of audio, video and related equipment" and the CEA "Procedure for DAM Testing: For TVs" (CEA DAM test procedure). DOE's proposed off mode test procedure incorporates IEC 62087-2011.

Although DOE is aware of TVs with additional modes, DOE is not proposing to require testing these, but rather is simply considering these modes and requesting comment on them.

These modes include:

- 1) On mode tests for TVs with internet connectivity;
- 2) 3D mode, if capable; and
- 3) Standby-active, low mode (when the internet is enabled but the TV is in standby, and the TV is not sending or receiving external data, for those TVs with internet access).

To support its efforts in developing a Federal test procedure, DOE conducted various tests, the results of which can be found on the DOE website<sup>5</sup>. The information found on the DOE website helps support this NOPR by providing additional data and clarification. DOE conducted testing at two different testing facilities and therefore some of the data is organized according to where that data was collected. The data from test facility one is denoted with numerical values, while the data from test facility two is denoted with alphabetical letters. The test facilities were determined to produce similar results as indicated in the Round Robin Test Program Final Report for Televisions. This information, found on the DOE website<sup>6</sup>, includes the following:

- 1) **Television Test Procedure Comparison Chart** which compares key aspects of various TV standards including IEC 62087-2011, CEA 2037-2010, ENERGY STAR version 5.1, CEC, BS EN 62087 “Methods of measurement for the power consumption of audio, video, and related equipment”, and EN 62087 “Methods of measurement for the power consumption of audio, video, and related equipment”.
- 2) **Video Signal of Test Patterns Comparison Table** which compares the different advantages and disadvantages of particular video signals including the 3-bar, 9-point, DOE 5- point, and dynamic video signals. DOE assessed these video signals based on their availability, impact on average picture level (APL), affect on power limiting, and interested party input among other features.

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<sup>5</sup> The DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011. <[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

<sup>6</sup> Id.

- 3) **Room Illuminance Measurements During TV Viewing: Pilot Study** which summarizes a pilot study that DOE conducted to continuously measure room illuminance in nine homes over a period of a week or more as well as taking discrete one-off measurements at different locations in the room. This document also sets out the detailed methodology that DOE used for its pilot study.
  - a. **Room Illuminance Measurements During TV Viewing: Pilot Study Data** which includes the source data which was analyzed to develop the conclusions in the pilot study
  
- 4) **Round Robin Test Program Final Report for Televisions** that summarizes a round robin test study to assess the repeatability and reproducibility of TV energy test results. This round robin study utilized the ENERGY STAR version 5.1 test procedure across three labs and compares their results.
  
- 5) **Television Energy and Luminance Test Data Set** which includes the energy and luminance data for all of the TVs on which DOE conducted testing.
  - a) **Television Luminance Data** which includes test results for luminance testing using the 9-point (both perpendicular and off-axis measurements), 5-point Video Electronics Standards Association (VESA), and DOE 5-point video signals. DOE conducted luminance testing based on the ENERGY STAR version 5.1 test procedure but altered the video signal to determine which video signal was most appropriate. DOE used the 3-bar static video signal specified in IEC 62087 Ed.

2.0 as well as the 9-point, VESA 5-point, and DOE 5-point video signals as specified in this NOPR.

- b) **Television Luminance Stabilization Period Data** which includes graphs indicating how TV screen luminance changes over time and with respect to different stabilization periods. DOE took measurements of screen luminance after different stabilization periods to determine the most appropriate method for conducting luminance testing. DOE initially warmed-up the TVs using the method from IEC 62087-2011 and then displayed the video signal for 15 minutes to conduct the luminance measurement. The second luminance measurement was taken after a 10 minute warm-up period followed by 2 minutes of a black screen. DOE tested this stabilization period for both the IEC 3-bar and 9-point video signals.
  
- c) **Television Power Data** that includes test results for power consumption testing while TVs are in various different modes. DOE conducted this testing according to the ENERGY STAR version 5.1 test method, but adjusted specific aspects on the TV to determine the energy consumption associated with that particular feature including volume, ABC, and internet connectivity.
  
- d) **Television Internet Standby Data** which is comprised of data indicating the energy consumption when TVs are in standby mode and connected to various external sources including HDMI, cable, Ethernet, and wireless internet. DOE conducted power consumption testing according to the ENERGY STAR v. 5.3

standby test procedure while alternating the specific internet connections present on the TV.

- e) **Television 9-point Video Signal Comparison Data** that includes data depicting the difference between perpendicular and off-axis measurements while the TV is displaying the 9-point video signal. Luminance results were collected according to the ENERGY STAR version 5.1 test procedure, except that DOE altered the video signal to the 9-point video signal specified in this NOPR.
  
- f) **Television On Mode Automatic Brightness Control Data** which includes the power and luminance data for TVs tested by DOE with ABC enabled by default across various room illuminance levels. A PowerPoint which charts some of this data is also included to demonstrate the range of implementation of ABC among TVs tested by DOE. DOE conducted power consumption testing according to the ENERGY STAR v. 5.3 (with additional room lighting levels) using the IEC dynamic test clip specified in IEC 62087 Ed. 2.0. Luminance results were collected according to the ENERGY STAR version 5.1 test procedure, using the 3-bar static test pattern specified in IEC 62087 Ed. 2.0.
  
- g) **Television Download Acquisition Mode Data** which includes data indicating the energy consumption associated with DAM mode. DOE conducted this testing on two TVs by configuring the internal electronic program guide (not enabled by default) and connecting to a subscription cable service by (1) coaxial cable only,

(2) Ethernet only and (3) cable and Ethernet together. Results over a 24 hour period were recorded and charted for each connection configuration.

- h) **Television 3D Mode Data** that contains data as to TV energy consumption while in various 3D modes. This testing was conducted on five TVs under the following modes: when the TV is displaying a 3D video signal, when the TV is up-converting a 2D video signal to 3D, and when the TV is receiving a video signal from a Blu-ray player that has up-converted a 2D video signal to 3D.

DOE believes that the proposed test procedure will accurately represent the energy consumption of TVs by capturing the annual energy consumption in on mode, standby mode, and off mode. However, DOE requests comments from interested parties on improvements or changes to the proposed test procedure. DOE will consider modifications that improve the accuracy, precision of language, or other elements of the procedure and/or decrease the testing burden. In submitting comments, interested parties should state the nature of the recommended modification and explain how it would improve upon the test procedure proposed in this NOPR. Interested parties should also submit data, if any, to support their positions.

### **III. Discussion**

#### **A. Effective Date and Compliance Date of Test Procedure**

If adopted, the effective date for this test procedure would be 30 days after publication of the test procedure final rule in the Federal Register. At that time, the new metrics and any other measure of energy consumption which depends on these metrics may be represented pursuant to

the final rule. Compliance with the new test procedure for representation purposes would be required 180 days after the date of publication of the test procedure final rule. On or after that date, any such representations, including those made on marketing materials and product labels, must be based upon results generated under the final test procedure proposed to be included in Appendix H to Subpart B of 10 CFR Part 430.

Furthermore, EPCA requires the Federal Trade Commission (FTC) to prescribe labeling rules for certain covered products including TVs. (42 U.S.C. 6294(a)(2)(I)) Hence, the final DOE test procedure is required to be utilized by the FTC for labeling requirements and shall be utilized or referenced by other organizations, such as the EPA for its ENERGY STAR specification for TVs. This test procedure must also be referenced by the CEC in California and any other state regulation providing for the disclosure of information with respect to any measure of TV energy consumption once the test procedure becomes effective 30 days after the test procedure final rule publication. The final rule would supersede any existing state test procedure for TVs to the extent the state regulation requires testing in a manner other than that required by the final DOE test procedure. (42 U.S.C. 6297(a)(1))

#### B. Existing Television Test Procedures

While developing the proposed test procedure for TVs, DOE researched existing industry test procedures that measure TV energy consumption, as discussed in its 2010 RFI. 75 FR 54048, 54049. Among the most widely accepted are the IEC 62087-2011 and EPA's "ENERGY STAR

Program Requirements for Televisions, Version 5.3” (ENERGY STAR v. 5.3).<sup>7</sup> DOE also reviewed both the CEA-2037-2009 “Determination of Television Average Power Consumption” and the CEC test procedures, and noted that these test procedures are largely based on both the EPA and IEC 62087 test procedures. In response to the 2010 RFI, DOE received comments from interested parties on what they believed aspects of a robust test procedure should include, as well as on the validity of the existing test procedures that DOE reviewed and considered.

Several interested parties expressed general concerns and made suggestions pertaining to what should be considered when DOE developed its proposed test procedure. Consumer Electronics Retailers Coalition (CERC) expressed desire for a standardized test procedure and standard that are reflective of consumer use and that will not increase the cost of equipment. CERC further stated that a patchwork of state regulations, mandating different test procedures for energy consumption, different standards, or different labels, will confuse consumers with conflicting or unclear information, and ultimately be counterproductive. (CERC, No. 10 at p. 1) CERC urged DOE to adopt a single federal test procedure for TV energy consumption, because it will better inform the public and better show energy savings. (CERC, No. 10 at p. 2) Natural Resources Defense Council (NRDC) asked that DOE develop a test procedure that allows flexibility for policy makers when setting standards such as allowing policy makers to require testing at different pre-set picture settings and establishing desired luminance ratios. (NRDC, No. 5 at p. 1) Pacific Gas and Electric (PG&E) and a joint comment submitted by Southern California Gas Company, San Diego Gas and Electric Company, and Southern California

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<sup>7</sup> ENERGY STAR v. 5.3 references ENERGY STAR v. 4.2; however, for the purposes of the NOPR, all references will be made in terms of ENERGY STAR 5.3 although testing was conducted using ENERGY STAR 5.1. <[http://www.energystar.gov/ia/partners/prod\\_development/visions/downloads/television/V5.3\\_Program\\_Requirements.pdf](http://www.energystar.gov/ia/partners/prod_development/visions/downloads/television/V5.3_Program_Requirements.pdf)>

Edison, henceforth referred to as “California Investor Owned Utilities (IOUs),” expressed desire for a test procedure that accounts for all current and future TV technologies. (PG&E, No. 12 at p. 1; California IOUs, No. 9 at p. 1) Finally, Sony asked that the test procedure provide adequate guidance and meaningful power consumption data without forcing manufacturers to perform unnecessary, burdensome, and costly activities. (Sony, No. 8 at p. 4)

Environment Northeast (ENE) also had general recommendations for DOE’s proposed TV test procedure and suggested that the test procedure should be designed so that the test results reflect energy consumption in the field to the maximum extent possible. (ENE, No. 2 at p. 1) It urged DOE to develop a test procedure that only promotes energy management features that deliver significant savings in the field. (ENE, No. 2 at p. 1) ENE commented that energy consumption should be measured under a range of values (rather than using average values for ambient illumination, viewing distances and angles, and user adjustments to settings) and that the average expected energy consumption of a model in the field be calculated. (ENE, No. 2 at p. 1) ENE believes that a test procedure that adheres to its direction will provide more accurate results and reduce the likelihood of manufacturers "designing to the test". (ENE, No. 2 at p. 1) Finally, ENE urged DOE to design a test procedure that does not discourage innovation. (ENE, No. 2 at p. 1)

Other interested parties commented that DOE should use existing test procedures when developing its test procedure. NRDC stated that DOE should review and adopt key portions of IEC 62087-2008 but noted that aside from the IEC 62087-2008 dynamic broadcast-content video signal, the remaining sections of the IEC 62087-2008 test procedure are either incomplete or need revision. (NRDC, No. 5 at p. 2) CEA believes that future ENERGY STAR specifications

should conform to the DOE test procedure, and that CEA-2037-2009 is suitable for adoption now with specified discrete changes, although the CEA did not specify these discrete changes. (CEA, No. 13 at p. 2) CEA also urged DOE to adopt CEA-2037-2009 to avoid the federal government using and promoting two different test procedures. (CEA, No. 13 at p. 3) CERC commented that the CEA-2037-2009 test procedure is the best test procedure because it is most familiar to manufacturers and retailers and added that it provides a reasonably accurate, practicable, and cost-effective test procedure. (CERC, No. 10 at p. 2) SHARP urged the DOE to utilize IEC 62087-2008 and CEA-2037-2009 as a basis for its test procedure. (SHARP, No. 14 at p. 1) Finally, Mitsubishi requested that DOE adopt CEA-2037-2009 as its fundamental TV test procedure, and commented that if DOE finds that CEA-2037-2009 test procedure is inadequate, then it should base its test procedure on IEC 62087-2008. (Mitsubishi, No. 7 at p. 2)

Sony and CEC asked DOE to consider how its test procedure will affect state regulations and test procedures. Sony recommended that DOE create a test procedure that supersedes state regulations, while CEC believes that DOE should consider how its test procedure will preempt CEC's test procedure. (Sony, No. 8 at p. 4) Specifically, CEC urged DOE to measure on mode power, standby-passive power, power factor, and luminance to ensure that the CEC can also require this testing. (CEC, No. 15 at p. 4)

In addition to considering stakeholder comments, DOE also conducted research and validation testing, which consisted of on, standby, and off mode energy consumption testing as well as luminance testing. The results of this research indicated that the IEC 62087-2011 could

be utilized with some modifications as it would adequately measure TV energy consumption<sup>8</sup>. DOE proposes a test procedure for TVs that uses IEC 62087-2011 as a basis, with additional detail and modifications, most of which are seen in ENERGY STAR v. 5.3. DOE believes this is consistent with the requests of many commenters, who recommended using IEC 62087-2011 and CEA-2037-2009, which references the IEC 62087 test procedure. DOE based the proposed luminance measurement on the one found in ENERGY STAR v. 5.3.

### C. Scope

#### 1. Products Covered by This Rulemaking

In the 2010 RFI, DOE requested comments on the scope of the TV test procedure rulemaking. DOE received comments highlighting the similarities and differences between displays, TVs, and digital picture frames and the coverage of the test procedure. Unlike TVs, displays and digital picture frames do not have a TV tuner and therefore cannot receive digital broadcast content. While all of these technologies have the ability to display digital content they do have some differences. DOE notes that these differences are subtle, and therefore considered the possibility of including all displays in this rulemaking.

Display and TV technologies have started to converge and have become more similar in their capabilities. Given the convergence of display and TV technologies, PG&E, and the California IOUs advocated that the coverage of displays be explored in this rulemaking. They supported DOE's research into whether displays should be incorporated into the test procedure and specifically stated that DOE should study the category of displays less than 30 inches in

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<sup>8</sup> The DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011. <[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

greater detail as well as displays greater than 60 inches. (PG&E, No. 12 at p. 4; California IOUs, No. 9 at p. 4)

Other stakeholders opposed the inclusion of displays in the scope of the rulemaking. Sony asserted that TVs and displays are different in the following ways and therefore need to be tested differently. TVs have different resolutions than displays because rate conversion circuits operate differently in the two products; resolution affects power consumption in displays but not in TVs; and TVs with computer inputs do not fully comply with the VESA DPMS requirements established for displays. (Sony, No. 8 at p. 4) Rather, Sony recommended that DOE use the same definition for TVs that is used in the ENERGY STAR v. 5.3<sup>9</sup>. (Sony, No. 8 at p. 4) Panasonic also does not recommend combining TVs and displays, as they believe these are two distinct products. (Panasonic, No. 6 at p. 9) CERC commented that the scope of the test procedure should not encompass all types of TVs because professional and retail displays require high luminance, sharpness, and performance. (CERC, No. 10 at p. 3) CERC further commented that displays are designed differently than TVs due to their primary use; namely, TVs are meant to be viewed from further distances than displays. (CERC, No. 10 at p. 3) Finally, CEA commented that DOE should not include displays in its rulemaking because the IEC 62087-2011 dynamic broadcast-content video signal used for TV testing is not representative of typical content viewed on displays. (CEA, No. 13 at p. 9) SHARP recommended that DOE remain focused on TVs that are used primarily by residential consumers and that commercial displays should not be included. (SHARP, No. 14 at p. 10)

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<sup>9</sup> ENERGY STAR v. 5.3 defines TV as: A commercially available electronic product designed primarily for the reception and display of audiovisual signals received from terrestrial, cable, satellite, Internet Protocol TV (IPTV), or other digital or analog sources. A TV consists of a tuner/receiver and a display encased in a single enclosure. The product usually relies upon a cathode-ray tube (CRT), liquid crystal display (LCD), plasma display panel (PDP) which are examples of the more common display technologies.

DOE believes that some products can only be identified as TVs or displays on the basis of marketing. Some manufacturers (e.g., Samsung and LG) make identical products that are marketed separately as a display and TV<sup>10</sup>. Moreover, there exist high-definition displays sold with the option of purchasing an external tuner or speakers, which enable the customer to use the product as a TV. Modern TVs can also typically be connected to computers and function as monitors. Despite some overlap, DOE agrees with stakeholders who suggested that TVs and displays are designed differently in most instances (e.g. TVs are equipped with a tuner and displays are not). Although TVs and displays may be used interchangeably, they are designed to perform different tasks. Displays have different screen resolutions that allow for clearer text reading and are typically set up in a 4:3 aspect ratio, as opposed to TVs which are primarily set up in 16:9 aspect ratio which is optimal for displaying video. DOE acknowledges that despite the increasing overlap between these products, which may increase in the future, they currently have different usage patterns (e.g. they are used in different lighting conditions and locations as well as have different hours of operation).

The presence of a tuner is not an unequivocal distinguishing factor between TVs and other displays; however, DOE still considers it a suitable way of broadly separating products which are generally intended to be used as displays or digital picture frames from those generally intended to be used as TVs (particularly in the smaller sizes). Accordingly, DOE proposes to define TVs with reference to displays but excluding displays if they are sold without tuners. Further, DOE believes that this effectively excludes from the proposed TV test procedure most displays and digital picture frames currently on the market.

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<sup>10</sup> Personal Communication, DisplaySearch at SID Conference, May 22 2011.

TVs, unlike displays, often contain a tuner, which historically cost about \$5.50 to the manufacturer and were projected to cost around \$2.70 by the end of 2010<sup>11</sup>. Modern TVs have similar inputs to displays, and their uses are increasingly similar, with the latest TVs having USB ports, PC inputs, video inputs, Ethernet cable inputs, and inputs enabling connection with cameras and MP3 players (e.g., Samsung, Panasonic, Sony). Moreover, the latest display connection technology, High-Definition Multimedia Interface (HDMI), is expressly designed to work with both TVs and displays and does not differentiate between the two. DOE is monitoring marketplace convergence and will consider updating the definitions and scope of the TV rulemaking in the future.

Consequently, DOE is proposing to include in the scope of this rulemaking only displays of 15 inches and above which are sold with a tuner. DOE acknowledges interested party comments stating that TVs and displays capable of showing moving images are not similar in all ways. However, DOE believes that displays which are sold with a tuner are used in the same manner as TVs, and is also taking into consideration that EPA requires displays to be tested with IEC 62087 Dynamic broadcast content. DOE welcomes comment on the proposed scope of this rulemaking, particularly the inclusion of certain types of displays. (See Issue 1 in section V. E "Issues On Which DOE Seeks Comment").

## 2. Definition of Television Sets

TVs are a covered product under 42 U.S.C. 6292(a)(12) of EPCA. DOE has the authority to adopt test procedures for such covered products under 42 U.S.C. 6293(b)(2) of EPCA.

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<sup>11</sup> Quarterly LCD TV Cost & Price Forecast Model Report: Q1'11 History with Q2'11-Q4'15 Forecast. Rep. DisplaySearch, 2010

Further, 42 U.S.C. 6295(l)(3) of EPCA specifically grants DOE the authority to promulgate energy conservation standards for TVs. There are no statutory definitions for TVs under EPCA. In 1979 DOE adopted the following regulatory definitions for TVs (44 FR 39798, June 29, 1979), which are set forth in 10 CFR 430.2:

Television set: means a color television set or a monochrome television set.

Color television set means an electrical device designed to convert incoming broadcast signals into color television pictures and associated sound.

Monochrome television set means an electrical device designed to convert incoming broadcast signals into monochrome television pictures and associated sound.

Similar to DOE's recently repealed test procedure (74 FR 53640, October 20, 2009), the current DOE definitions for TVs, developed in 1979, are no longer appropriate and are proposed to be updated as part of this rulemaking. The definition refers to both color TVs and monochrome TVs (also known as black-and-white TVs, which are rarely produced for the mass market today) and with the evolution of technology, these definitions are too broad to adequately define the products covered by this rulemaking. Since the digital switch-over in 2009, analog TVs can no longer receive broadcast signals without an external digital tuner. Accordingly, the definitions require updating in order to reflect the realities of modern TVs and technological developments, including the convergence of display and TV technology, and to avoid the proposed rule being rendered ineffective.

DOE notes that at the time the Department repealed the test procedure for TVs (74 FR 53640, October 20, 2009), it also considered amending the definition of TVs on the basis of the transition to digital TV and found this factor in isolation to be an insufficient reason to amend the definition. At that time, the Department had not taken into account other factors, including, rapid technology changes, the changing focus away from transmission towards display technology and the phenomenon of TV and display technology convergence. The combination of these factors which are currently evident in this product market have led DOE to preliminarily determine that a revised definition of TVs is required.

CEA asked that DOE develop a definition of TVs that excludes battery-powered TVs because they inherently are designed for efficiency so as to improve battery life. CEA stated that battery-powered TVs are different from typical TVs that require AC or main power supplies in their technology and usage patterns. (CEA, No. 13 at p. 9) Additionally, CEA commented that displays used for commercial applications and those that fully function on battery-power should not be included in the scope of coverage. CEA further observed that portable and handheld displays are designed to be power efficient and should therefore not be included in the scope of coverage.

In today's NOPR, after reviewing TV, display, digital picture frame market trends, and accessory technologies, as well as other industry definitions from IEC, EPA, and CEA, DOE is proposing an updated definition for TVs; one that it believes will not become obsolete with rapid changes in technology. Accordingly, a broad technology-neutral definition is proposed that includes all TVs and displays above 15 inches which are sold with a TV tuner. This definition also includes products that incorporate internal media readers (e.g. TV DVD combination units)

while excluding laptop monitors, monitors having integrated computers (all-in-one integrated desktops), digital picture frames, and TVs operable by battery-power. The exclusion of these products is based upon DOE's belief that these products do not represent the typical TV usage and therefore should not be included in this definition. DOE has determined the typical TV usage as a product that is commonly used seven hours a day<sup>12</sup> to watch dynamic visual information. Consequently, DOE proposes the following definition to subpart A of 10 CFR 430.2:

Television set (also referred to as "TV"): A product designed to be powered primarily by mains power having a diagonal screen size of fifteen inches or larger that is manufactured with a TV tuner, and that is capable of displaying dynamic visual information from wired or wireless sources including but not limited to:

- (1) Broadcast and similar services for terrestrial, cable, satellite, and/or broadband transmission of analog and/or digital signals; and/or
- (2) Display-specific data connections, such as Video Graphics Array (VGA), Digital Visual Interface (DVI), High-Definition Multimedia Interface (HDMI), DisplayPort, used typically for a computer or workstation that is not physically attached to the display; and/or
- (3) Media storage devices such as a USB flash drive, a memory card, or a DVD; and/or

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<sup>12</sup> The Nielsen Company, LLC (2011).

(4) Network connections, usually using Internet Protocol, typically carried over Ethernet or WiFi.

A TV may contain, but is not limited to, one of the following display technologies: liquid crystal display (LCD), light-emitting diode (LED), cathode-ray tube (CRT), and plasma display panel (PDP). TVs also include TV Combination Units that DOE has further defined in appendix H to subpart B of this part.

DOE notes that this proposed definition also includes TV combination units which are TVs that incorporate additional devices such as a digital video disc (DVD) player, Blu-ray player, hard disk drive (HDD), or videocassette recorder (VCR). These products maintain the general purpose of a TV but are combined with additional features.

### 3. Other Definitions

DOE's proposed test procedure for TVs incorporates definitions from IEC 62087-2011 and ENERGY STAR v. 5.3. DOE is also proposing to add its own definitions, which were neither addressed by IEC 62087-2011 nor ENERGY STAR v. 5.3, and feels the proposed definitions are necessary.

Specifically, DOE proposes to include the following defined terms found in IEC 62087-2011: "additional functions," "off mode," "standby-active, high mode," "standby-active, low mode," and "standby-passive mode." DOE is aware that section 42 USC 6295(gg)(1) of EPCA defines on, standby, and off modes, but believes that the proposed IEC 62087-2011 definitions provide added clarification to the test procedure. Second, DOE proposes to include the following

defined terms found in ENERGY STAR v. 5.3: “download acquisition mode,” “luminance,” “on mode,” and “TV combination unit.” For the reasons discussed below, DOE also proposes to develop new definitions for “home picture setting” and “retail picture setting.”

a. Definitions Incorporated from IEC 62087-2011

DOE is proposing to define “additional functions” using the definition found in IEC 62087-2011. DOE is proposing to define “additional functions” because many TVs are now equipped with a wide variety of features, such as DVD players, memory card readers, music player inputs, that are not standard among different manufacturers and models. Furthermore, DOE believes that this definition from IEC 62087-2011 is appropriate because it is clear, concise and widely accepted as an industry definition. The definition for additional functions found in IEC 62087-2011 also has not been redefined by any of the later published TV industry standards. Accordingly, DOE is proposing to define this term in section 2.1 (additional functions) of appendix H to subpart B of 10 CFR part 430 as follows:

Additional functions: Additional functions are functions that are not required for the basic operation of the device. Additional functions include, but are not limited to a VCR unit, a DVD unit, a HDD unit, a FM-radio unit, a memory card-reader unit, or an ambient lighting unit.

DOE is proposing to define “off mode” using the definition found in IEC 62087-2011, rather than the definition provided in ENERGY STAR v. 5.3. Although ENERGY STAR v. 5.3 also defines off mode, DOE believes the definition is too broad. Specifically, the ENERGY STAR v. 5.3 definition requires that an indicator be present that shows that the product is in off

mode, a clause that is not included in the IEC 62087-2011 definition. Accordingly, DOE is proposing to define this term in section 2.9 (off mode) of appendix H to subpart B of 10 CFR part 430 as follows:

Off mode: Off mode is the mode where the appliance is connected to a power source, produces neither sound nor picture and cannot be switched into any other mode with the remote control unit, an external or internal signal.

DOE is proposing a test for standby-passive mode in this NOPR and thus provides a definition for the mode. DOE is proposing to define “standby-passive mode” by using the IEC 62087-2011 definition for standby-passive. This standby-passive mode test is being proposed to capture the energy consumption associated with the TV when it produces neither sound nor picture. DOE believes that IEC has clearly and appropriately defined standby-passive mode. DOE is proposing to define this term in section 2.12 (standby-passive mode) of appendix H to subpart B of 10 CFR part 430 as follows:

Standby-passive mode: Standby-passive mode is the mode in which the appliance is connected to a power source, produces neither sound nor picture but can be switched into another mode with the remote control unit or an internal signal.

DOE is proposing to define “standby-active, high mode” consistent with the IEC 62087-2011 definition for standby-active, high. IEC’s definition clearly and accurately captures the state of the TV while in standby-active, high mode. DOE is proposing a definition for standby-active, high, since DOE is also proposing a test in the standby-active, high mode. Standby-active,

high mode would cover TVs when they are switched off with a remote, but remain active in some manner. This includes TVs that are downloading information from the internet or cable while switched into standby mode. Accordingly, DOE is proposing to define this term in section 2.13 (standby-active, high mode) of appendix H to subpart B of 10 CFR part 430 as follows:

Standby-active, high mode: The appliance is connected to a power source, produces neither sound nor picture but 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 and is exchanging/receiving data with/from an external source.

DOE is proposing to define “standby-active, low mode” consistent with the IEC 62087-2011 definition for standby-active, low. Although DOE is not proposing a test in the standby-active, low mode, DOE is still proposing a definition for standby-active, low to remain consistent with IEC 62087-2011 and to ensure that this particular mode is not tested. DOE has reviewed existing industry definitions, TV technology, and TV operating modes and believes that IEC 62087-2011 clearly separates distinct TV operating modes and defines each of these modes appropriately. Standby-active low mode would cover TVs when they are switched off with a remote and can be switched into other modes via an external signal. Accordingly, DOE is proposing to define this term in section 2.14 (standby-active, low mode) of appendix H to subpart B of 10 CFR part 430 as follows:

Standby-active, low mode: The appliance is connected to a power source, produces neither sound nor picture but 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.

b. Definitions Incorporated from ENERGY STAR v. 5.3

DOE proposes to include a definition for “download acquisition mode” (otherwise known as DAM) in its test procedure that is identical to the definition found in ENERGY STAR v. 5.3. The DAM involves a TV’s download of data while it produces neither sound nor picture. The definition allows readers to more clearly understand the DAM energy consumption test procedure. The energy consumption associated with DAM is measured when the TV is downloading information from an electronic program guide (EPG). DOE also believes that the ENERGY STAR v. 5.3 definition is appropriate because it is a widely accepted industry definition and the term is not defined in IEC 62087-2011. Accordingly, DOE is proposing to define this term in section 2.3 (download acquisition mode) of appendix H to subpart B of 10 CFR part 430 as follows:

Download acquisition mode: Download acquisition mode is the power mode in which the product is connected to a mains power source, produces neither sound nor picture, and is actively downloading data. Data downloads may include channel listing information for use by an electronic programming guide, TV setup data, channel map updates, firmware updates, monitoring for emergency messaging/communications or other network communications.

DOE is proposing to define “luminance” by incorporating the definition found in ENERGY STAR v. 5.3. DOE believes that the ENERGY STAR v. 5.3 definition is appropriate

because it is widely accepted within the industry and the term is not defined in IEC 62087-2011. Further, the ENERGY STAR v. 5.3 definition is appropriate because DOE is proposing the luminance ratio so that it may be used in the ENERGY STAR test procedure. The ENERGY STAR v. 5.3 definition is clear and concise and provides the manufacturer with a thorough understanding of what is meant by luminance to allow for luminance testing. Accordingly, DOE is proposing to define this term in section 2.8 (luminance) of appendix H to subpart B of 10 CFR part 430 as follows:

Luminance: Luminance is 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<sup>2</sup>).

DOE is proposing to define “on mode” using the definition found in ENERGY STAR v. 5.3, rather than the definition provided in IEC 62087-2011. ENERGY STAR v. 5.3 defines “on mode” more broadly, stating that the TV can be providing “one or more of its primary functions.” On the other hand, the IEC 62087-2011 definition specifies that the TV must be producing both sound and picture. Although many TVs will produce sound and picture, DOE’s proposed scope may include units that are not able to produce sound (e.g. computer monitor that does not include speakers). Because DOE does not want to prevent those products from being tested in the “on mode”, DOE is proposing to exclude any references to sound consistent with the definition from ENERGY STAR v. 5.3 in section 2.10 (on mode) of appendix H to subpart B of 10 CFR part 430 as follows:

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

DOE is proposing to define “TV combination unit” using the definition found in ENERGY STAR v. 5.3. IEC 62087-2011 defines multi-function equipment, which may be considered similar to TV combination unit, but this term is not specific to TVs. Defining the term TV combination unit provides clarity to the test procedure since these particular TVs may require special consideration when being tested. Accordingly, DOE is proposing to define this term in section 2.16 (TV combination unit) of appendix H to subpart B of 10 CFR part 430 as follows:

TV combination unit: TV combination unit is a television in which the TV and one or more additional devices (e.g., DVD player, Blu-ray Disc player, Hard Disk Drive) are combined into a single enclosure, and which meets the following criteria: a) it is not possible to measure the power of the individual components without removing the product housing; and b) the product connects to a wall outlet via a single power cord.

#### c. New Definitions for Incorporation

DOE is proposing to define “home picture setting” in its test procedure. DOE developed this definition because neither IEC 62087-2011 nor ENERGY STAR v. 5.3 provides a definition for this particular setting. ENERGY STAR v. 5.3 does reference a home mode (or default mode), as the mode in which the TV is shipped. In order to eliminate confusion between picture settings and testing modes (such as on mode, standby mode, and off mode), defining home picture setting helps clarify how to conduct both the luminance and on mode tests since home picture setting is utilized for conducting part of the luminance test as well as the on mode test. DOE believes that

defining home picture setting will improve the consistency in which products are tested across labs. DOE is proposing to define this term in section 2.4 (home picture setting) of appendix H to subpart B of 10 CFR part 430 as follows:

Home picture setting: (or default picture setting) is the picture setting which is recommended by the manufacturer from the initial set up menu or the mode that the television comes shipped in if no setting is recommended.

Finally, DOE is proposing to define “retail picture setting” in its proposed test procedure. Retail picture setting is a picture setting present on most TVs and corresponds to the brightest preset selectable picture setting. Although ENERGY STAR v. 5.3 uses the term retail mode in its specification, it does not provide a definition of this mode. So as not to confuse picture settings with testing modes (such as on mode, standby mode, and off mode), DOE is proposing to utilize the term “retail picture setting” instead of the term “retail mode”. In the proposed DOE test procedure, retail picture setting is one of the two picture settings that the TV is set to for luminance testing. Therefore, DOE believes that defining retail picture setting clarifies the requirements of the test procedure. DOE is proposing to define this term in section 2.11 (retail picture setting) of appendix H to subpart B of 10 CFR part 430 as follows:

Retail picture setting: is the preset picture setting in which the TV produces the highest luminance during the on mode conditions.

#### D. Testing Conditions and Instrumentation

##### 1. Accuracy and Precision of Measurement Equipment

a. Power Supply

In this NOPR, DOE is proposing a slightly modified version of the power supply specifications from IEC 62087-2011. DOE proposes to limit the input voltage and frequency used in its test procedure to 115 V at 60 Hz, rather than including a general requirement that the TV be tested at “the nominal voltage of the region,” as in IEC 62087-2011. DOE is also proposing to add a power factor measurement requirement. The power factor measurements are based on those found in IEC 62087-2011 as well as ENERGY STAR v. 5.3.

DOE is also proposing certain specifications for test tolerances. First, DOE is proposing to incorporate tolerances for voltage and frequency identical to those in ENERGY STAR v. 5.3, which specifies that the voltage and frequency be maintained at  $\pm 1$  percent rather than  $\pm 2$  percent, as required by IEC 62087-2011. DOE believes that this will not impose undue burden because many interested parties are already accustomed to these more stringent specifications required to meet ENERGY STAR specifications. Second, DOE is proposing to add a tolerance of power measurements consistent with that in ENERGY STAR v. 5.3. As mentioned above, ENERGY STAR v. 5.3 refers the reader to ENERGY STAR v. 4.2 where these specifications can be found. Third, DOE is proposing to add the requirements for total harmonic distortion (THD) consistent with that in IEC 62087-2011, which requires that the harmonic components not vary by more than 5 percent. While ENERGY STAR v. 5.3 has requirements for THD that are more stringent (2 percent), DOE believes that these requirements may impose undue burden on manufacturers by requiring the purchase of more expensive equipment. DOE believes that the cost of more expensive equipment (e.g., a power supply unit as found by market research) outweighs the benefits of stricter THD requirements, therefore less stringent requirements are being proposed. DOE believes that the requirements that it is proposing to incorporate are

accepted within industry and are sufficient to ensure a repeatable and reproducible test procedure. THD impacts the quality and stability of the electricity being received by the TV which can impact energy consumption. High levels of THD can increase current draw on TVs resulting in high circuitry temperatures and inefficiencies. The language proposed to ensure that the correct power is being supplied to the TV is being incorporated in section 3.1.1 (power supply) of appendix H to subpart B of 10 CFR part 430 is as follows:

Carry out measurements using a power supply providing voltage of 115 V at 60 Hz..

The fluctuation of the voltage supplied during the tests shall not exceed  $\pm 1$  percent. The frequency fluctuation and the harmonic components of the supplied power shall not exceed  $\pm 1$  percent and 5 percent respectively.

b. Power Meter

DOE is proposing to incorporate specifications for the power meter used to collect the power data for the TV test. DOE plans to slightly modify the specification found in IEC 62087-2011 to include more guided instructions on the sampling rate. Rather than setting the sampling rate “high enough to achieve an accurate measurement” as required in IEC 62087-2011, DOE is proposing that samples be taken once per second or more frequently. This sampling rate is generally accepted by the industry and found in IEC 62301-2011. This sampling rate should not be difficult to accomplish and produces a more repeatable power measurement than the measurement specified in IEC 62087-2011. Specifying the proposed sampling rate decreases the chances of missing trends and power spikes. The duration of testing remains the same and typically only a few changes to the data acquisition program are required to modify the sample

rate. The language proposed to ensure that the correct power measurements are taken is being incorporated in section 3.1.2 (power meter) of appendix H to subpart B of 10 CFR part 430 is as follows:

The measurement shall be carried out directly by means of a wattmeter, a wattmeter with averaging function, or a watt-hour meter, by dividing the reading by the measuring time. For TVs for which the input video signal varies over time, use a wattmeter with an averaging function to carry out the measurement.

The language proposed to ensure that the correct sampling rate for which the power measurements shall be taken is being incorporated in section 3.1.2.1 of appendix H to subpart B of 10 CFR part 430 is as follows:

The sampling rate of the watt-hour meter or wattmeter with averaging function shall be one measurement per second or more frequent.

The language proposed describing the power measurement uncertainty is being incorporated in section 3.1.2.3 of appendix H to subpart B of 10 CFR part 430 is as follows:

Power measurements of 0.5 W or greater shall be made with an uncertainty of less than or equal to 2 percent (at the 95 percent confidence level). Measurements of power of less than 0.5 W shall be made with an uncertainty of less than or equal to 0.01 W (at the 95 percent confidence level). The power measurement instrument shall have a resolution of:

- 0.01 W or better for power measurements of 10 W or less;
- 0.1 W or better for power measurements of greater than 10 W up to 100 W;
- 1 W or better for power measurements of greater than 100 W.

DOE is also proposing to require that, as part of the test procedure, the power factor of the TV be recorded while in “on mode” consistent with that in ENERGY STAR v. 5.3. DOE believes that requiring a power factor measurement will not impose undue burden on manufacturers because the ability to measure power factor is widely available on power meters. The power factor measurement only requires that the power factor be recorded while the on, standby, and off modes are measured. DOE is proposing to require this measurement because power quality can impact energy consumption and measuring the power factor will allow other regulating bodies the flexibility to consider requirements for power quality. The language proposed to ensure that the power factor and real power consumed are taken is being incorporated in section 3.1.2.2 of appendix H to subpart B of 10 CFR part 430 is as follows:

The power measurement instrument used shall measure the power factor and the real power consumed regardless of the power factor of the device under test.

#### c. Light Measurement Devices

##### i. Luminance Contact and Distance Meters

Light measurement devices (LMDs) are used to measure the luminance of the TV screen. DOE is aware of two primary categories of LMDs that are used to make luminance

measurements: contact meters and distance meters. In response to the 2010 RFI, DOE received comments advocating that the DOE test procedure for TVs allow the use of the contact meter to measure luminance. Panasonic stated that although there are many valid methods of measurement, a contact measurement is easier to comply with since it prevents ambient light from interfering with the measurement and eliminates the need for a dark room. (Panasonic, No. 6 at p. 4) NRDC also supports the contact method of measuring luminance as it simplifies the performance of the test due to it being unnecessary to adjust the room lighting levels. (NRDC, No. 5 at pp. 4--5)

In this NOPR, DOE is proposing to allow the use of either a distance meter or a contact meter to measure luminance for purposes of the DOE test procedure, so long as the meter meets the specifications detailed in section III.D.1.c.ii of the NOPR. DOE is aware that each type of meter has specific advantages. While distance LMD meters are typically less accurate and require the use of a dark room for luminance measurements, they are less expensive than contact LMD meters. DOE is also aware that the use of a dark room adds burden to the procedure by increasing both cost and set-up time. Alternatively, the use of a contact LMD meter would reduce set up time (with regard to both aligning the meter as well as removing the need for a dark room) and will have a more accurate measurement since these meters typically have a higher accuracy; however, contact meters themselves are more expensive. Through testing, DOE has learned that the two types of meters yield similar results when used to test TVs<sup>13</sup>. Therefore, in section 3.1.3 (light measurement device) of appendix H to subpart B of 10 CFR part 430, the test procedure allows the use of either meter as long as it meets the specifications outlined below.

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<sup>13</sup> This similarity of results can be found in the Round Robin Test Program Final Report for: Television at the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011. <[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

By allowing the use of different meters it provides more flexibility, while ensuring the accuracy of the measurement and providing comparable results.

## ii. Light Measurement Device Specifications

In this NOPR, DOE is proposing to incorporate specifications for the LMDs used in performing the test procedure. Neither IEC 62087-2011 nor ENERGY STAR v. 5.3 provides specific requirements with respect to LMDs. Consequently, DOE has developed proposed specifications for today's NOPR. To develop these, DOE researched existing test procedures and standards that provide LMD specifications. DOE has found that the VESA Flat Panel Display Measurements Standard v. 2 provides tolerances for LMDs. VESA specifies that the luminance must be within  $\pm 5$  percent and repeatability must be less than  $\pm 0.5$  percent of the luminance or the uncertainty introduced by any digitalization over a five minute period. DOE also researched available LMDs for testing to develop the following proposed requirements.

DOE is proposing, in section 3.1.3 (light measurement device) of appendix H to subpart B of 10 CFR part 430, that all LMDs have an accuracy of  $\pm 2$  percent ( $\pm 2$  digits) of the digitally displayed value and repeatability within 0.4 percent ( $\pm 2$  digits) value. DOE is also proposing that the LMD should have an acceptance angle of 3 degrees or less. To determine the precision of a measured number, the displayed value on the measuring device needs to be taken into consideration. The increment of the last significant digit is said to be the accuracy of the display and 2 digits is twice the interval. The overall tolerance of LMDs is found by taking (+/-) the absolute sum of 2 percent and 2 significant digits of the measured value.

DOE believes that these criteria are sufficiently stringent to ensure that measurements will be repeatable and accurate, without imposing burden on manufacturers by requiring overly precise measurement devices. However, DOE welcomes comments on the proposed LMD specifications. (See Issue 2 in section V.E "Issues On Which DOE Seeks Comment").

## 2. Test Room and Set-Up Criteria

DOE received comments from interested parties requesting that it clarify how to set up the TV for testing. Specifically, NRDC requested that DOE review the requirements in IEC 62087-2008 and urged DOE to provide sufficient clarity on preparing the TV before testing. (NRDC, No. 5 at p. 2) DOE has analyzed IEC 62087-2008 as NRDC requested and found that the requirements in IEC 62087-2008 are similar to those found in IEC 62087-2011. PG&E and California IOUs also requested that DOE require a standard test set-up that ensures the most robust results possible. (PG&E, No. 12 at p. 3; California IOUs, No. 9 at p. 3) DOE has analyzed both IEC 62087-2011 and IEC 62087-2008, and has evaluated other existing TV test procedures to develop proposals for creating dark room conditions, ambient temperature and humidity, THD, and signal source generation, with the goal of ensuring repeatable results. The proposals are discussed in detail in the following sections.

### a. Dark Room Conditions

DOE is proposing that, if the lab technician elects to use a distance meter for luminance testing, it must make the measurements in dark room conditions, similar to the requirement in ENERGY STAR v. 5.3. DOE is proposing, in section 4.2 (dark room conditions) of appendix H to subpart B of 10 CFR part 430, language from the requirement in ENERGY STAR v. 5.3, which (with minor modification), states: "All luminance testing shall be performed in dark room

conditions. Display screen illuminance...as measured with the UUT in [o]ff [m]ode shall be less than or equal to 1.0 lux.”

#### b. Ambient Temperature and Humidity

DOE is proposing ambient conditions consistent with IEC 62087-2011 and ENERGY STAR v. 5.3, which both require that ambient temperature be  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ . ENERGY STAR v. 5.3 further specifies that relative humidity must be between 10 and 80 percent, which DOE is also proposing to require in its test procedure. Because these are both widely accepted test methods, and each of the temperature and humidity ranges is quite large, these requirements should be reproducible across a wide range of test laboratories. These ambient condition requirements are being proposed in sections 4.3 (ambient temperature conditions) and 4.4 (ambient relative humidity conditions) of appendix H to subpart B of 10 CFR part 430.

#### c. Signal Source and Generation

In the 2010 RFI, DOE requested feedback from interested parties regarding the signal source as well as the input cable to be used when testing. 75 FR 54048, 54050. As discussed below, interested parties were generally in agreement that the input cable should be HDMI, if the TV has an HDMI input. If the TV does not have an HDMI input, DOE has proposed a list of alternative connections in the order in which they should be used to conduct testing, which can be found below. Interested parties were also in support of using a Blu-ray player as the signal source for testing.

Mitsubishi, Sony, LG, NRDC, Panasonic, CEA, CEC, PG&E, and California IOUs were all in support of DOE using HDMI as its preferred input cable. Mitsubishi recommended that

DOE require an HDMI cable be used if the input exists and component cables be used if HDMI inputs do not exist. (Mitsubishi, No. 7 at p. 5) Sony similarly commented that a HDMI input cable should be the preferred input cable, and if it not available, the next highest resolution input should be used. (Sony, No. 8 at p. 3) LG supported using an HDMI input cable because it has a digital signal and other sources have calibration issues. (LG, No. 3 at p. 1) NRDC recommended that DOE use a HDMI input cable if the input is available. If not available, then a component input cable should be used. NRDC also stated that VGA connectors should not be allowed to serve as the means to input the content. (NRDC, No. 5 at p. 6) Panasonic agreed that a HDMI input cable should be used if available. (Panasonic, No. 6 at p. 6) CEA agreed that a HDMI input cable should be used if it is available, but stated that variation between different inputs is minor. (CEA, No. 13 at p. 7) CEA further commented that it is vital to allow various different input cables to be used because some TVs are produced with neither a HDMI input nor a component input. (CEA, No. 13 at p. 7) Ecos Consulting found in its previously cited report the effect of different input cables on the test results. Their report recommended that an HDMI input cable be used for testing because it produced similar results to a standardized signal generator unlike component and VGA inputs<sup>14</sup>.

As outlined above, comments from all interested parties agreed that an HDMI input should be the preferred input. Some interested parties also advocated that alternative inputs should be allowed if an HDMI input is not available. DOE acknowledges that all TVs may not be shipped with an HDMI input available, and therefore is proposing the following order for inputs:

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<sup>14</sup>Calwell, Chris, Mercier, Catherine, & Foster-Porter, Suzanne. Assessment of Options for Improving Energy Efficiency Test Procedures for Display. (Last accessed July 26, 2011).  
<[http://www.efficientproducts.org/%5Creports%5Ctvs%5CEcos\\_Display%20Test%20Procedure%20Report\\_FINALE.pdf](http://www.efficientproducts.org/%5Creports%5Ctvs%5CEcos_Display%20Test%20Procedure%20Report_FINALE.pdf)>

HDMI/DVI, VGA, component, S-Video, and finally composite. If none of these inputs are available, the highest resolution input must be used. DOE believes that by proposing an input format hierarchy, it will ensure consistency and repeatability between tests without imposing undue burden upon manufacturers. However, DOE welcomes comments on the purposed input formats hierarchy. (See issue 14 in section V.E “Issues on Which DOE Seeks Comments”)

DOE also received comments on the signal source to be used for testing. NRDC commented that a signal should not be generated by a personal computer (PC). NRDC preferred that a standard method of generating signal be used, but did not specify what the preferred method should be. (NRDC, No. 5 at p. 6) Panasonic believes that the Blu-ray player is the most appropriate device to supply the IEC 62087-2008 dynamic broadcast-content video signal, which is the same as the IEC 62087-2011 dynamic broadcast-content video signal. (Panasonic, No. 6 at p. 6) CEC concurs with the recommendations made in the report done by Ecos Consulting regarding signal sources, which recommends a signal generator with an HDMI input connection. (CEC, No. 15 at p. 3) PG&E and California IOUs also cited the report done by Ecos Consulting, but commented that DOE should conduct additional testing on various size TVs with different display technologies to confirm the proper signal source. (PG&E, No. 12 at p. 3; California IOUs, No. 9 at p. 3) SHARP recommended that DOE not require a specific signal source like CEA-2037-2009. (SHARP, No. 14 at p. 7) SHARP commented that there should be no dependency on the nature of the source (Blu-ray player, computer, etc), as long as the decoder and signal are properly implemented according to existing and well-known standards. (SHARP, No. 14 at p. 7)

The IEC 62087-2011 dynamic broadcast-content video signal, which is discussed further in section III.E.3.a of this NOPR, is supplied in two formats for testing, DVD and Blu-ray. DOE acknowledges interested party comments recommending that a particular signal source should not be used but believes that establishing a specific signal source will increase repeatability and reproducibility. As some commenters requested, DOE is proposing to require testing using a Blu-ray player. The TV market is moving towards watching TV in high-definition, as evidenced by increased production of high definition TVs and broadcasting of high definition channels. Blu-ray players produce a 1080p image that yields far more detail than the 480p image provided by DVD; therefore, DOE is proposing that it be used for testing. DOE welcomes comments on the signal source and generation specifications proposed in this NOPR. (See Issue 3 in section V.E "Issues On Which DOE Seeks Comment").

#### E. Test Measurements

As previously mentioned, DOE is proposing a test procedure largely based on IEC 62087-2011, with some modifications to improve the repeatability as well as tailor the procedure to the U.S. market. DOE is proposing that the following test measurements be taken as described in the following sections.

##### 1. Picture Settings to Test

In the 2010 RFI, DOE requested comment on testing the TV in multiple power consuming modes. For luminance testing, ENERGY STAR v. 5.3 requires that the TV be tested in two picture settings: home mode and retail mode. As stated earlier, DOE is proposing to replace the terms home mode and retail mode (as used in ENERGY STAR v. 5.3) with home picture setting and retail picture setting. This is to distinguish the luminance picture setting from

the testing modes for energy consumption. IEC 62087-2011 does not reference luminance testing. Alternatively, for power testing, both IEC 62087-2011 and ENERGY STAR v. 5.3 require that TVs be tested only in the home picture setting. DOE received comments and is considering testing energy consumption in picture settings other than the home picture setting.

Numerous commenters informed DOE that only a limited number of consumers switch their TVs out of the home picture setting, and therefore DOE should only require testing in the home picture setting. Other interested parties suggested that DOE analyze all preset picture settings to determine the energy consumption of all possible picture settings. Mitsubishi commented that manufacturer statistics show that less than 5 percent of TV viewers ever utilize non-default display settings. (Mitsubishi, No. 7 at p. 2) PG&E and California IOUs stated that DOE should collect and analyze available technologies (e.g., LCD, plasma) in several selectable preset picture settings: the dimmest setting, home setting, and retail setting. (PG&E, No. 12 at p. 1; California IOUs, No. 9 at pp. 1-2) PG&E and California IOUs also urged DOE to develop the test procedure such that any preset picture setting may be measured using the procedure. (PG&E, No. 12 at p. 2; California IOUs, No. 9 at p. 2) Finally, they suggested that the DOE should obtain and analyze data on consumer home viewing habits. (PG&E, No. 12 at p. 2; California IOUs, No. 9 at p. 2) SHARP commented that because consumers do not adjust their TV settings and it is not possible to predict the popularity of each picture setting, multiple picture settings should not be tested. (SHARP, No. 14 at p. 4)

DOE also received comments desiring that only the home picture setting should be used for testing. SHARP stated that there are no reliable data on the popularity of modes that can be applied across the industry, and, therefore, the out-of-the-box setting remains the best predictor

of actual power use. (SHARP, No. 14 at p. 3) Sony commented that there is little information regarding consumer preferences for preset picture settings. Sony's call center data indicates that more than 95 percent of returned sets remain in the home picture setting when received, while information obtained during CEC's rulemaking process suggests that consumers tend to use the home picture setting. (CEC, No. 15 at pp. 2--3 and Sony, No. 8 at p. 2) NRDC commented that to the extent a TV has a "forced" set up menu; the test should be performed on the TV as shipped after selecting the home picture setting in the menu. (NRDC, No. 5 at p. 3) CERC believes that the test procedure should focus on the energy consumption of TVs in the home picture setting due to the difference in room lighting and energy consumption of TVs in retail and home settings. (CERC, No. 10 at p. 3) CEA commented that DOE should not require testing of other preset viewing settings because it is time consuming and will not yield useful information because consumer viewing habits are unknown and preset viewing settings are not standard across manufacturers. (CEA, No. 13 at p. 5)

In this NOPR, DOE is proposing that luminance measurements be taken in both the home and retail picture settings, and that power measurements (for TVs without ABC enabled) only be taken in the home picture setting. As many interested parties commented, most consumers do not switch their TVs out of the picture setting in which they are shipped. Therefore, requiring power measurements in the retail picture setting or any other alternative picture settings may cause unnecessary burden on manufacturers by increasing testing time. A luminance measurement in both the home and retail picture setting must still be taken in order to generate a luminance ratio, which is utilized by other regulatory programs such as ENERGY STAR. However, DOE is also considering testing on mode energy consumption in picture settings other than the home picture setting. DOE is aware of some TVs that are equipped with remotes that have easy-to-access

shortcuts that enable the user to switch from the home picture setting to other preset picture settings (sport, vivid, movie, etc.), without requiring that the user enter the main menu. Although interested parties commented that consumers do not switch between picture settings, DOE believes that if TV remotes are designed with shortcuts to switch between preset picture settings, more consumers may do so, either accidentally or intentionally. For this reason, DOE is considering whether this should be taken into account in the test procedure. In particular, DOE is considering testing on mode energy consumption in some of these additional preset picture settings. Possible approaches could include testing in the highest and lowest energy consuming preset picture settings, while displaying the IEC 62087-20011 dynamic broadcast-content video signal, or the brightest and dimmest preset picture settings. An additional approach could include testing in all preset picture settings. DOE invites comments on testing in additional preset picture settings, particularly the balance between a representative and not overly burdensome test procedure. (See Issue 4 in section V.E "Issues On Which DOE Seeks Comment").

## 2. Testing Order

In today's NOPR, DOE is proposing to require that testing be conducted in the following order: luminance, on mode power, standby mode power, and off mode power tests. This is not consistent with the test procedure prescribed in ENERGY STAR v. 5.3, which specifies on mode tests be conducted prior to luminance tests. DOE is aware that some TVs are unable to operate in the retail picture setting once the TV has been switched into the home picture setting. Therefore, it is necessary to measure luminance in the retail picture setting before switching to the home picture setting to ensure that the retail picture setting luminance is captured. For this reason, DOE is proposing to perform luminance testing prior to on mode power testing in section 5.3.1 (luminance test) of appendix H to subpart B of 10 CFR part 430. DOE does not believe that this

alternative testing order will increase the testing burden or cause any issues with test results, but will ensure that all TVs are adequately tested in each prescribed mode.

### 3. Luminance

Although IEC 62087-2011 does not include a luminance test, ENERGY STAR v. 5.3 requires a test of the screen luminance. The luminance test is included to ensure that TVs are not shipped in an overly dim picture setting in order to achieve a lower measured on mode power value, since under ENERGY STAR v. 5.3 TVs are tested in “as shipped” condition. In the 2010 RFI, DOE asked interested parties for comments on multiple facets of luminance testing. Specifically, DOE requested input on (a) whether testing luminance should be required, and (b) the different display patterns that can be used to adequately test luminance. 75 FR 54048, 54049. Many interested parties provided feedback regarding the need for luminance testing. Several interested parties supported luminance testing. NRDC stated that screen luminance is important to include in the test procedure because it often has a direct impact on TV on mode power use and future energy conservation standards might include these parameters in the rulemaking; thus, including a test for screen luminance would allow policy makers the ability to add luminance requirements to their standards. (NRDC, No. 5 at pp. 2-3) It further clarified that the luminance test method should include details on (a) the video signal being used; (b) the type of instrument and its precision; (c) the angle and location of the measurement points; and (d) the ambient lighting conditions, if necessary. (NRDC, No. 5 at p. 5) Finally, NRDC stated that it believes the DOE luminance testing could require: (a) testing in “as shipped” conditions in home or retail picture settings; (b) ability to measure either a luminance ratio or a power ratio; and (c) TVs to be set at a specified luminance prior to measurement. (NRDC, No. 5 at pp. 3-4)

LG supported the ENERGY STAR luminance test method, which involves measuring the luminance while displaying the IEC 62087-2011 three bar video signal. This test is conducted twice, once while the TV is in the home picture setting and again when the TV is in the retail picture setting. After both measurements are taken, the ratio of the two luminance measures is calculated. LG believes that it is an acceptable and representative measure of luminance and provides consistency across state and federal programs. (LG, No. 3 at p. 1) SHARP does not support luminance testing, but asserts that, if DOE must define a luminance measurement procedure, it should follow the ENERGY STAR v. 4.1 (which remained unchanged in ENERGY STAR v. 5.3) test procedure in detail. (SHARP, No. 14 at p. 5) Similarly, Sony believes that the luminance requirement as defined by ENERGY STAR v. 5.3 is an unnecessary test, but finds the method itself provides a rather simple solution to a complex subject. (Sony, No. 8 at p. 2)

Alternatively, CEA and some manufacturers strongly opposed requiring a luminance measurement, with primary arguments including that default TV picture settings are not too dim, and DOE should not regulate a performance metric. CEA stated that a luminance requirement is unnecessary, premature and essentially not energy related. (CEA, No. 13 at p. 3) CEA also commented that any proposal to impose limits on luminance and/or tie luminance levels to power levels is speculative and a performance requirement should not be embedded within the test procedure as it may not be authorized by EPCA. (CEA, No. 13 at p. 4) Mitsubishi stated that DOE should not set standards that assure that products meet a certain consumer utility. (Mitsubishi, No. 7 at p. 3) CEA noted that DOE should not include a luminance requirement, but if a luminance test is included it should mirror the test outlined in ENERGY STAR v. 4.1 (which, as noted above, remained unchanged in ENERGY STAR v. 5.3). (CEA, No. 13 at p. 4) According to CEA, data indicates that consumers maintain the default settings of the TVs, and,

therefore, retail picture settings are not relevant to those consumer viewing habits. (CEA, No. 13 at p. 3) Sony also commented that, after thoroughly reviewing its call center data, it found no complaint of dim pictures, which was DOE's reasoning for including a luminance test. (Sony, No. 8 at p. 1) Sony commented that the test procedure should measure power and should not be a luminance test procedure. (Sony, No. 8 at p. 4) Mitsubishi commented that manufacturers will not produce TVs with dim home picture settings, because this would create poor reviews and high return rates. Mitsubishi further believes it is undesirable for manufacturers in this industry to sell a TV that is too dim because there are very tight margins. (Mitsubishi, No. 7 at p. 2) Panasonic believes that a regulation on luminance is not required since manufacturer competition discourages the shipping of dim TVs. (Panasonic, No. 6 at p. 1) Panasonic affirmed that the luminance testing in ENERGY STAR v. 5.3 was adopted as a solution to prevent only the remote possibility of the TVs being shipped too dim. (Panasonic, No. 6 at p. 2)

SHARP stated that DOE should not specify a luminance measurement and observed that the 65 percent home to retail ratio required by ENERGY STAR specifications may be encouraging TVs to have a brighter home picture setting than they otherwise would. SHARP did not believe that setting a lower bound for luminance would address the issue of shipping a TV too dim to decrease its power consumption for home mode testing. (SHARP, No. 14 at p. 3) SHARP wrote that IEC did not set luminance requirements because manufacturers will not ship overly dim TVs and risk product returns. Additionally, SHARP commented that there is no consensus on how to measure brightness levels, and setting a lower bound on home mode brightness is a performance requirement rather than an energy requirement. (SHARP, No. 14 at p. 2) SHARP further noted that if performance requirements force minimum luminance levels to be set too high, potential energy savings are lost. (SHARP, No. 14 at p. 3) Lastly, SHARP

commented that any static video signal can be detected and circumvented, and therefore DOE should not implement a luminance measurement. (SHARP, No. 14 at p. 3) It stated that IEC 62087-2008 (which is the same as IEC 62087-2011) was not based on prescribed luminance levels for the following reasons:

- 1) Consumers generally do not adjust their TVs from the default settings,
- 2) Relatively few consumers have their TVs professionally calibrated,
- 3) There is no consensus on how to measure perceived brightness levels,
- 4) Perceived brightness is often related to contrast ratio as it is related to pure brightness,
- 5) Some TV technologies have a non-linear relationship between power and brightness,
- 6) Variation in consumer illuminance levels make the ideal brightness difficult to determine, and
- 7) Humans have poor acuity for discerning absolute brightness levels, and there is no data that identifies the level of brightness to which the average person would adjust a television by hand. (SHARP, No. 14 at p. 2)

In this NOPR, DOE is proposing to include a luminance test as part of its test procedure. In recognition of interested parties' concerns, DOE clarifies that the proposed luminance test is included in the test procedure solely for the purpose of supporting the ENERGY STAR program; the Department is not proposing to include the luminance measurements in its final metrics for measuring the energy efficiency or consumption of TVs. Including a luminance test as part of the test procedure for TVs will allow other programs such as ENERGY STAR to utilize the results. The sections, below, describe the different aspects of this proposal, as well as comments from interested parties on these aspects.

#### a. Warm-up and Stabilization

As mentioned in section III.E.2, above, DOE is proposing to require that luminance tests be conducted prior to on mode testing. Due to the change in luminance testing order (conducting testing in the retail picture setting prior to the home mode picture setting), DOE considered both warming-up the TV with respect to power and stabilizing the TV for luminance. However, in today's notice, DOE is proposing that the TV be warmed-up but not be stabilized prior to measuring display luminance.

IEC 62087-2011 and ENERGY STAR v. 5.3 both require that the TV be warmed-up prior to energy measurement but do not include a recommended or minimal time period. Rather, they state that energy measurements be taken "after the TV has achieved a stable condition with respect to power consumption." With respect to luminance testing, ENERGY STAR v. 5.3 requires the three bar video signal be displayed for 10 minutes to stabilize a TV prior to conducting a measurement. DOE received comments from interested parties on the appropriate time required to warm-up and stabilize a TV prior to conducting testing. 75 FR 54048, 54051

Mitsubishi commented that measurements of power consumption should be taken after the TV has reached normal operating temperature. (Mitsubishi, No. 7 at p. 5) Mitsubishi further commented that warm-up times vary by model and it is difficult to identify a minimally sufficient warm-up time, but it is also unnecessary. It continued by adding that it is sufficient to require that before testing begins, the device under test has reached thermal equilibrium, and that the test procedure need not indicate a specific time but rather a minimum. (Mitsubishi, No. 7 at p. 6) PG&E and California IOUs stated that the warm-up time should be sufficient to reflect real-

world conditions while also aiming not to be too long so as to become overly burdensome. (PG&E, No.12 at p. 3; California IOUs, No. 9 at p. 3) SHARP, Sony, Panasonic, and CEA recommended that DOE refer to the IEC 62087-2008 test procedure for warm-up periods. The warm-up periods remained unchanged in IEC 62087-2011. (SHARP, No 14 at p. 7; Sony, No. 8 at p. 3; Panasonic, No. 6 at p.7; CEA, No. 13 at p. 7)

DOE acknowledges all stakeholder comments and is proposing to incorporate language that the TV be warmed-up consistent with that in IEC 62087-2011, with the addition of a minimum warm-up period requirement. In this NOPR, DOE is proposing TVs be warmed-up using the IEC 62087-2011 dynamic broadcast-content video signal for at least one hour in section 5.2 (warm-up) of appendix H to subpart B of 10 CFR part 430. DOE conducted testing to determine if this warm-up was appropriate<sup>15</sup>. Although the power did not change drastically over the one hour for any of the TVs tested, DOE believes that because no interested party commented on the desire to reduce the duration, a one hour warm-up period was still appropriate. DOE will further propose that the TVs can be warmed-up for longer than one hour if the TV does not reach a stable state with respect to power consumption within the one hour time period. DOE is defining a stable state as an average power measurement over the 10 minute test clip that varies by less than 2 percent on consecutive plays. DOE believes that by establishing a minimum warm-up period, the test results will be more consistent, because all TVs will be warmed up for an identical time period. Further, DOE testing indicates that the majority of TVs will stabilize within one hour. DOE also consulted with industry subject matter experts<sup>16</sup> who

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<sup>15</sup> The warm up period data can be found on the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011.  
<[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

<sup>16</sup> Keith Jones, Managing Director, Australian Digital Testing and

had similar findings<sup>17</sup>. Although DOE plans to specify that a one hour warm-up period be used, there is flexibility to utilize a longer warm-up period for the TV to reach a stable energy consuming state. For luminance stabilization, DOE is not proposing that the TV be stabilized prior to conducting luminance measurements, rather that luminance measurements be taken immediately upon displaying the three bar video signal. Luminance measurements are made immediately to prevent automatic image correction programs from revising the luminance of the observed test pattern.

DOE received a comment from Panasonic recommending that DOE adopt the luminance measurement test procedure in ENERGY STAR v. 5.3, which requires that luminance be measured immediately following the on mode test, ensuring that the TV is sufficiently stabilized with respect to power prior to conducting the luminance test. Panasonic also stated that it does not object to increasing the 10 minute stabilization periods if it is felt to be necessary. (Panasonic, No. 6 at p. 7) No other interested parties commented on the topic.

ENERGY STAR v. 5.3 requires that the TV display the three bar video signal for 10 minutes prior to conducting a luminance measurement. As part of today's NOPR, DOE is proposing to require that luminance measurements be taken immediately after displaying the IEC 62087-2011 dynamic broadcast-content video signal from the warm-up period in section 5.4.1 of appendix H to subpart B of 10 CFR part 430. DOE conducted extensive research to determine

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<sup>17</sup> The stabilization period can be seen to stabilize within one hour based on the data found in the Luminance Period document which can be found on the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011.

<[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

the appropriate stabilization period and has preliminarily determined that taking luminance measurements immediately after displaying the IEC 62087-2011 dynamic broadcast-content video signal is the most technology neutral method<sup>18</sup>. DOE's research also found that the luminance of some TV technologies drops as the same image remains on the screen and luminance with other TV technologies increases as the same image remains on the screen<sup>19</sup>. Taking an immediate measurement helps to mimic actual operating conditions, in which images are changing constantly.

Specifically, taking measurements according to this method ensures that TVs, particularly plasmas, do not enter into an automatic brightness limiting (ABL) state prior to luminance testing. ABL is a technology that is used on phosphor based TV screens (CRT and plasma) that is designed to limit the luminance of the screen to a level that will avoid damage to the phosphors. This type of protection is not necessary in LCD technology as high luminance levels cannot cause damage to the display elements. Measuring the luminance immediately after displaying the IEC 62087-2011 dynamic broadcast-content video signal, without allowing a substantial period of delay, will ensure that TVs do not require additional stabilization time while displaying the IEC 62087-2011 three bar video signal which would result in some TVs entering an ABL state. This method will promote more consistent testing across products. Taking measurements according to this method also ensures that TVs, particularly LCDs with cold cathode fluorescent lamp (CCFL) technology, have been stabilized. DOE welcomes comments

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<sup>18</sup> The appropriate stabilization period and drop off in luminance compared to time can be seen in the Luminance Stabilization Period document found on the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011.

<sup>19</sup> [http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)

<sup>19</sup> Id.

on the stabilization and warm-up periods proposed in this NOPR. (See Issue 6 in section V.E "Issues On Which DOE Seeks Comment").

#### b. Method for Testing Luminance

As mentioned above, many TVs have multiple preset viewing settings. Again, the retail picture setting is typically used in showrooms, whereas the home picture setting is intended to be more suited for typical home viewing conditions. ENERGY STAR v. 5.3 uses a luminance ratio test that compares these two picture settings. However, DOE is aware of alternative methods for ensuring that the TV does not have an overly dim home picture setting such as power ratios and absolute luminance measurements, and therefore in the 2010 RFI, DOE requested feedback on testing by using luminance ratios, power ratios and absolute luminance. 75 FR 54048, 54049.

Many commenters believed that power cannot be measured to determine the brightness of the TV. Panasonic commented that the relationship between power and luminance is often non-linear and is highly variable between TV technologies, specifically in TVs with "local dimming" and "power on demand". Panasonic believes that this non-linear relationship makes a power ratio an unfair measurement of screen brightness. Panasonic believes that the measurement of the power would not result in the goal of determining whether a TV is "too dim." (Panasonic, No. 6 at p. 2) Panasonic commented that though they recognized all of DOE's concerns pertaining to a luminance ratio, they support its inclusion in the test procedure. (Panasonic, No. 6 at p. 2) Mitsubishi commented that different display technologies have different luminance and power characteristics, and these two aspects of TVs should not be conflated. Mitsubishi also noted that luminance variation across the screen is unrelated to energy consumption. (Mitsubishi, No. 7 at

p. 2) Mitsubishi also believes that measuring power rather than a luminance ratio does not satisfy the "goal" of preventing manufacturers from producing devices that are not useful in the home picture setting. (Mitsubishi, No. 7 at p. 3) Finally, Mitsubishi commented that some TV display technologies have a power consumption that correlates significantly with the content displayed rather than the display luminance. (Mitsubishi, No. 7 at p. 3) SHARP stated that a fixed luminance level is not prescribed for power measurements made with CEA-2037-2009 and IEC 62087-2008 (nor in IEC 62087-2011), and therefore DOE does not need to implement a luminance measurement. (SHARP, No. 14 at p. 3) Sony also does not support measuring power consumption at prescribed luminance levels or picture settings. Sony believes that picture settings are performance settings and are not directly tied to luminance. (Sony, No. 8 at p. 2)

CEC presented an alternative method for using power to ensure the TV is not shipped in an overly dim picture setting. CEC suggested that a power ratio be taken between home and retail picture settings. The home picture setting would be used for compliance when the ratio was closer to one, while a weighted result of home and retail picture settings power would be used as the power deviates from one. (CEC, No. 15 at p. 2) NRDC suggested that DOE improve the ENERGY STAR luminance test by establishing a minimum screen luminance for all presets in the set up menu. The method would require the lab technician to record the screen brightness that was measured prior to running the on mode power test with the IEC 62087-2008 dynamic broadcast-content video signal, which is the same as the IEC 62087-2011 dynamic broadcast-content video signal. (NRDC, No. 5 at p. 4) NRDC also urged DOE to ensure that all measurements for ratios should be made identically. (NRDC, No. 5 at p. 5)

SHARP also suggested an alternative method for ensuring that TVs are shipped in a picture setting that satisfies consumer viewing desires. SHARP commented that DOE should set a requirement based on a “floor,” which would be a fixed percentage of the power of the most consumptive setting, and recommends that the floor be 40 percent of the most power consuming setting. This approach will help ensure that home picture setting is not overly dim as well as cap the maximum power consumption of a TV regardless of the picture setting. (SHARP, No. 14 at p. 5) SHARP supports the maximum power ratio approach, given that the allowable home to retail picture settings power ratio is no more than 40 percent. SHARP believes that unlike the luminance ratio approach, which is a performance requirement, setting a threshold for reported power is part of the power measurement process. (SHARP, No. 14 at p. 3) P.R. China suggests implementing an efficiency ratio of the output power and input power that includes luminance in the nominator, multiplied by the screen size, and divided by the input power. (China, No. 16 at p. 3)

PG&E, California IOUs, and CEC requested a flexible test procedure with respect to luminance. PG&E and California IOUs recommended that the test procedure be designed so that policy-makers could consider luminance or power ratios between different preset picture settings. (PG&E, No.12 at p. 2; California IOUs, No. 9 at p. 2) CEC urged DOE to adopt a test procedure which includes both power and luminance testing at a minimum picture setting and the retail picture setting, but provides enough flexibility that the policy makers can decide how these numbers are used to set standards. (CEC, No. 15 at p. 2)

Interested parties also offered comments discouraging the possible inclusion of an absolute luminance measurement. Panasonic believes that absolute luminance does not provide

enough data to determine if the TV is providing a "satisfactory consumer viewing." Panasonic noted that many TV calibrators and video post production engineers consider the contrast ratio to be more important than absolute luminance. (Panasonic, No. 6 at p. 2) Panasonic also commented that when measuring luminance, the method must provide accurate results across all technologies, which is much easier with a ratio than with absolute luminance measurements. (Panasonic, No. 6 at p. 2) Finally, Panasonic commented that using a relative ratio is more tolerant of non-calibrated luminance meters, measurement distances and angles and the measurement location because the error cancels out between the two measurements. (Panasonic, No. 6 at p. 3)

In this NOPR, DOE is proposing measuring luminance to allow the ENERGY STAR program to utilize the measurement in section 5.3.1 (luminance test) of appendix H to subpart B of 10 CFR part 430. As mentioned in section III.E.1 above, DOE is proposing to test the TV in home and retail picture settings. DOE is proposing to include a luminance ratio, as is done in ENERGY STAR v. 5.3. DOE believes that by taking a ratio, less error is introduced than if taking an absolute luminance measurement. Further, ratios have been used in many other TV efficiency measures. For example, ENERGY STAR v. 5.3 requires that home picture setting shall not be less than 65 percent of the peak luminance of the retail picture setting. The European Parliament requires a luminance ratio of at least 65 percent in the Commission Delegated Regulation (EU) No 642/2009. Australia's government requires a 50 percent luminance ratio in AS/NZS 62087.2.2:201. Although DOE does not currently intend to include the luminance measurements in its final metrics for measuring energy efficiency or consumption, testing for a luminance ratio will allow DOE's TVs test procedure to support the requirements of the ENERGY STAR Program and allow other regulating bodies to include a luminance ratio in their

test procedures. DOE invites comments on luminance testing and including a luminance ratio. (See Issue 5 in section V.E "Issues On Which DOE Seeks Comment").

### c. Video Signals

To test luminance, ENERGY STAR v. 5.3 requires that a static video signal be displayed, and a measurement be taken using an LMD. In the 2010 RFI, DOE asked for comments on the use of two video signals: the IEC 62087-2008 three bar video signal, which is the same as the IEC 62087-2011 three bar video signal, and the Chinese TV test procedure's nine point video signal (hereafter referred to as the nine point video signal). 75 FR 54048, 54050. As mentioned, IEC 62087-2011 does not require luminance testing, whereas ENERGY STAR v. 5.3 requires that a single luminance measurement be taken while the TV is displaying the three bar video signal.

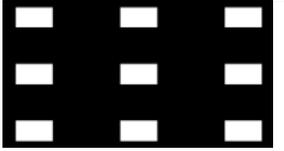
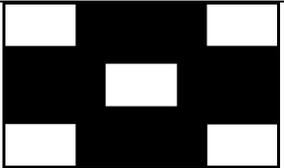
DOE believes that an ideal TV luminance video signal should represent actual broadcast content as closely as possible so that the measured luminance is an accurate reflection of the luminance produced under real-world operating conditions and is technology-neutral. DOE recognizes that it is possible that an ideal video signal may vary depending on the purpose for which it will be used. DOE envisions that the three bar luminance video signal proposed in today's NOPR would be used as part of a luminance ratio. The table below lists the various video signals that DOE is considering as well as their perceived advantages and disadvantages. It should be noted that a number of stakeholder comments appear to equate the number of white areas in the video signal with the number of measurements. DOE wishes to clarify that these are two separate issues (for example, the nine point video signal could be used to test at anywhere

between one and nine points); the number of measurements and related test burden are discussed in a following section. Any of the following video signals could be measured at a single point or multiple points.

Three key features of plasma TV technology impact the brightness of white areas on their screens. These features, therefore, need to be taken into consideration in evaluating and selecting an appropriate technology-neutral video signal. Most plasma technology TVs limit brightness for very bright parts of the screen. As mentioned above, this feature called ABL is intended to protect the screen. Although the intention of ABL is to protect the screen, ABL functions differently across TVs. The protection is, however, generally based on the size of the bright area. For very small areas such as tiny spots seen on firework displays, ABL is likely to have little effect and the spots, therefore, will be very bright. The larger the white area, the more ABL tends to be applied. The second type of protection is when a static picture is detected with bright (and maybe not so bright) areas. After several minutes of a static image the brightness may be decreased to try to eliminate phosphor image burn. The third protection mode operates when the whole screen is bright: to protect plasma drive circuits, the power, and thus also the luminance, tend to be limited. What is being observed is the image burning protection.

DOE recognizes that none of the video signals currently under consideration is ideal. Each has advantages and disadvantages which are described below. Until a markedly improved video signal is made available, DOE is not inclined to change the status quo. DOE understands that IEC is contemplating a pattern with a dynamic video signal which may have significant advantages. DOE supports IEC's development of this potentially improved pattern and would consider incorporating it in future TV test procedures.

**Table -1 Proposed Video Signals for Luminance Testing**

Video Signal	Sample Image	Average Picture Level (APL)	Usage	Advantages	Disadvantages
3-Bar Video Signal		50%	<ul style="list-style-type: none"> <li>• Has been the default luminance video signal for the display industry</li> <li>• Initially developed for use with CRT displays</li> </ul>	<ul style="list-style-type: none"> <li>• Already referenced by ENERGY STAR, CEC, and IEC</li> <li>• Pattern widely available on DVD or Blu-ray test discs</li> </ul>	<ul style="list-style-type: none"> <li>• APL higher than typical TV program content</li> <li>• No reference point for vertical centering</li> <li>• Static pattern – not representative of dynamic video typical of TV program content</li> <li>• Results in quick automatic brightness limiting for plasmas due to the amount of white on the screen.</li> </ul>
9-Point Video Signal		17%	<ul style="list-style-type: none"> <li>• Used by Chinese TV test procedure and ISO/IEC test procedure for front projectors</li> </ul>	<ul style="list-style-type: none"> <li>• Results in less automatic brightness limiting for plasmas than the 3 bar, but nonetheless results in automatic brightness limiting for some.</li> <li>• White target is in the middle of screen</li> </ul>	<ul style="list-style-type: none"> <li>• As part of a luminance ratio may disproportionately disadvantage plasma TVs</li> <li>• APL lower than typical TV program content</li> <li>• Static pattern – not representative of dynamic video typical of TV program content</li> <li>• Results in automatic brightness limiting for some plasmas.</li> </ul>
DOE 5-Point Video Signal		34%	<ul style="list-style-type: none"> <li>• Developed by DOE as part of this proposed test procedure</li> </ul>	<ul style="list-style-type: none"> <li>• APL of typical broadcast content</li> <li>• White target is in the middle of screen</li> <li>• Similar in appearance to an available VESA 5-point pattern (RT01BN)</li> </ul>	<ul style="list-style-type: none"> <li>• Static pattern – not representative of dynamic video typical of TV program content</li> <li>• Results in automatic brightness limiting for some plasmas.</li> </ul>
Dynamic Video Signal <sup>20</sup>		~34%	<ul style="list-style-type: none"> <li>• In development by IEC</li> </ul>	<ul style="list-style-type: none"> <li>• APL of typical broadcast content</li> <li>• Not a static image – representative of dynamic video typical of TV program content</li> <li>• Pattern under consideration by IEC .</li> </ul>	<ul style="list-style-type: none"> <li>• Pattern not yet finalized by IEC</li> </ul>

<sup>20</sup> This pattern was created using the IEC 62087-2011 dynamic content video signal with black and white squares in the center of the screen as measurement points.

DOE received comments on each of the video signals (see sections, below), described above as well as alternative suggestions for luminance testing, including the number of measurements to take while displaying a particular video signal. In response to commenters' concerns, DOE considered multiple video signals when developing its NOPR. DOE considered the three bar, the nine point, and a DOE developed dynamic video signal. In this NOPR, DOE is proposing to test luminance using the three bar video signal in section 5.3.1.2 (three bar video signal measurement) of appendix H to subpart B of 10 CFR part 430, but is also considering using the other two signals.

#### i. Three Bar Video Signal

The three bar video signal was developed by the IEC and published in the third edition of its TV broadcast transmission test procedure, IEC 60107-1997 Ed. 3.0 "Methods of measurement on receivers for TV broadcast transmissions - Part 1: General considerations - Measurements at radio and video frequencies." The three bar video signal is found in IEC 62087-2011, and is used to measure luminance in ENERGY STAR v. 5.3. It is the most widely used video signal for measuring luminance. The three bar video signal produces three equidistant vertical white bars on a black background. The width of each of these bars is 1/6 of the nominal horizontal width of the picture. The three bar video signal has an APL of 50 percent. A higher APL can cause some plasma TVs to enter more quickly into a power limiting state to prevent screen burn-in caused by displaying a bright screen for an extended period of time.

In response to the 2010 RFI, many commenters expressed desire for DOE to use the three bar video signal for testing luminance. CERC, CEA, Sony, Mitsubishi, and Panasonic supported the use of the three bar video signal. (CERC, No. 10 at p. 3; CEA, No. 13 at p. 4; Sony, No. 8 at p. 2; Mitsubishi, No. 7 at p. 3; Panasonic, No. 6 at p. 3) Mitsubishi believes that the three bar video signal is adequate. (Mitsubishi, No. 7 at p. 4) Sony commented that the 3-bar test pattern is used in IEC and ENERGY STAR test procedures. Changing it will add complexity to an already complex subject. (Sony, No. 8 at p. 2) CEA stated that DOE should institute the ENERGY STAR test method of using the three-bar measurement procedure. (CEA, No. 13 at p. 4) Panasonic supports the use of the 3 bar pattern, as it is used by ENERGY STAR, CEA, CEC, and Australia. (Panasonic, No. 6 at p. 3)

Conversely, SHARP commented that the three bar video signal is ineffective for plasma TVs, giving an advantage to the technology and is not necessarily “unpredictable for LED backlit TVs,” as DOE stated in the 2010 RFI. (SHARP, No. 14 at p. 4)

Although DOE is proposing that luminance testing be conducted with the three bar video signal, DOE acknowledges that there are drawbacks associated with its use. The APL of the three bar video signal is 50 percent, which is greater than that of typical broadcast content. The three bar video signal also does not have a reference point to vertically center the luminance meter readings which requires additional time to establish where the measurement should be taken. Another drawback to the three bar video signal is a static video signal which is not representative of typical TV program content. The final disadvantage to the three bar video signal is that it results in a quick ABL for plasma TVs due to the amount of white space on the screen. Although, the three bar video signal has disadvantages, DOE is currently unaware of a

truly technology neutral video signal that isn't affected by the type of TV technology. Video signals can have differing affects on TV technologies resulting in higher power consumption in some technologies and lower power consumption in other technologies. Because the three bar video signal is the current industry standard, it is used as a basis for comparison for the other video signals considered in the sections below.

#### ii. Nine Point Video Signal

The nine point video signal is used in the Chinese TV test procedure ICS 27.010. The video signal was developed to measure variations in luminance across the screen and account for local dimming. This video signal consists of nine white rectangular boxes symmetrically arranged in a three by three grid. The nine point video signal is also a static video signal which does not improve upon the current three bar video signal and can also result in some ABL for plasma TVs. The average APL for the nine point video signal is 17 percent which is lower than typical broadcast content. (P.R. China, No. 16 at p. 3) Because the nine point video signal has a lower APL than the three bar video signal, it alters the luminance ratio between home and retail picture settings for some TVs which would force policy makers to alter their respective luminance ratio requirements. DOE found that at least four different plasma TVs, which would have met ENERGY STAR requirements for luminance ratio with the three bar video signal, had a ratio below 65 percent when displaying the nine point video signal.

Panasonic discouraged DOE from using the nine point video signal and Digital Video Essential (DVE) window (a VESA industry video signal) because Panasonic believes these patterns do not prevent some TVs from power limiting; therefore they are not technology neutral.

Panasonic did not provide any comment on how the video signals impact the TV's power limiting. (Panasonic, No. 6 at p. 4)

Alternatively, P. R. China recommended that DOE utilize the nine point video signal because the APL is 17 percent, it is technology neutral, and it accounts for non-uniform screen luminance. (P.R. China, No. 16 at p. 3)

DOE conducted various tests utilizing the nine point video signal. After interpreting data, the absolute luminance values obtained while using the DOE nine point video signal were generally higher in the retail picture setting and lower in the home picture setting than those obtained while using the three bar video signal, particularly in plasma TVs. DOE believes these results can be attributed to the lower APL of the nine point video signal, which prevents the TV from quickly entering ABL. This video signal might than disproportionately disadvantage plasma TVs. DOE also determined that changing the video signal will also impact the luminance ratio. Due to the change in absolute luminance values obtained while using the DOE nine point video signal, luminance ratios generally decreased for plasma TVs when compared to displaying the three bar video signal. DOE did not find any other major trends in size or brand for the TVs in which the ratio differed when using the nine point video signal as opposed to the three bar video signal. Due to the reasons stated above, DOE has determined not to propose utilizing the nine point video signal in this NOPR.

### iii. DOE Five Point Video Signal

As mentioned above, DOE developed a five point video signal that has an APL identical to typical consumer broadcast content (34 percent). This video signal is based largely on the

VESA five point video signal and consists of five white rectangular boxes arranged with one box in the center of the screen and one box in each corner.

Upon testing, DOE found that the absolute luminance values obtained while using the DOE five point video signal were generally lower than those obtained while using the three bar video signal. DOE believes these results are due to the fact that the five measurements took into account the perimeter of the screen which is typically dimmer than the center. Similar to the nine point and the VESA five point video signal, this can also be attributed to the location of the measurements taken, as the center of the screen is typically brighter than the edges. With testing, DOE determined that this video signal also displayed some ABL for some plasma TVs regardless of the fact that the APL is 34 percent. DOE did not find any major trends in size or brand for the TVs in which the ratio differed when using the DOE five point video signal as opposed to the three bar video signal other than changes in the luminance ratio for some TVs.

#### iv. DOE Dynamic Video Signal

Finally, DOE is interested in the development of a video signal that it believes may be more representative of actual consumer use, and may be more technology neutral. A technology neutral video signal was requested by numerous interested parties in response to DOE's 2010 RFI.

Some interested parties expressed a general desire for a technology neutral video signal or one that has an APL more similar to the IEC 62087-2008 dynamic broadcast-content video signal, which is the same as the IEC 62087-2011 dynamic broadcast-content video signal. PG&E and California IOUs encouraged DOE to develop a video signal that has an APL that is more

similar to the IEC 62087-2008 dynamic broadcast-content video signal than the three bar video signal. This will help ensure that the luminance measurements are more reflective of actual TV usage. (PG&E, No.12 at p. 2; California IOUs, No. 9 at p. 2) PG&E and the California IOUs also commented that the video signal should not favor one type of display technology over another. (PG&E, No.12 at p. 2; California IOUs, No. 9 at p. 2) Panasonic agreed that the goal of a technology neutral video signal is certainly appropriate, though they feel that such a pattern has been elusive. (Panasonic, No. 6 at p. 3) NRDC encourages DOE to track the IEC development effort that is in progress, because IEC may be considering a potentially more technology neutral video signal including the nine point video signal used in China. (NRDC, No. 5 at p. 4) Finally, CEC supported DOE's investigation to identify a suitable video signal and recommends one that has an APL close to that of the IEC 62087-2008 dynamic broadcast-content video signal. (CEC, No. 15 at p. 2) P. R. China agrees that an alternative video signal with an APL more similar to the IEC 62087-2008 dynamic broadcast-content video signal should be developed. (P.R. China, No. 16 at p. 3) P.R. China suggests that TVs be adjusted using the "8-gray scale mode" and then be tested using the nine point video signal. (P.R. China, No. 16 at p. 3)

Panasonic also suggested alternative language found in the EuP 642/2009<sup>21</sup> to conduct luminance testing. The EuP 642/2009 allows for different video signals for various TV technologies and only specifies that the video signal must be a "full screen," which does not exceed the APL point where power limiting occurs. (Panasonic, No. 6 at p. 3) Panasonic commented that the European Union recognizes that each technology has a different, non-linear methodology for determining the brightness of individual images and therefore has prescribed

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<sup>21</sup> Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for televisions <<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:191:0042:0052:EN:PDF>>

different video signals for various technologies to meet the criteria of having a video signal that is not "power limiting" or dimming the screen as more pixels are required to be illuminated. Panasonic believes that both of these methods are also valid approaches of measuring luminance. (Panasonic, No. 6 at p. 3)

Alternatively, Mitsubishi commented that the APL is irrelevant to the goal of measuring luminance, which is to determine if the home picture setting luminance is overly dim. (Mitsubishi, No. 7 at p. 3)

To address interested party comments, DOE's subject matter experts<sup>22</sup> have recommended development of a video signal that simulates the apparent brightness of a picture as well as an APL similar to the IEC 62087-2011 dynamic broadcast-content video signal. The proposed video signal would consist of a black rectangle (with an APL of zero percent) and a white rectangle (with an APL of 100 percent) placed at the center of the IEC 62087-2008 dynamic broadcast-content video signal. These rectangles will maintain the video signal's APL at approximately 34 percent, which is similar to typical broadcast content. Each rectangle would be approximately 1 x 1 inch for a 26 inch TV. The purpose of the small size of the rectangles is to minimize the overall impact they have on the APL of the video signal but allow for a white section to measure the luminance. Also, to help ensure that the TV does not detect the squares as stationary objects, the squares will alternate places with each other every minute.

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<sup>22</sup> Keith Jones, Managing Director, Australian Digital Testing and  
Bob Harrison, Principal Scientist, UK Government Market Transformation Programme ICT and CE products

DOE hopes that this video signal will not unfairly benefit any specific technology, because it will simulate the state that the TV enters when displaying the IEC 62087-2011 dynamic broadcast-content video signal. This video signal may also prevent the TV from APL, because it is a dynamic video signal which neither the three bar nor nine point video signal are capable of preventing.

In summary, DOE understands the issues associated with the three bar video signal as well as all static video signals, but is utilizing the three bar video signal as the tentative default video signal for this NOPR while it continues to investigate other video signals and receive comments about them. Although DOE is proposing to require the three bar video signal, it would appreciate any comments on measuring luminance while displaying either the nine point or dynamic video signal that DOE also considered for incorporation in this rulemaking. (See Issue 7 in section V.E "Issues On Which DOE Seeks Comment").

#### d. Number of Luminance Measurements

In addition to the particular video signal displayed during luminance testing, the number of measurements and how those measurements are taken is important. In the 2010 RFI, DOE asked for comments on a nine point test measurement versus a single point test measurement. 75 FR 54048, 54050. Given the interested party feedback and additional testing discussed below, DOE is proposing to only require a single point luminance measurement.

In response to the 2010 RFI, many commenters expressed desire for DOE to only require one luminance measurement if a luminance measurement is required. Mitsubishi stated that the

variation of luminance across the screen, which they believe is the purpose of measuring multiple points while displaying the nine point video signal, does not relate to the goal of ensuring that TVs do not have a home picture setting that is overly dim. Mitsubishi added that, for this reason, taking nine measurements using the nine point video signal adds unnecessary burden. (Mitsubishi, No. 7 at p. 4) Sony believes that using a video signal other than the three bar video signal and measuring multiple points will add complexity to an already complex subject. (Sony, No. 8 at p. 2) Panasonic commented that the nine point video signal offers no benefit over the three bar video signal, noting that a nine points measurement requires more time, is more difficult to perform, and is less repeatable. (Panasonic, No. 6 at p. 3) Sony similarly stated that manufacturers in China suggested that measuring luminance while utilizing the nine point video signal is lengthy and complex when measuring multiple points, and it does not provide more meaningful energy information than measuring a single point, though Sony did not explicitly state which Chinese manufacturers provided this comment. (Sony, No. 8 at p. 2) CEA also strongly opposed replacing the single point luminance measurement with the nine point video signal measurement, because taking nine measurements adds burden without giving more meaningful results. (CEA, No. 13 at p. 5) SHARP believes that a single point measurement is adequate for a ratio test. SHARP added that the Chinese test procedure uses a nine point video signal since it outputs an absolute luminance. (SHARP, No. 14 at p. 4) SHARP commented that a nine point video signal measurement is much more expensive than a single, centered measurement. (SHARP, No. 14 at p. 4)

Other commenters urged DOE to adopt a luminance test that required multiple measurements, rather than a single measurement as currently required in ENERGY STAR v. 5.3. PG&E and California IOUs recommended DOE collect and analyze data using multiple point

video signals to account for variations of luminance levels on different areas of a screen. (PG&E, No.12 at p. 2; California IOUs, No. 9 at p. 2) PG&E and California IOUs acknowledged that adding a multiple measurement video signal will add test variation; however, they believe that luminance measurements from multiple points may be needed. (PG&E, No.12 at p. 2; California IOUs, No. 9 at p. 2) NRDC did not specify a particular video signal to be used, but they prefer a method that requires multiple measurements rather than a single measurement. (NRDC, No. 5 at p. 4)

DOE conducted testing with the nine point video signal in order to determine the drawbacks and benefits of measuring luminance at multiple locations compared to measuring at only one point. Testing using this video signal was conducted using two separate methods: 1) perpendicularly realigning the LMD to the center of each of the nine white squares (hereinafter referred to as the DOE nine point method); and 2) aligning the LMD perpendicularly with the center white square, maintaining the LMD fixed position, and angling the meter to measure eight off-axis white squares (hereinafter referred to as the Chinese nine point method). A distance luminance measurement is required to test off-axis measurements, but both a distance and contact meter can be used to take the perpendicular measurements. These nine measurements can be averaged to arrive at the overall screen luminance, ensuring that the brightness across the entire screen is accounted for in the measurement. Although the results for individual points varied across the screen when measuring luminance at multiple locations, DOE notes that measuring the additional locations would not impact the luminance ratio as the ratio would remain similar between TVs. DOE found that each of the individual measurement points across the TV screen maintained a similar ratio in the home and retail picture setting. DOE therefore believes that its proposed method of measuring luminance at a single location is sufficient for

this test procedure. DOE's test results show that the ratio from the average of the nine locations and only the central location are exactly the same on all but one TV tested which had ratios that were within three percent<sup>23</sup>. Because luminance is calculated as a ratio, multiple location measurements serve to decrease the measurement accuracy and repeatability of measurement.

In summary, DOE is proposing that only one luminance measurement be taken in each home and retail picture setting in section 5.3.1.2 (three bar video signal measurement) of appendix H to subpart B of 10 CFR part 430. Taking multiple measurements, specifically with a distance meter, greatly increases the test burden and this burden outweighs the potential benefits of measuring multiple locations around the screen. Measuring only one location will also harmonize the DOE test procedure with other TV test procedures that manufacturers currently use to evaluate products. Although DOE is proposing to only require one luminance measurement per picture setting, DOE is seeking comments on taking a single measurement versus multiple measurements when testing for luminance, along with any testing data that supports or refutes DOE's proposed method.

#### e. Measurement Distances and Angles for Luminance Testing

In the 2010 RFI, DOE considered requiring that luminance measurements be taken at various distances and angles, rather than perpendicular to the center of the screen as required by ENERGY STAR v. 5.3. 75 FR 54048, 54050. However, after further investigation and input

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<sup>23</sup> The luminance ratio data indicates that the ratio from any one particular location (regardless of location) is similar between home and retail settings. This data can be found on the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011. <[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

from interested parties, DOE is proposing that luminance measurements be taken perpendicular to the center of the screen, similar to the approach in the ENERGY STAR test procedure.

PG&E and California IOUs believe that the angle needs to be specifically defined and that a perpendicular angle may be appropriate; they also recommend that DOE acquire test results using different angles to inform the decision. (PG&E, No. 12 at p. 2; California IOUs, No. 9 at p. 2) Sony questioned the need to measure at angles and the benefits it provides in a test procedure, stating that the optimal distances to take luminance measurements are described in the LMD specifications. (Sony, No. 8 at p. 2) Similarly, Panasonic recommended that a single luminance measurement be taken perpendicular to the center of the screen. (Panasonic, No. 6 at p. 4) They believe that the contrast will vary with the room ambient light and the viewing angles. (Panasonic, No. 6 at p. 2) CEA also stated that the measurement distances and angles are not as important as making the measurements in a consistent manner. (CEA, No. 13 at p. 5) P.R. China measures luminance from a distance of three times the height of a high-definition TV screen and four times the height of a standard display TV screen because it simulates consumer viewing conditions. (P.R. China, No. 16 at p. 4) Finally, SHARP commented that luminance measurements at various distances and angles would only be appropriate if absolute luminance measurements were the goal. (SHARP, No. 14 at p. 4) SHARP also commented that a perpendicular measurement is adequate, if a luminance measurement is required. (SHARP, No. 14 at p. 4) SHARP stated that the correct distance for the measurement is dictated by the measurement tool, rather than the TV. (SHARP, No. 14 at p. 4)

Taking nine perpendicular measurements using a distance measure greatly increases testing burden as it requires that the meter be aligned nine times, once for the measurement of

each white square. The Chinese nine point method also increased burden as it requires nine measurements rather than a single one. Although the luminance meter only needs to be positioned once, the additional off-angle measurements still increase the burden of the test method. In addition, the Chinese nine point method eliminates the ability to use a contact LMD.

As stated, above, DOE is proposing that luminance measurements be taken perpendicular to the center of the screen in section 5.3.1.1 (LMD setup) of appendix H to subpart B of 10 CFR part 430. DOE believes that measuring multiple locations on off-axis angles will add unnecessary variation to measurements made, will likely reduce the repeatability of the test and increase testing time. DOE is also proposing that the distance for which these measurements are taken are in accordance to the set specifications for the luminance measurement device, which can be found in III.D.1.c.ii of this NOPR.

#### 4. On Mode

DOE is proposing to use the IEC 62087-2011 on mode test procedure. This test procedure displays the widely accepted IEC 62087-2011 dynamic broadcast-content video signal while the TV is in the on mode. Consistent with ENERGY STAR v. 5.3, DOE is considering testing on mode differently depending on whether ABC is enabled or disabled when the TV is shipped. If the TV is shipped with ABC enabled by default, the TV would be tested at multiple room illuminance levels, and if the TV is without ABC enabled by default, it would only be tested in the home picture setting. However, DOE wishes to continue to encourage manufacturers to ship TVs with ABC enabled. Although DOE is proposing to measure on mode without being connected to the internet, DOE is also interested in receiving feedback on

potentially measuring on mode while the TV is connected to the internet. See section 11 of this NOPR.

a. IEC 62087-2011 Dynamic Broadcast-Content Video Signal

IEC 62087-2011 and ENERGY STAR v. 5.3 both require the use of the IEC 62087 dynamic broadcast-content video signal for on mode testing, which is the same in both the 2008 and 2011 versions of the test procedure. This video signal displays a variety of clips that have an average APL equivalent to typical broadcast content. DOE received a comment from NRDC supporting the use of the IEC 62087-2008 dynamic broadcast-content video signal. (NRDC, No. 5 at p. 2) Although no other interested party explicitly stated that the IEC 62087-2011 dynamic broadcast-content video signal should be incorporated, no interested party opposed the use of the video signal. Moreover, a number of parties suggested that the clip should be the basis for any 3D test procedure, affirming its wide acceptance. In this NOPR, DOE is proposing that the IEC 62087-2011 dynamic broadcast-content video signal be used to measure on mode energy consumption in 2D mode on all TVs.

b. Testing of Television Sets Shipped with Automatic Brightness Control Enabled

ABC is a power saving feature in which the TV automatically adjusts the screen luminance to account for the ambient lighting conditions (room illuminance). IEC 62087-2011 and ENERGY STAR v. 5.3 require TVs with ABC enabled by default to be tested differently than those without ABC enabled by default. DOE requested comment on the method for testing TVs with ABC enabled by default, as well as which room illuminance levels are most appropriate for testing. 75 FR 54048, 54050.

Interested parties were generally in support of DOE adopting a test procedure for TVs with ABC enabled by default. PG&E and California IOUs commented that appropriate implementation of an ABC feature for TVs could result in significant energy savings. (PG&E, No. 12 at p. 2; California IOUs, No. 9 at p. 2) PG&E and California IOUs urged DOE to adopt a repeatable and representative method for measuring energy consumption of TVs with ABC enabled by default, stating that this should be a key area of focus for DOE. (PG&E, No. 12 at pp. 2-3; California IOUs, No. 9 at pp. 2-3) PG&E and California IOUs have observed that the on mode power consumption reported to EPA drops by an average of 24 percent when testing with the ABC feature enabled. They obtained this data by comparing 18 specific TV models that did not have the ABC feature enabled on the August 2010 EPA product list, but did have it enabled on the September 2010 list. (PG&E, No. 12 at p. 3; California IOUs, No. 9 at p. 3) NRDC also supported the inclusion of a method to test TVs with ABC enabled by default, stating that when designed properly, the ABC feature can provide low cost means of delivering significant energy savings. (NRDC, No. 5 at p. 5) NRDC further commented that many TVs have ABC as a means to comply with the new, more stringent ENERGY STAR 4.1 specifications as well as standards in California and elsewhere that are also likely to be effective soon. (NRDC, No. 5 at p. 5) Sony commented that the IEC 62087-2008 and ENERGY STAR v. 4.1 use the proper method to measure ABC energy consumption, and in the absence of a better method, DOE should adopt the same method. (Sony, No. 8 at pp. 2 -- 3) This same method is used in IEC 62087-2011 and ENERGY STAR v. 4.3. SHARP believes that ABC scaling factors should continue to encourage adoption of a default-on ABC feature. (SHARP, No. 14 at p. 6) Panasonic commented that due to tremendous variability between TV manufacturers and individual models, it is difficult to measure the performance of the ABC features of TVs. (Panasonic, No. 6 at p. 5) Finally, CEA

informed DOE that it will consider changes to ABC testing in the next revision of CEA-2037-2009 and will propose any change to DOE. (CEA, No. 13 at p. 6)

DOE agrees with the interested parties that are in support of incorporating TVs with ABC enabled by default in a test procedure. Although some interested parties disagree with the current method of measuring ABC energy savings, the majority of them agreed that testing TVs with ABC enabled by default was appropriate. DOE therefore is proposing to incorporate a test procedure for TVs with ABC enabled by default in section 5.4 (on mode test for TVs without ABC enabled by default) of appendix H to subpart B of 10 CFR part 430. The sections below provide details relating to room illuminance levels and the method for creating test room illuminance for purposes of measuring energy consumption of TVs enabled with ABC.

#### i. Test Room Illuminance Levels and Associated Television Luminance Levels

ENERGY STAR v. 5.3 and IEC 62087-2011 require that ABC energy consumption be measured at two test room illuminance levels, 0 lux and greater than 300 lux. As mentioned in the 2010 RFI, a 2009 study conducted by Ecos Consulting discovered that ABC is often implemented in a manner that may not take full advantage of the potential energy savings<sup>24</sup>. In particular, if implemented incorrectly, ABC may achieve significant energy savings at the expense of TV picture quality, reducing the likelihood that users will actually enable the feature and achieve the claimed energy savings. The study showed that some TVs reduce the brightness of their displays at 0 lux, and then increase the brightness significantly at room illuminance

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<sup>24</sup> Calwell, Chris, Mercier, Catherine, & Foster-Porter, Suzanne. Assessment of Options for Improving Energy Efficiency Test Procedures for Display. [http://www.efficientproducts.org/%5Creports%5Ctvs%5CEcos\\_Display%20Test%20Procedure%20Report\\_FINAL.pdf](http://www.efficientproducts.org/%5Creports%5Ctvs%5CEcos_Display%20Test%20Procedure%20Report_FINAL.pdf).

levels only slightly above 0 lux. Since both IEC 62087-2011 and ENERGY STAR v. 5.3 only measure energy consumption at the mentioned two luminance levels, the TV seems to consume less energy than it does in use, causing results that are not representative of actual use. DOE also performed testing with respect to this issue and rarely observed any kind of gradual change in screen luminance in response to changes in room illuminance<sup>25</sup>.

DOE conducted testing in mid-2011 on multiple TVs representing various manufacturers, display technologies, and screen sizes to understand how TV luminance varies with changes in room illuminance when ABC is enabled. These measurements largely confirm those recently conducted by the Collaborative Labeling and Appliance Standards Program (CLASP<sup>26</sup>), revealing that some TVs increase their screen luminance in a steady, continuous fashion as room illuminance increases (models D and L in 1 below).

DOE's testing shows that other TVs with ABC operate in a more binary fashion (models K and M in 1 below), holding luminance largely constant until room illuminance becomes quite low, and then dropping their luminance dramatically. This behavior is likely a consequence of the way ENERGY STAR currently provides an energy savings credit to TVs with ABC enabled by default, since ENERGY STAR currently only measures at 0 and 300 lux, and not at any intermediate points.

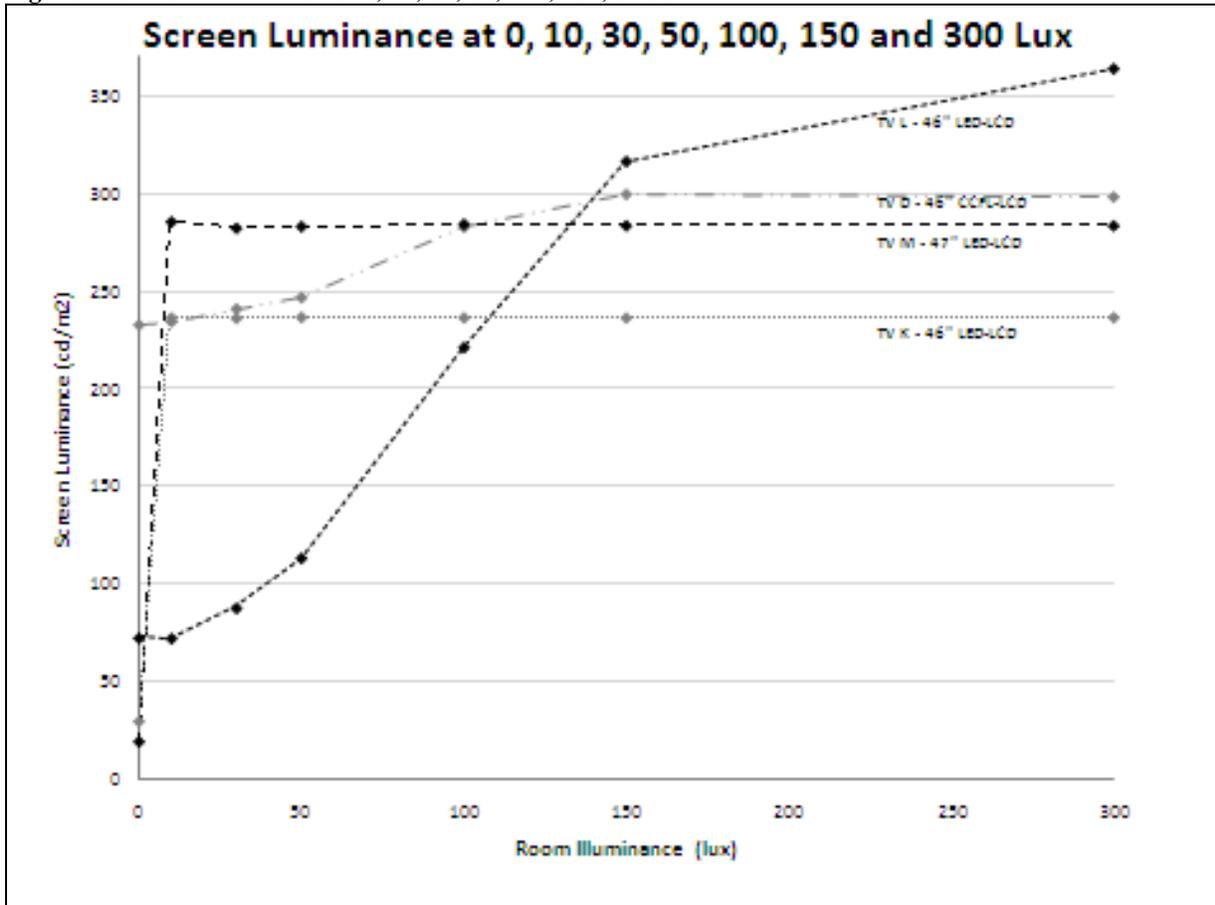
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<sup>25</sup> The energy consumption at different illuminance levels while ABC is enabled can be found on the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011. <[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

<sup>26</sup> Jones, Keith, *Analysis of Television Luminance and Power Consumption*, CLASP, August 2011, <<http://www.clasponline.org/en/ResourcesTools/Resources/StandardsLabelingResourceLibrary/2011/Analysis-of-tv-luminance-and-power-consumption>>

Sample data from DOE's testing are shown in 1. DOE has provided the full data set for this testing on its website<sup>27</sup>.

Figure 1: Screen Luminance at 0, 10, 30, 50, 100, 150, and 300 lux



DOE has also determined that a significant number of TVs that currently implement ABC do so in a way that yields unusually low screen luminance values (less than 50 nits) when room illuminance is at 10 lux or less. Display experts recommend a minimum luminance for dark room

<sup>27</sup> The energy consumption comparison when ABC is on and off can be found on the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011. <[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

viewing conditions of approximately 80 to 137 nits.<sup>28</sup> Very low luminance levels help to reduce energy consumption, but may yield a display that is so dim that users would want to disable ABC or modify room lighting conditions in order to cause the display to operate at a higher luminance level. In either case, much of the desired energy savings from ABC operation would be lost.

As a result, DOE is seeking comment from stakeholders regarding whether there should be a limit to the reduction in display luminance achieved from ABC, and how a minimally acceptable display luminance value should be established. DOE also received a number of comments on the appropriate room illuminance levels at which to conduct testing.

CEC, PG&E and California IOUs encouraged DOE to continue to research room illuminance conditions that are representative of consumer homes. CEC supports improvements to ABC testing, and believes that more appropriate lighting levels can be derived from Illuminating Engineering Society of North America (IESNA) studies. (CEC, No. 15 at p. 3) PG&E and California IOUs urged DOE to collect and analyze luminance and power data with and without ABC enabled with a range of room illuminance levels typical of consumer viewing conditions. (PG&E, No. 12 at p. 3; California IOUs, No. 9 at p. 3)

Although some manufactures suggested that 0 lux should be changed, manufacturers were generally opposed to altering the room illuminance levels at which the TV is tested.

Mitsubishi believes that measuring power at two levels of illuminance and assuming a linear

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<sup>28</sup> The minimum luminance to which CNET calibrates televisions for optimal viewing in a dark room is 137 nits. See <http://reviews.cnet.com/how-we-test/tv/>. The Imaging Science Foundation (ISF) recommends a similar minimum luminance for dark room viewing conditions. Televisions with an ISF Expert display mode tested by DOE operated at a minimum luminance in that mode of 100 to 130 nits. Televisions with a THX display mode tested by DOE operated a minimum luminance in that mode of 80 to 95 nits.

relationship between the values is an approximation at best. (Mitsubishi, No. 7 at p. 5) They continued by adding that measuring at four illuminance points (e.g. 0, 10, 100, and 200 lux) doubles the testing burden on the lab making the measurement and does not ensure a linear relationship between any of the two points or necessarily make the power consumption approximation significantly better. (Mitsubishi, No. 7 at p. 5) NRDC stated that DOE should require testing at low, medium and high room light levels, all at least 100 lux or brighter, to better represent actual viewing conditions. (NRDC, No. 5 at p. 5) Further, NRDC asserted that the test should require the lab technician to report the power levels, at different luminance levels, and leave it to the policy maker to determine the weight at each level. The test procedure should also require testing with ABC off. (NRDC, No. 5 at p. 5) CEA advised against changing the ENERGY STAR specification, as testing at additional luminance levels will not create a more repeatable and representative test method without further testing. (CEA, No. 13 at p. 6) CEA recommends the use of ENERGY STAR's ABC test, but changing "300 lux or greater" to "300 lux" with a reasonable tolerance limit. (CEA, No. 13 at p. 6) Additionally, Panasonic noted that if absolute luminance measurements are required at various levels other than 0 lux and greater than 300 lux, it will be difficult to develop a test method that ensures accurate and repeatable results across labs. (Panasonic, No. 6 at pp.5-6) Sony believes that accurately capturing light conditions and energy savings associated with TVs equipped with ABC is difficult. Illuminance meters must be placed in the exact same position and orientation of the light sensor of the TV, in order to properly create the desired illuminance which varies from home to home and from test lab to test lab. Sony stated that the lighting conditions are outside of the scope of the test procedure. (Sony, No. 8 at p. 3)

Alternatively, SHARP recommended that, at a minimum, the low light condition be increased somewhat above 0 lux, but to determine an appropriate value, or if additional levels are required, more data collection and study is required. (SHARP, No. 14 at p. 5) SHARP also supported the high illuminance condition being at precisely 300 lux, allowing for some reasonable tolerance in the measurement condition. (SHARP, No. 14 at p. 5)

To determine the appropriate illuminance levels required during on mode testing for those TVs with ABC-enabled by default, DOE analyzed a Japanese study<sup>29</sup> undertaken by Sony, Seikei University, Sharp, and Panasonic pertaining to room illuminance and ABC. In addition, DOE conducted its own preliminary room illuminance field test<sup>30</sup>. In 2011, the Japanese study of 77 Japanese homes found that the most common room illuminance range of either day or night measurements was 50 to 75 lux, and room illuminance was 100 lux or less in more than 50 percent of the measurements.

In June 2011, DOE conducted its own preliminary field tests of room lighting levels during TV viewing events<sup>31</sup>. Room lighting levels and TV power consumption were logged continuously over a one-to-two week period in nine homes. From this data, light levels were correlated to times when the TV was actually being watched. Across the nine homes, the TV was watched for 10 minutes or more 95 times in the period under consideration. DOE has collated the logged illuminance levels for each of those sessions, defined as “TV viewing session room

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<sup>29</sup> Matsumoto et al., "Appropriate Luminance of LCD Television Screens under Real Viewing Conditions at Home", The SID Digest, (2011)

<sup>30</sup> The preliminary field tests of room lighting levels can be found on the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011. <[http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)>

<sup>31</sup> Id.

illuminance” measurements, and found that they ranged in duration from 10 minutes to over five hours. Thirty-one, or about one-third, of the TV viewing sessions occurred during the day (defined as 6 am to 6 pm), and 64, or about two-thirds, occurred at night (6 pm to 6 am). For daytime measurements, the range was 0 to 499 lux, with a mean of 116 lux and a median of 81 lux. For nighttime measurements, the range was 0 to 106 lux, with a mean of 19 lux and a median of 12 lux. Across all room illuminance measurements, the mean was 51 lux and the median was 17 lux. More than 90 percent of measurements had a room illuminance level between 1 and 200 lux, and more than 70 percent of the measurements had a room illuminance level between 5 and 100 lux.

In addition to the Japanese study and its own preliminary study, DOE is also aware that CLASP recently conducted a study which assessed how TV energy consumption is affected by illuminance levels<sup>32</sup>. The CLASP study found that there is no consistency in the way in which manufacturers implement ABC (e.g. automatically adjusting TV luminance according to the ambient light levels). The CLASP study suggested that appropriate room illuminance levels at which to measure ABC are: 10, 50, 100, and 300 lux<sup>33</sup> to properly characterize how ABC performs.

Given DOE’s preliminary results that more than 70 percent of measurements fell between a room illuminance level of 5 and 100 lux, and CLASP’s recommended room illuminance levels, DOE is proposing to require testing at 10, 50, 100, and 300 lux illuminance levels in this NOPR.

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<sup>32</sup> Jones, Keith. Analysis of Television Luminance and Power Consumption, CLASP, August 29, 2011, [www.clasponline.org/](http://www.clasponline.org/), <  
<http://www.clasponline.org/en/ResourcesTools/Resources/StandardsLabelingResourceLibrary/2011/Analysis-of-tv-luminance-and-power-consumption>>

<sup>33</sup> Id.

DOE is proposing this testing in section 5.5.1 of appendix H to subpart B of 10 CFR part 430. These proposed illuminance levels will help to characterize how TV energy consumption is altered by ABC, which is affected by changes in room lighting. The CLASP study included testing on forty TVs and investigated the energy consumption of TVs using ABC at various illuminance levels. DOE's own laboratory testing revealed that televisions implement ABC differently, with screen luminance often following a complex function of room illuminance. Some televisions exhibit an increase to nearly full screen luminance slightly above 0 lux, while others exhibit an "S-shaped" response to room illuminance, with maximum change occurring between approximately 50 and 100-150 lux. Having at least three (and ideally four) measurement points at increasing room illuminance levels can begin to capture the shapes of either of these behaviors that become clearly evident with larger numbers of measurements.

DOE is not proposing testing at 0 lux, because it believes that ambient lighting levels this low are very difficult to achieve in practice in homes or laboratories when the television is operating. DOE is only proposing one point above 100 lux, based on the limited evidence available from the Japanese study and its own study (both referenced above), DOE assumes that viewing at illuminance levels higher than 100 lux will be limited. The studies measured room illuminance at different points – the Japanese study from the top of the television and facing the viewer, the DOE study from the bottom bezel of the television and facing the viewer - however, with the limited data collected, static measurements of light levels at these locations in the DOE study suggest that the difference in the recorded values is relatively small (12 percent lower when measured at the top of the television). DOE is also proposing to measure these 4 illuminance values with the IEC 62087-2011 main menu displayed on the TV. This screen is a static image that is seen directly before the Dynamic Broadcast video clip and is a predominantly black

screen. This allows the TV to stay on so it doesn't need to be warmed up again and increases repeatability.

DOE is proposing testing at multiple levels to reflect how ABC could change display luminance in relation to changes in room illuminance. Although DOE believes that testing at four illuminance levels is the most appropriate for this test procedure, it is also considering measuring at alternative illuminance levels to reduce test burden. DOE welcomes any comment on potentially testing less than four room illuminance levels, including which levels would be recommended and the rationale for such levels.

DOE believes that it is difficult to measure exact ambient light values with illuminance meters having high accuracy (high resolution). As such, DOE is proposing specified tolerance values for each ambient light level. All measurements made shall be within the specified tolerance levels. The proposed tolerance levels for room illuminance measurements are based on the observation that power consumed by ABC-enabled products varies greatly with changes in ambient lighting conditions less than 100 lux. Based on this observation, DOE would require that measurements at lower lighting levels be made as accurate as possible and, as such, proposes low tolerance levels at 10 lux ( $\pm 1$  lux ) and 50 lux ( $\pm 2$  lux ). DOE observed low variance in power consumed by TVs at higher ambient light levels and hence proposes greater tolerance levels at 100 lux ( $\pm 5$  lux) and 300 lux ( $\pm 9$  lux). These tolerance requirements have been incorporated in section 5.5.1 of appendix H to subpart B of 10 CFR part 430 DOE seeks comments from interested parties on setting tolerance levels at each room illuminance point. (See Issue 8 in section V.E "Issues On Which DOE Seeks Comment")

DOE is currently not proposing to weigh power consumption at each of the illuminance levels. DOE is, however, considering a weighted average to calculate the overall power consumption recorded when testing at the four illumination levels by assigning equal weights to each of the values. The weighting would reflect the amount of time that the average TV spends in that particular illuminance level. Providing weighting to different illuminance levels reflects the fact that TVs are watched in rooms with different lighting levels and at different times of the day. If DOE had additional data on the proportion of time TVs spend within different illuminance ranges, DOE might consider assigning different weightings to the power consumptions recorded at each illuminance level. DOE welcomes comments from interested parties on the methods under consideration. (See Issue 8 in section V.E "Issues On Which DOE Seeks Comment").

#### ii. Method for Creating Illuminance Conditions

Once the respective illuminance levels have been selected, DOE must specify how to create the room illuminance in the test procedure to be both repeatable and representative. This involves the orientation of the illuminance measurement meter, the light source type and the location for measurement.

In today's NOPR, DOE is proposing to measure the room illuminance at the location of the ABC sensor on the TV with the light entering directly into the sensor. This method is currently being employed by ENERGY STAR v. 5.3 as well as IEC 62087-2011, and was generally supported by interested parties. However, DOE is also considering an alternative method. The alternative method requires that the room illuminance be created using a diffused

light source, and be measured either at the center of the screen or the location of the ABC sensor. In response to the 2010 RFI, DOE received comments on the appropriate method for creating illuminance levels.

DOE received general comments requesting a test procedure that clearly outlines where to create and measure room illuminance with respect to the TV. NRDC encourages DOE to establish a more specific test method on how to measure the light that is entering the ABC sensor and/or the TV screen, but NRDC did not specify an appropriate alternative. (NRDC, No. 5 at p. 5) NRDC stated that the test procedure should provide detail on the orientation of the illuminance meter, the type of light source, and the location for measurement. (NRDC, No. 5 at p. 6) PG&E and California IOUs recommended that DOE specify guidance on illuminance meter orientation, source light and the direction of the source light to ensure consistent testing across products. (PG&E, No.12 at p. 3; California IOUs, No. 9 at p. 3)

Commenters expressed desire for measuring the room illuminance at the location of the light presence sensor with the light directly entering the sensor. PG&E and the California IOUs recommend that measurement of room illuminance be taken at the location of the TV light presence sensor. (PG&E, No.12 at p. 3; California IOUs, No. 9 at p. 3) Sony believed that to accurately capture light conditions, the illuminance meter should be placed at the sensor. (Sony, No. 8 at p. 3) Panasonic recommended that ABC be measured with the light entering directly into the TV's ambient light sensor as specified by IEC 62087-2008, ENERGY STAR v. 4.1, and CEA 2037. (Panasonic, No. 6 at p. 6) CEA similarly commented that the illuminance measurement should be taken at the sensor and the illuminance meter should be in the same horizontal orientation as the light sensor to ensure repeatability across measurements. (CEA, No.

13 at p. 6) Finally, Panasonic commented that the illuminance should be measured immediately adjacent and in the same plane as the TV's ambient light sensor opening. They believe that measuring light at the center of the screen will not provide meaningful and repeatable results. (Panasonic, No. 6 at p. 6) SHARP commented that manufacturers do not gain any advantage by putting the ABC sensor in an obscure or hidden position, and thus the illuminance measurement location should be at the sensor. (SHARP, No. 14 at p. 6) SHARP also believed that no problem exists with respect to measurement location and lighting, and anything other than the IEC 62087-2008 method adds complexity, uncertainty and cost to the measurement. (SHARP, No. 14 at p. 6)

DOE evaluated a second option for furnishing ambient light to the automatic brightness control sensors in a laboratory setup. This second option utilizes a diffuse light source. Such a source would be located further away from the TV than a direct source, and its light would reach the TV through a combination of direct and indirect (e.g., reflections from the ceiling, walls, and floor) pathways. Although a diffuse light source better represents actual in-home lighting conditions, DOE determined that such an approach depends on too many variables that are difficult to control and which introduce uncertainties into the test procedure relative to the direct approach. The diffuse light source would need to be much brighter in order to yield the target lux values at the television. The light would be arriving at the television from many different angles and would be incident on the television screen as well as its ABC sensor. This increases the likelihood that the technician's position in the room during the test would influence the measured result, and makes it difficult to employ a non-contact luminance meter for television screen brightness measurements. Finally, differences in test room size, configuration, surface reflectivity, and light source type would also make it very difficult to replicate identical test

conditions in multiple laboratories. For the above reasons, DOE proposes to employ only a direct light source for all ABC testing.

In addition to specifying to lighting position and sensor measurement location, DOE also believes that it is necessary to specify the lighting type. Of artificial lighting sources, incandescent light most closely follows the spectral distribution of natural light. Compact fluorescent lights (CFL) and LED tend to be discontinuous in the spectral density curves which may impact the ABC sensors ability to perceive light. Incandescent lights have a color rendering index (CRI) of about 100 while CFL and LED have a CRI ranging from 75-85 (natural light has a CRI of 100, a metric used for how light makes the perceived color of an object appear). DOE is proposing that the room illuminance be created only by using 100 watt halogen incandescent light bulbs, although the number of bulbs need is dependent on the size of the room and the distance from the ABC sensor.

While DOE feels that specifying a halogen incandescent is sufficient for creating a repeatable lighting condition, DOE requests comments on incorporating a color temperature range in addition to lighting type. Consumers have a wide variety of lighting options to choose from ranging from “warm” (2800 – 3000 K) to “cool” (3600 – 5500 K) color temperatures and it is still unknown how these characteristics may be perceived by ABC sensors. DOE also requests comments on a warm-up time for the lighting source. Incandescent lights do not typically have the same warm-up characteristics as other lights like CFL that require time before reaching their optimal brightness.

In today's NOPR, DOE is proposing to measure the room illuminance at the location of the ABC sensor on the TV with a halogen incandescent light source entering directly into the sensor in section 5.5.2 of appendix H to subpart B of 10 CFR part 430. Although neither ENERGY STAR v. 5.3 or IEC 62087-2011 specifies the particular location of the light source, DOE believes that through specifying the location, it will have a more thorough and complete test procedure that is representative of actual use. Although DOE is proposing to measure using only one light source, DOE is also interested in receiving feedback on measuring using multiple light sources. (See Issue 9 in section V.E "Issues On Which DOE Seeks Comment").

c. Television Sets Shipped without Automatic Brightness Control Enabled

For TVs shipped without ABC enabled, DOE is proposing to incorporate testing consistent to that in the ENERGY STAR v. 5.3, which references Section 11: Measuring Conditions for Television Sets in On (average) Mode of IEC 62087, Ed 2.0. DOE believes that this is a respected method that is widely accepted in industry and reasonably measures the average on mode power consumption of the TV in section 5.4.1 of appendix H to subpart B of 10 CFR part 430. In this test procedure, the on mode power consumption is obtained by playing the IEC 62087-2011 dynamic-broadcast video signal (which was created to mimic typical TV content) in "as shipped" condition which is the mode in which DOE assumes that most TVs stay according to feedback from Sony. As noted above, Sony commented that their call center data indicates that more than 95 percent of returned sets remain in the home picture setting when received. (Sony, No. 8 at p. 2) DOE did not receive any comments pertaining to on mode power testing for TVs shipped without ABC enabled.

#### d. Three Dimensional Display Testing

In the 2010 RFI, DOE requested comment on incorporating a test method for testing TVs capable of displaying 3D images in 3D mode. 75 FR 54048, 54051. Interested parties commented on the inclusion of this testing into the DOE test procedure.

All agreed that 3D was likely to become increasingly prevalent. Interested parties, however, had mixed views as to the importance of DOE incorporating 3D testing in this version of its test procedure. Some did not seem to consider it a priority, some considered it premature, stating that the market share is currently small but rapidly increasing and the technology is still developing, and others felt it should clearly be included. Sony offered its support to DOE's studies into 3D technology. They believe that the amount of time consumers spend watching 3D content is currently relatively small compared to 2D content but increasing. Sony believes that sufficient time should be allowed for the IEC to create a 3D version of its 2D dynamic broadcast-content video signal. (Sony, No. 8 at p. 3) Mitsubishi commented that a test procedure for 3D should be included in DOE's test procedure but it need not involve a 3D disc, 2D content could be converted to 3D in real time. (Mitsubishi, No. 7 at p. 6) NRDC commented that TVs having the "3D boost" feature could result in a significant increase in TV power to display 3D content. (NRDC, No. 5 at p. 6) Panasonic asserts that TVs display 3D images in a similar manner as 2D images. Thus, they believe that a TV that is efficient in 2D mode will also be efficient in 3D mode, when compared to other TVs operating in 3D mode. Once IEC has developed a 3D clip, or even before, Panasonic believes that it should be referenced by DOE. (Panasonic, No. 6 at p. 7) CEA believes that DOE should support standards development organizations investigating 3D technologies but due to the lack of a standardized method and current small volumes on the market, 3D technology should not be included in DOE's current test procedure. CEA

acknowledged that it may be appropriate to modify the DOE test procedure in the future to include 3D testing. (CEA, No. 13 at pp. 7 – 8) P.R. China suggested that it is too early to consider 3D technology in the DOE test procedure. (P.R. China, No. 16 at p. 5) SHARP believes that it is premature to set power standards for TV in 3D modes stating that there are three things that are needed: standardized language for testing, a standardized test signal, and accurate weightings based on actual viewing habits. SHARP recommended that the IEC develop a 3D dynamic broadcast-content video signal, but such a result is unlikely to be available before late 2012. (SHARP, No. 14 at p. 7) DOE should revisit 3D power measurements when a 3D dynamic broadcast-content video signal becomes available – probably no earlier than 2013. (SHARP, No. 14 at p. 7) PG&E, California IOUs, and Mitsubishi supported DOE in currently including 3D testing in its proposed test procedure. PG&E and California IOUs commented that 3D TVs are expected to significantly increase in market share, and drop in price. Therefore they urged DOE to develop a test procedure that applies to 3D TVs on the market. (California IOUs, No. 9 at p. 3; PG&E, No. 12 at p. 3) Although Mitsubishi recognized the difficulties of creating a test procedure for testing 3D, they believed that power consumption in 3D operating mode(s) should have a single, recognized test procedure, and that power consumption in 3D operating mode(s) should be measured. (Mitsubishi, No. 7 at p. 6)

DOE recognizes that 3D content is becoming increasingly popular and that 3D TVs are becoming more affordable. PG&E and California IOUs cited a study that showed that 3D TVs are projected to increase from 4.2 million units in 2010 to 78 million units by 2015, rising at a compound annual growth rate of 80 percent, and that the global average selling price for 3D TVs

in 2015 will drop by more than half the price in 2010<sup>34</sup>. (California IOUs, No. 9 at p. 3; PG&E, No. 12 at p. 3) Industry has more recently indicated that over the next couple of years 3D will become a common feature on many TVs, almost available as standard on larger screen sizes and with higher end models (Society for Information Display conference, 2011). Moreover, 3D content is becoming increasingly prevalent with emerging native 3D material (movies, sports content etc. shot in 3D), and Blu-ray players and TVs on the market with the ability to convert content from 2D to 3D. DOE understands the need for a standardized method for measuring the power consumption of TVs in 3D mode. DOE's research thus far indicates that for most mainstream technologies' 3D mode consumes a significant additional power premium. However, DOE understands that 3D is a developing technology and will most likely take time to mature.

In today's NOPR, DOE is not proposing to include a test procedure to measure 3D energy consumption for the reasons that: (a) 3D technology has not yet stabilized, and (b) a uniform method for 3D mode energy measurement has not yet been created. However, DOE is considering two potential alternatives for future inclusion in its test procedure. The two alternatives involve either creating a 3D dynamic broadcast-content video signal similar to that of the IEC 62087-2011 dynamic broadcast-content video signal, or employing a device that can uniformly convert the 2D dynamic broadcast-content video signal to 3D and output 3D content in real time. The two potential test methods under consideration are outlined below.

For the first approach that DOE is considering, DOE would create a 3D test disc capable of being played in a Blu-ray player. DOE has been working closely with the IEC. IEC has agreed

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<sup>34</sup> Global 3-D TV Shipments Set to Soar to 78 Million Units in 2015. Riddhi Patel. iSuppli Press Release. March 1, 2010.

in principle to provide DOE with all the rights which it is able to provide DOE to modify the 2D test clip and distribute modified versions of the test clip. If DOE creates a modified 3D version of the IEC test clip for any purpose, it has agreed to provide a copy to IEC which IEC could then use in its development of an IEC 3D test clip<sup>35</sup>.

It is the intent of DOE that the disc will be capable of playing Blu-ray format 3D, a HDMI 1.4 interface at 1080 horizontal lines of vertical resolution and at least 1440 vertical lines of horizontal resolution. When playing the disc, 3D capable TVs will recognize that the disc contains 3D content, and will switch into 3D mode. The average APL of the 3D disc would be 34 percent thus simulating normal viewing content even while the TV is in 3D mode. At this time, DOE believes that this approach is the best approach for developing a 3D test procedure and is interested in working with the IEC and other interested parties in its development.

DOE is also considering a second approach, which employs a device that can convert the 2D test clip to 3D and output 3D content in real time. Under this approach, DOE would try to develop a performance specification for Blu-ray devices that have this capability to ensure that the test results are consistent across labs if using different 2D to 3D convertors. DOE has tested some of these devices, and cannot conclude at this time what the performance specification should be for these devices. However, DOE welcomes comments on this aspect of the test procedure under consideration.

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<sup>35</sup> IEC and necessary copyright holders have agreed in principle to allow DOE to modify the test clip and return it to IEC. IEC is able to assign rights over the material in the test clip with the possible exception of certain portions of the test clip owned by one copyright holder. Currently, DOE is in discussions with that copyright holder.

As mentioned, DOE has performed 3D testing using two Blu-ray players available for sale in the U.S. from different manufacturers, both of which are able to convert 2D images to 3D in real time. DOE measured the average power consumption over a specified amount of time and then played a 2D disc of the same footage on the 2D to 3D converter. DOE found very little difference between TV power measured using 3D source material and TV power measured using 2D source material converted to 3D using the Blu-ray players. To make the comparison, DOE used market available Blu-ray videos with both a 3D and a 2D version and measured the energy consumption over the same ten minute section of the film using both methods for generating 3D material. The comparison was made on five 3D capable televisions spanning LED LCD, plasma, and DLP technologies.

DOE believes that, generally, the limited test results of the converter are comparable to those of playing 3D content. However, there were issues with this approach. DOE is concerned that the variability found between playing the test clip in the converter, versus playing a 3D test clip, can be a function of the test clip, converter and TV used in the test and is not certain how to develop an adequate performance specification for the converter alone. DOE also found through testing that not all converters worked with all TV brands. Further, DOE determined that, in some cases, the converters put the TV into a mode that consumed less energy when playing 2D content converted to 3D than when playing the same content in 2D.

DOE requests comment on these two options for generating the video signal for 3D TVs, along with any other considerations for testing 3D TVs. (See Issue 10 in section V.E "Issues On Which DOE Seeks Comment").

## 5. Standby and Off Modes

As mentioned above, EISA 2007 requires DOE to include consideration of standby mode and off mode energy consumption in future amendments to both its test procedure and energy conservation standard. In order to adhere to EISA 2007, DOE is proposing to include the standby mode requirements according to IEC 62087-2011 and the off mode requirements according to IEC 62301-2011. When developing a proposed standby and off mode test procedure, DOE assessed both IEC 62301-2005 Household Electrical Appliances – Measurement of Standby Power and IEC 62087-2011. ENERGY STAR v. 5.3 references IEC 62087-2011. In today's NOPR, DOE is proposing to incorporate standby tests for standby-passive in section 5.6.1 (standby-passive mode test) of appendix H to subpart B of 10 CFR part 430 and standby-active, high in section 5.6.2 (standby-active, high mode test) of appendix H to subpart B of 10 CFR part 430 as well as an off mode test in section 5.7 (off mode) of appendix H to subpart B of 10 CFR part 430. Although DOE is not currently proposing to include a standby test for standby-active, low, DOE is considering this requirement for the future.

In the 2010 RFI, DOE requested comments dealing with standby and off mode. Specifically DOE focused on additional functions, internet connectivity and power saving technologies, since they can possibly alter the energy consumed by the TV. 75 FR 54048, 54051.

### a. Additional Functions

As mentioned above, additional functions have the potential to increase energy consumption while the TV is in standby and off mode. Additional functions are defined as any function that is not required for the basic operation of the device. Although DOE did not

specifically request comments pertaining to additional functions in the 2010 RFI, both NRDC and SHARP provided comments on assessing the power use associated with additional functions.

NRDC asked that DOE provide guidance in its test procedure for additional functions and that DOE revise the standby section of IEC 62087-2008, which is the same as IEC 62087-2011. NRDC believes that the test procedure must address whether the TVs additional functions should be left as is, turned on, or turned off/disabled prior to testing. (NRDC, No. 5 at p. 2)

Although NRDC requested guidance, they were generally opposed to testing with additional functions switched on unless initially enabled by default. NRDC believes that built-in DVD and Blu-ray players should be tested without a disc inserted, and play should not be selected. However, they believe that the DVD and Blu-ray players should not be allowed to be turned off or physically removed prior to testing. (NRDC, No. 5 at p. 2) NRDC also commented that the TV should be tested without the cable card inserted, but DOE should potentially include a supplement to its test procedure that allows guidance on how to report for features such as cable cards. (NRDC, No. 5 at p. 3) Additionally, DOE should gather data and evaluate methods, including the Australian method, which includes measuring standby-active and standby-passive once the TV has been tuned to an Australian broadcast channel. (NRDC, No. 5 at p. 7)

SHARP was also opposed to enabling additional functions when conducting energy measurements. SHARP commented that IEC 62087-2008 requires that additional functions be turned off to provide for equivalent TV model comparison. (SHARP, No. 14 at p. 8) SHARP recommends that DOE follow precedence and measure the basic TV functions without

intervention in the areas of nascent technologies, services and innovations. (SHARP, No. 14 at p. 9)

In this NOPR, DOE is proposing testing the TV as shipped, without manually enabling any additional functions. This method is consistent with the comments made by both SHARP and NRDC. Although enabling additional functions while testing in standby and off mode would encourage manufacturers to lower energy consumption for those functions, it would make it difficult to compare TVs with different functions. Also, DOE is not aware of any usage data that illustrates how consumers use TVs with additional functions and DOE believes that proposing testing with additional functions would require an understanding of such usage.

#### b. Power Saving Technologies

The number of TVs that are being sold with various power saving technologies is continuing to increase, and therefore DOE investigated the how these technologies affect energy consumption. These technologies include, but are not limited to, auto-shut-off, presence sensor, DPMS, and HDMI-CEC.

Panasonic, Sony, NRDC, and SHARP believe that TVs with power saving technologies should not be given an energy credit in the current rulemaking because many are still being developed. Panasonic believes that it would be difficult to determine the amount of power saved and to obtain data by various power saving technologies and complex measurement procedures will not be useful. (Panasonic, No. 6 at p. 7) Sony stated that it is impossible to know the actual savings of energy saving functions, so additional studies are needed prior to DOE adopting them in its test procedure. (Sony, No. 8 at p. 4) LG stated that the ENERGY STAR and IEC 62087-

2008 test procedure, which only account for ABC, adequately evaluate power saving functions available today. (LG, No. 3 at p. 2) CEA also stated that not every possible energy using feature needs to be covered, especially if it is too difficult, impractical, costly or speculative. (CEA, No. 13 at p. 2) More specifically, NRDC and Panasonic do not support giving credit for presence sensors; a power saving technology that turns the TV off if it senses that no consumers are viewing it. They believe that the technology will likely be disabled by the consumer; assuming the TV is shipped with presence sensors enabled. (NRDC, No. 5 at p. 7; Panasonic, No. 6 at p. 8).

SHARP also noted that many power saving technologies are proprietary and should therefore be avoided. Specifically, DPMS has intellectual property implications. (SHARP, No. 14 at p. 9) SHARP believes that HDMI-CEC can provide some mechanisms for power saving. They supported their comment by stating that the application layer is not well enough defined for consistent cross-company interoperability, and many HDMI-CEC implementations are currently proprietary. (SHARP, No. 14 at p. 9)

Many interested parties supported DOE research into power saving technologies. NRDC urged DOE to revisit power savings features, and whether credits should be provided for power saving features. (NRDC, No. 5 at p. 7) CEA also encouraged DOE to continue to study and investigate energy saving features but be cautious as to not promote technology that is restrictive and costly. (CEA, No. 13 at p. 8) CERC believes that the standard should be allowed to evolve with new technologies. CERC commented that technologies still in early development, including automatic shut-off and ABC, should be allowed to be developed more fully before a standard and test procedure are imposed on their operation, allowing manufacturers more incentive to

innovate. (CERC, No. 10 at pp. 2-3) PG&E and the California IOUs urged DOE to account for new technologies in the test procedure to the greatest extent possible. (PG&E, No. 12 at p. 4; California IOUs, No. 9 at p. 4)

Finally, some manufacturers commented on specific power saving technologies available in products today. Sony commented that its TVs contain intelligent presence sensors with face and motion detectors, light sensors, power savings (regardless of picture mode), idle TV standby, auto shut-off and the energy savings switch (completely off). (Sony, No. 8 at p. 4) LG commented that their TVs have features that place the TV into standby mode if no signal is present for 15 minutes. (LG, No. 3 at p. 2) SHARP commented that the auto-standby feature that is available in some manufacturers' products can potentially save energy, but also may annoy consumers. (SHARP, No. 14 at p. 9) SHARP also believes that California's requirement that the power button put the TV into passive standby, can have negative consequences, such as terminating a nearly complete program guide download. (SHARP, No. 14 at p. 9)

Given the interested party feedback, DOE is not proposing to test new power saving technologies because DOE believes more investigation is needed to be able to better understand any potential benefits from these technologies. Although DOE will continue to investigate the new technologies, DOE believes that the market is currently at too early a stage of development. In order to continue to investigate these new technologies, DOE welcomes interest parties submit information pertaining to all power saving technologies, which would help DOE in its investigation present on TVs.

c. Standby Modes

i. Standby-Passive Mode

As stated in section 5 above, DOE is proposing a test procedure for standby-passive mode in section 5.6.1 (standby-passive mode test) of appendix H to subpart B of 10 CFR part 430. IEC 62087-2011 defines standby-passive mode as the mode in which the appliance is connected to a power source, produces neither sound nor picture but can be switched into another mode with the remote control unit or an internal signal as referenced in III.C.3.a of this NOPR. Testing in this mode would require putting the TV into standby-passive mode as defined in section 2.12 (standby-passive mode) of appendix H in subpart B of 10 CFR part 430, and measuring the power consumed according to section 4.3.1 of IEC 62301-2011. Standby-passive mode would include modes such as when the TV is connected to the internet but not actively receiving a signal.

ii. Standby-Active, Low Mode

The number of TVs that are being sold with the capability of accessing the internet (either wirelessly or via Ethernet) is continuing to increase; PG&E and California IOUs stated that by 2014, internet-enabled TVs are estimated to account for 54 percent of the total global TV market. They supported their statement by commenting that in 2010, shipments of these TVs rose 125 percent globally from 2009. (PG&E, No. 12 at p. 4; California IOUs, No. 9 at p. 4) In the 2010 RFI, DOE requested comments on testing TVs with internet connectivity. 75 FR 54048, 54051.

Some interested parties commented in favor of TVs being connected to the internet when measuring standby and off mode energy consumption. NRDC suggested that the TV should be

connected to the internet, then turned off normally, and the energy consumption associated with the TV being connected to the internet should be measured and reported as part of standby power use. (NRDC, No. 5 at p. 2) PG&E and the California IOUs also stated that DOE should incorporate internet connectivity and power usage associated with this feature in the test procedure. They suggested that DOE do this by including a network mode, consistent with what will be included in IEC 62301 Edition 2.0. (PG&E, No. 12 at p. 4; California IOUs, No. 9 at p. 4)

Other interested parties commented that internet connectivity energy consumption should not be included in the test procedure. Interested parties commented against including a general internet measurement as well as enabling internet when conducting the standby test. Interested parties reasoned that internet connectivity has not been researched thoroughly, and is still in the early development stages. Sony commented that their limited data suggests that the power consumption of TVs equipped with Ethernet ports is equivalent to the power consumption in the home mode while streaming contracted network connects from the various service providers. (Sony, No. 8 at p. 3) Sony also stated that because power and usage of internet capable TVs is unknown, additional study is needed prior to incorporating it into the test procedure. (Sony, No. 8 at p. 3) CEA similarly stated that internet connectivity is still in an early phase of development and should therefore not be included in the test procedure without further research. (CEA, No. 13 at p. 8) Panasonic recommends using the same on mode power measurement with the IEC 62087-2008 dynamic-broadcast video signal, regardless of the TV's internet capabilities. (Panasonic, No. 6 at p. 8) Panasonic believes that the power consumed from an internet connection is minimal and complex, and will be difficult to reproduce. (Panasonic, No. 6 at p. 8) SHARP further commented that consumers all use the internet differently, so setting a test procedure to mirror actual internet use would be a daunting task with minimal value. (SHARP,

No. 14 at p. 8) SHARP believes that much more study is required before DOE can characterize the power consumed from TVs based on active internet use. (SHARP, No. 14 at p. 8) SHARP believes that due to competitive pricing, TVs have limited storage capacity, and therefore internet communications are limited or non-existent when the TV is in sleep mode, making testing it not relevant. (SHARP, No. 14 at p. 8)

Other interested parties commented on specific details pertaining to internet connectivity energy consumption. NRDC believes that the test procedure should have language to ensure that no content is being downloaded from the internet while the measurement is being made. (NRDC, No. 5 at pp. 2 -- 3) LG commented that “currently the HDMI input is available to the IEC Standard 62087 internet source; however it is impossible to implement it through the current environment LAN Port.” (LG, No. 3 at p. 2) DOE notes that while IEC 62087-2011 provides a video signal of different websites to represent internet energy consumption, there is currently no standard method for measuring actual internet usage when connected to the internet via a LAN Port.

Given the comments received in the 2010 RFI, DOE researched the energy consumption associated with internet, HDMI, and cable connectivity. DOE completed standby and off mode energy testing while the TV was connected to the internet (both wirelessly and via Ethernet), while connected to a cable signal, while connected to a peripheral device through a HDMI cable and while not connected to input or output sources except for power. DOE found very little

evidence of increased energy consumption associated with additional connections while the TV was in standby and off mode<sup>36</sup>.

In today's NOPR, DOE is proposing to test standby and off mode energy consumption without having the TV connected to the internet in sections 5.6 (standby mode tests) and 5.7 (off mode test) of appendix H to subpart B of 10 CFR part 430. As mentioned above, DOE also conducted testing when the TV was connected to both a cable signal and an HDMI input. DOE did not measure a significant power increase when the TV was connected to the internet, cable or an HDMI input while in standby mode or off mode<sup>37</sup> DOE believes that conducting additional standby testing while the TV is connected to an internet, cable or HDMI input is unduly burdensome due to the lack of significant results indicating increased energy consumption from DOE's testing. Therefore, DOE is not proposing to require that the TV be connected to a cable input, HDMI input or to the internet when testing standby and off mode energy consumption. However, DOE welcomes comments by interested parties on the energy consumption associated with internet connectivity in standby mode should be included. (See Issue 11 in section V.E "Issues On Which DOE Seeks Comment").

### iii. Standby-Active, High Mode

IEC defines standby-active, high as the mode when the appliance is connected to a power source, produces neither sound nor picture but can be switched into another mode with the remote control unit or an internal signal and can additionally be switched into another mode with

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<sup>36</sup> The data indicating a lack of increased power consumption associated with connecting the TV to the internet, cable or an HDMI input can be found on the DOE website: [Appliance and Commercial Equipment Standards: Television Sets](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). U.S. Department of Energy. August 2, 2011.

<sup>37</sup> [http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html)

<sup>37</sup> Id.

an external signal and is exchanging/receiving data with/from an external source. DOE believes that the TV is in standby-active, high mode when the TV is actively exchanging/receiving data (likely from the internet) as well as while in DAM mode. In the 2010 RFI, DOE requested feedback as to the possibility of including a DAM test. 75 FR 54048, 54051.

#### iv. Download Acquisition Mode

ENERGY STAR v. 5.3 defines DAM as the mode where the product is connected to a mains power source, is not producing a sound or a picture, and is actively downloading data, to include but not limited to, channel listing information according to a defined schedule for use by the electronic programming guide, TV setup data, channel map updates, TV firmware updates, monitoring for emergency messaging/communications and/or otherwise communicating through a network protocol. DOE believes it is important to include DAM testing because the tested TVs had heightened energy consumption while in this mode.

Several interested parties commented that DAM should be tested. PG&E and the California IOUs indicated that there has been at least one reported instance of a TV consuming a significantly greater amount of power and spending a majority of time in DAM when the TV should have been in standby mode. Therefore, they urged DOE to account for DAM in its test procedure. (PG&E, No.12 at p. 5; California IOUs, No. 9 at p. 5) They requested that the test programming content, used for testing in DAM, should be publically available and able to be utilized by non-proprietary technology. (PG&E, No.12 at p. 4; California IOUs, No. 9 at p. 4)

Many interested parties specifically suggested that DOE implement the “CEA Test Procedure for Download Acquisition Mode Testing<sup>38</sup>” (CEA test procedure for DAM testing). Specifically, Sony, LG, Panasonic and CEA recommended that DOE adopt this test procedure. (Sony, No. 8 at p. 3; LG, No. 3 at p. 2; Panasonic, No. 6 at p. 8; CEA, No. 13 at p. 8) Panasonic and Sony supported their recommendations by noting that ENERGY STAR v. 4.1 references the CEA test procedure for DAM testing. (Panasonic, No. 6 at p. 8; CEA, No. 13 at p. 8)

Alternatively, SHARP commented that although the CEA test procedure for DAM testing is a good test procedure, it should not be incorporated into DOE’s test procedure. SHARP supports the flexibility of the CEA test procedure for DAM testing, but is concerned that it is not specific enough to be used by third parties. However, SHARP is not aware of any test procedure that is specific enough to fit these criteria. (SHARP, No. 14 at pp. 8, 10)

In the 2010 RFI, DOE noted that ENERGY STAR v. 4.1 tests DAM according to the Rovi DAM test procedure. However, Rovi commented that DOE should not incorporate the Rovi DAM test procedure into the DOE test procedure. (Rovi, No. 4 at p. 2) Rovi explained that EPG software maintains a local database of programming available to the viewer, which is periodically downloaded during times when the TV is in the standby or off mode. Rovi noted that the location, previous downloads, data delivery method and communication errors are among the things that affected power consumption, meaning if any of these conditions are varied, different results will be obtained. (Rovi, No. 4 at p. 1) Rovi stated that in the near-future a revision to ENERGY STAR v. 4.1 will replace the Rovi test procedure with a generic system

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<sup>38</sup> CEA Procedure for Download Acquisition Mode DAM Testing: For TVs, September 8, 2010. <[http://www.energystar.gov/ia/partners/prod\\_development/revisions/downloads/television/CEA\\_DAM\\_Test\\_Procedure.pdf](http://www.energystar.gov/ia/partners/prod_development/revisions/downloads/television/CEA_DAM_Test_Procedure.pdf)>

that depends in large measure on specific technical knowledge of the device under test (after the publication of the 2010 RFI, ENERGY STAR has revised their test procedure and standard to include the CEA test procedure for DAM testing). (Rovi, No. 4 at p. 1)

DOE notes that the CEA test procedure for DAM testing does not identify specific connections to be used when conducting testing. CEA only states that an appropriate signal source for communication should be used but does not specify what connection should be utilized when more than one connection could be used to communication with the DAM function. DOE believes that a hierarchy of network connection types is needed when more than one connection is capable of communicating with the DAM function to produce a more repeatable test procedure. DOE is proposing the following priority to ensure consistency across standby-active, high mode tests in section 5.6.2.1 of appendix H to subpart B of 10 CFR part 430:

- 1) Wi-Fi
- 2) Ethernet. If the UUT supports an Energy Efficient Ethernet, then it shall be tested using that connection.
- 3) Thunderbolt
- 4) USB
- 5) Firewire
- 6) Other

In today's NOPR, DOE is proposing to include the DAM energy consumption testing under its standby-active, high test method as defined in 2.3 (download acquisition mode) of

appendix H to subpart B of 10 CFR part 430. The majority of interested parties including CEA, Sony, LG, Panasonic, PG&E, California IOUs and NRDC were all in favor of requiring a DAM energy consumption test. Many, including CEA, Sony, LG and Panasonic, recommended incorporating the CEA test procedure for DAM testing. Given the positive input from interested parties supporting a DAM test, and particularly the CEA test procedure for DAM testing, DOE is proposing to incorporate by reference the CEA Procedure for DAM Testing in section 5.6.2 (standby-active, high mode test) of appendix H to subpart B of 10 CFR part 430. DOE is also aware that TVs can communicate and obtain similar information via an internet connection. Although DOE has developed a network connection priority list of preferred connections to conduct DAM testing, DOE seeks comment on using a priority list and the hierarchy that should be used. DOE also seeks comments from interested parties on the method for measuring standby mode energy consumption in all standby modes. (See Issue 12 in section V.E "Issues On Which DOE Seeks Comment").

#### d. Off Mode

DOE is proposing to test TVs in the off mode if applicable. DOE is defining off mode according to the IEC 62087-2011 definition. Off mode is the mode where the appliance is connected to a power source, produces neither sound nor picture, and cannot be switched into any other mode with the remote control unit, an external, or internal signal. This mode will not pertain to TVs that are only able to be switched on or off with a remote, rather it will be applicable to TVs that have an additional switch or method of reaching this mode. In today's NOPR, DOE is proposing that the power consumed in off mode be tested according to IEC 62301-2011 section 3.5 in section 5.7 (off mode test) of appendix H to subpart B of 10 CFR part 430. EISA 2007 requires DOE to implement an off mode energy consumption measurement. (42

U.S.C. 6295(gg)(2)(A)) This particular off mode test will meet the EISA 2007 requirements and allow DOE to capture the energy consumption associated with the TV while it is turned off. DOE seeks comments from interested parties on the method for measuring off mode energy consumption. (See Issue 12 in section V.E "Issues On Which DOE Seeks Comment").

## 6. Energy Efficiency Metric(s) for Televisions

In today's NOPR, DOE is considering two methods for determining the metrics of TVs in order to receive stakeholder comments. These methods include a luminance ratio, on mode energy consumption, standby mode energy consumption, and off mode energy consumption.

The first method would output four separate metrics, including a luminance ratio, on mode energy consumption, standby mode energy consumption, and off mode energy consumption. The test procedure yields a ratio of the home picture setting luminance to the retail picture setting luminance. This number would be expressed as a percentage (i.e., the luminance ratio). The test procedure would also output an on mode energy consumption according to the on mode test for TVs with ABC enabled by default or the on mode test for TVs without ABC enabled by default. For the standby mode tests, all TVs should be tested according to the standby-passive mode test. For TVs with DAM, the test procedure would also propose requiring an average energy consumption reading for standby-active, high mode. Finally, the test procedure would record the off mode energy consumption.

Alternatively, DOE is also considering a single output metric based on combining the on, standby, and off-mode energy consumption values to provide an annual energy use. The format of the metric, expressed as annual energy consumption (AEC, kWh/year), would be as follows:

$$\text{AEC}_{\text{metric}} = ((P_{\text{on}} * H_{\text{on}} + P_{\text{standby-passive}} * H_{\text{standby-passive}} + P_{\text{off}} * H_{\text{off}} + \text{DEC}_{\text{DAM}})/1000) * 365$$

where:

$P_m$  = power measured in a given mode  $m$  (in Watts)

$H_m$  = hours per day spent in mode  $m$

$\text{DEC}_{\text{DAM}}$  = daily energy consumption in DAM, if applicable (tested according to the CEA DAM test procedure)

Proposed values for  $H_m$  (in hours/day) would be as follows:

$$H_{\text{on}} = 7$$

$$H_{\text{standby-passive}} = 17$$

$$H_{\text{off}} = 0$$

To determine  $H_{\text{on}}$ , DOE obtained Nielsen TV viewing statistics for the months June 2010 through May 2011.<sup>39</sup> Nielsen collected between 48,791 and 52,105 samples in each month, from a representative cross section of U.S. households. DOE separated the data for each household to consider the primary TV. The mean viewing hours per day for primary TVs was determined for each month, and then the mean across the whole 12 months was taken to provide the final value. It was important to consider 12 months, not just one, as there is significant seasonal variation in viewing habits.

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<sup>39</sup> The Nielsen Company, LLC (2011).

It was assumed that the remainder of the time, TVs would be in standby-passive mode (thus,  $H_{\text{standby-passive}} = 24 - H_{\text{on}}$ ), except for the case of TVs with DAM capability, where the average hours per day the TV is in DAM would also be included in the calculation. Therefore,  $H_{\text{off}} = 0$  is based on the assumption that virtually all TVs remain in standby mode rather than being physically switched off when not in use.

Note that  $P_{\text{on}}$  is itself a weighted average of measurements for units with automatic brightness control available:

$$P_{\text{on}} = P_{10} * W_{10} + P_{50} * W_{50} + P_{100} * W_{100} + P_{300} * W_{300}$$

where:

$P_i$  = on mode power measured at room illuminance of  $i$  lux

$W_i$  = weighting at room illuminance  $i$ , expressed in percent.

$W_i$  are proposed to be equally weighted ( $W_{10} = W_{50} = W_{100} = W_{300} = 25$  percent). See Section IIII.E.4.b.i for further discussion and explanation.

The advantage of using a single metric is that the approximate annual average energy consumption can be calculated within the test procedure. Although a single metric would require manufacturers to represent the efficiency of their TVs in a consistent manner, this is already being accomplished under the FTC Labeling Program for TVs as it is currently using this

method. A single metric would help harmonize the different voluntary, incentive, and State programs applicable to TVs. However, the DOE proposed single metric would most likely eliminate the current energy efficiency standards for TVs established by California, since California established separate standards for both on mode and standby mode. All manufacturers would be required to make energy representations with the final DOE test procedure within 180 days after publication. After that time, manufacturers would not be required to provide to California separate results for on mode and standby mode in accordance with the California standard. This single metric would also require a change in the ENERGY STAR Program for TVs, since ENERGY STAR also has separate requirements for on mode, standby mode and DAM. The DOE proposed single metric would require DOE to monitor how the coefficients used to calculate the metric change with consumer usage and technological advancements in the TV market. For instance, the average number of primary TV viewing hours has increased by approximately 0.16 hours per day each year from 2007 to 2011, or 10 percent over four years. Additionally, the single metric considered in this NOPR does not distinguish between different usage profiles for calculating annual energy consumption for types of TVs with different features included in our TV definition, such as computer monitors over 30 inches. Finally, the proposed single metric does not capture all measurements in the test procedure such as power factor and illuminance ratio.

Although DOE is proposing multiple output metrics, it seeks comments from interested parties on both of the methods presented in this NOPR, including the use of a single metric for calculating annual energy consumption. (See Issue 13 in section V.E "Issues On Which DOE Seeks Comment").

## **IV. Procedural Issues and Regulatory Review**

### **A. Review Under Executive Order 12866**

The Office of Management and Budget has determined that test procedure rulemakings do not constitute “significant regulatory actions” under section 3(f) of Executive Order 12866, Regulatory Planning and Review, 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget (OMB).

### **B. Review under the Regulatory Flexibility Act**

The Regulatory Flexibility Act (5 U.S.C. 601 et seq.) requires preparation of an initial regulatory flexibility analysis (IFRA) for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, “Proper Consideration of Small Entities in Agency Rulemaking,” 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel’s website: [www.gc.doe.gov](http://www.gc.doe.gov).

DOE reviewed today’s proposed rule under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. This proposed rule

prescribes a test procedure to be used to develop and implement future energy conservation standards for TVs. DOE certifies that this proposed rule will not have a significant impact on a substantial number of small entities. The factual basis for this certification is as follows.

The Small Business Administration (SBA) considers an entity to be a small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. The thresholds set forth in these regulations are based on size standards and codes established by the North American Industry Classification System (NAICS)<sup>40</sup>. TV manufacturers are classified under NAICS code 334220, “Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing,” and are considered small entities if they employ 750 employees or less.

DOE determined that most manufacturers of TVs are large multinational corporations. To develop a list of domestic manufacturers, DOE reviewed the Hoover database<sup>41</sup> and other publicly available data, including the Energy Star qualified TVs database. As a result of its review, DOE determined that there were no TV manufacturers who would qualify as small entities. DOE also notes that manufacturers are already required to use a test procedure similar to DOE’s proposed test procedure to make energy representations under the Federal Trade Commission’s EnergyGuide labeling program. 76 FR 1038. DOE’s proposed test procedure can be conducted concurrently with FTC testing without significant additional burden.

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<sup>40</sup> For more information visit: <http://www.sba.gov/>. The size standards are available at <[http://www.sba.gov/sites/default/files/Size\\_Standards\\_Table.pdf](http://www.sba.gov/sites/default/files/Size_Standards_Table.pdf)>

<sup>41</sup> Hoovers. Web 12 Dec 2011. <<http://www.hoovers.com/>>

Based on the above, DOE certifies that there would not be a significant impact on a substantial number of small entities and has not prepared an IRFA for this rulemaking. DOE transmitted the certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the SBA for review under 5 U.S.C. 605(b). DOE requests comment on its conclusion that there are no small business manufacturers.

### C. Review Under the Paperwork Reduction Act of 1995

There is currently no information collection requirement related to the test procedure for TVs. In the event that DOE proposes an energy conservation standard with which manufacturers must demonstrate compliance, DOE will seek OMB approval of such information collection requirement.

DOE established regulations for the certification and recordkeeping requirements for certain covered consumer products and commercial equipment. 76 FR 12422 (March 7, 2011). The collection-of-information requirement for the certification and recordkeeping was subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement was approved by OMB under OMB Control Number 1910-1400. Public reporting burden for the certification was estimated to average 20 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

As stated above, in the event DOE proposes an energy conservation standard for TVs with which manufacturers must demonstrate compliance, DOE will seek OMB approval of the associated information collection requirement. DOE will seek approval either through a proposed amendment to the information collection requirement approved under OMB control number 1910-1400 or as a separate proposed information collection requirement.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

#### D. Review Under the National Environmental Policy Act of 1969

In this proposed rule, DOE proposes a test procedure that it expects will be used to develop and implement future energy conservation standards for TVs. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, this proposed rule establishes a new test procedure without affecting the amount, quality or distribution of energy usage, and, therefore, would not result in any environmental impacts. Thus, this rulemaking is covered by Categorical Exclusion A5 under 10 CFR part 1021, subpart D, which applies to any rulemaking that does not result in any environmental impacts. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

#### E. Review Under Executive Order 13132

Executive Order 13132, “Federalism,” 64 FR 43255 (August 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of today’s proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

#### F. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, “Civil Justice Reform,” 61 FR 4729 (Feb. 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide

a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, the proposed rule meets the relevant standards of Executive Order 12988.

#### G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. No. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of \$100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal

governments on a proposed “significant intergovernmental mandate,” and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at <http://www.gc.doe.gov>. DOE examined today’s proposed rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of \$100 million or more in any year, so these requirements do not apply.

#### H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

#### I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, “Governmental Actions and Interference with Constitutionally Protected Property Rights” 53 FR 8859 (March 18, 1988) that this regulation would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

#### J. Review Under Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed today's proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

#### K. Review Under Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that: (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

Today's regulatory action to establish a test procedure for measuring the energy efficiency of TVs is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

#### L. Review Under Section 32 of the Federal Energy Administration Act of 1974

Under section 301 of the Department of Energy Organization Act (Pub. L. 95-91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; FEAA) Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (FTC) concerning the impact of the commercial or industry standards on competition.

The proposed rule incorporates testing methods contained in annex C.3 and section 11.5.5, 11.5.6, and 11.6 of the commercial standard, International Electrotechnical Commission 62087 Edition 2.0 2011, "Method of Measurement for the Power Consumption of Audio, Video and Related Equipment;" section 5.3.1 of the commercial standard, International Electrotechnical Commission 62301 Edition 2.0 2011, "Household electrical appliances - Measurement of standby power" and CEA Procedure for Download Acquisition Mode Testing: For TVs," Revision 0.3, September 8, 2010. DOE has evaluated these standards and is unable to conclude

whether they fully comply with the requirements of section 32 (b) of the Federal Energy Administration Act (i.e., whether they were developed in a manner that fully provides for public participation, comment, and review).

As required by section 32(c) of the Federal Energy Administration Act of 1974 as amended, DOE will consult with the Attorney General and the Chairman of the Federal Trade Commission about the impact on competition of using the methods contained in these standards before prescribing a final rule.

## **V. Public Participation**

### A. Attendance at Public Meeting

The time, date and location of the public meeting are listed in the DATES and ADDRESSES sections at the beginning of this document. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586-2945 or [Brenda.Edwards@ee.doe.gov](mailto:Brenda.Edwards@ee.doe.gov). As explained in the ADDRESSES section, foreign nationals visiting DOE Headquarters are subject to advance security screening procedures.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website [http://www1.eere.energy.gov/buildings/appliance\\_standards/residential/tv\\_sets.html](http://www1.eere.energy.gov/buildings/appliance_standards/residential/tv_sets.html). Participants are responsible for ensuring their systems are compatible with the webinar software.

## B. Procedure for Submitting Prepared General Statements For Distribution

Any person who has plans to present a prepared general statement may request that copies of his or her statement be made available at the public meeting. Such persons may submit requests, along with an advance electronic copy of their statement in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format, to the appropriate address shown in the ADDRESSES section at the beginning of this notice. The request and advance copy of statements must be received at least one week before the public meeting and may be emailed, hand-delivered, or sent by mail. DOE prefers to receive requests and advance copies via email. Please include a telephone number to enable DOE staff to make a follow-up contact, if needed.

## C. Conduct of Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. After the public meeting, interested parties may submit further comments on the proceedings as well as on any aspect of the rulemaking until the end of the comment period.

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues

affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

A transcript of the public meeting will be included in the docket, which can be viewed as described in the Docket section at the beginning of this notice. In addition, any person may buy a copy of the transcript from the transcribing reporter.

#### D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting, but no later than the date provided in the DATES section at the beginning of this proposed rule. Interested parties may submit comments using any of the methods described in the ADDRESSES section at the beginning of this notice.

Submitting comments via regulations.gov. The regulations.gov web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to regulations.gov information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through regulations.gov cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through regulations.gov before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that regulations.gov provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery, or mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to regulations.gov. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information on a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments

Include contact information each time you submit comments, data, documents, and other information to DOE. Email submissions are preferred. If you submit via mail or hand delivery, please provide all items on a CD, if feasible. It is not necessary to submit printed copies. No facsimiles (faxes) will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, written in English and are free of any defects or viruses.

Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. According to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery two well-marked copies: one copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include: (1) A description of the items; (2) whether and why such items are customarily treated as confidential within the industry; (3) whether the information is generally known by or available from other sources; (4) whether the information has previously been made available to others without obligation concerning its confidentiality; (5) an explanation of the competitive injury to the submitting person which would result from public disclosure; (6) when

such information might lose its confidential character due to the passage of time; and (7) why disclosure of the information would be contrary to the public interest.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

#### E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1. Scope of Coverage – DOE seeks comments from interested parties on the proposed scope of this rulemaking, as well as the definition of TVs. Specifically, DOE would like comments on including both TVs and displays greater than 15 inches which are sold with a TV tuner. (See section III.C)
2. Light Measurement Devices – DOE seeks comments from interested parties on the LMD equipment specifications proposed in this NOPR. (See Section III.D.1.c)
3. Signal Source and Generation – DOE seeks comments from interested parties on the signal source and generation specified in this NOPR. (See section III.D.2.c)
4. Picture Settings to Test – DOE seeks comments from interested parties on its proposal to conduct luminance tests in home picture setting and retail picture setting. For testing on mode energy consumption, DOE seeks comment on its proposal to test in home picture setting, along with its consideration to test on mode in both the highest and lowest energy

consuming picture settings (or brightest or dimmest), or all picture settings. (See section III.E.1)

5. Luminance Testing – DOE seeks comments from interested parties on its proposed method of luminance testing. DOE also seeks comments on its proposal to include a luminance ratio. (See section III.E.3.b)
6. Warm-up and Stabilization – DOE seeks comments on the proposed method of taking the luminance measurement immediately after displaying the three bar video signal. (See section III.E.3.a)
7. Video signal for Luminance Testing – DOE seeks comments from interested parties on its proposal to use the three bar video signal for luminance testing. DOE further seeks comments on any of the additional video signals that it considered. (See section III.E.3.c)
8. Room Illuminance Levels for Television Sets Shipped with Automatic Brightness Control Enabled – DOE seeks comments from interested parties on whether there should be a limit to the reduction in display luminance achieved from ABC, and how a minimally acceptable display luminance value should be established. DOE also seeks comment from interested parties on its proposal to test TVs shipped with ABC enabled at room illuminance levels of 10, 50, 100, and 300 lux and their respected tolerances. DOE additionally welcomes comments on how these outputs should be weighted and combined. (See section III.E.4.b.i)
9. Method for Creating Illuminance Levels for Television Sets Shipped with Automatic Brightness Control Enabled – DOE seeks comments from interested parties on the method for creating room illuminance levels including both the direct light method that it proposed in this NOPR and the diffused light method considered in this NOPR. DOE also

seeks comments from interested parties on setting a color temperature range and a potential warm up period associated with other light sources in that range. (See section III.E.4.b.ii)

10. Three Dimensional Display Testing – DOE seeks comments from interested parties on 3D testing. DOE specifically seeks comment on its two methods under consideration for a future rulemaking which include converting the 2D IEC dynamic broadcast-content video signal to 3D using a real time converting Blu-ray player or creating a 3D version of the IEC dynamic broadcast-content video signal. DOE also seeks comments on how it can best work with the IEC and interested parties to promote the development of a 3D test procedure. (See section III.E.4.d)
11. Internet Connectivity – DOE seeks comments from interested parties on its consideration of testing the internet as part of on mode; standby-active, high mode; and standby-active, low mode. (See section III.E.4 for on mode and section III.E.5.c.ii for standby-active)
12. Standby and Off Modes – DOE seeks comments from interested parties on testing standby and off mode of TVs according to the procedure outlined, above. (See sections III.E.5.c and III.E.5.d)
13. Single Metrics – DOE seeks comments from interested parties on the alternative approach of using a single metric for calculating annual energy consumption. DOE also seeks comment on its preliminary decision not to take into account the possibility that consumers may switch between preset picture settings. (See section III.E.6)
14. Input Format Hierarchy – DOE seeks comments from interested parties on the hierarchy of input formats required to connect the TV to a video source. (See section III.D.2.c)

## **VI. Approval of the Office of the Secretary**

The Secretary of Energy has approved publication of this proposed rule.

### **List of Subjects in 10 CFR Part 430**

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Incorporation by reference, Intergovernmental relations, Small businesses.

Issued in Washington, DC, on December 20, 2011.

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Kathleen B. Hogan  
Deputy Assistant Secretary of Energy Efficiency  
Energy Efficiency and Renewable Energy

For the reasons stated in the preamble, DOE is proposing to amend part 430 of Chapter II of Title 10, Code of Federal Regulations as set forth below:

**PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS**

1. The authority citation for part 430 continues to read as follows:

**Authority:** 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

2. Section 430.2 is amended by:

- a. Removing the definitions “Color television set” and “Monochrome television set”; and
- b. Revising the definition for “Television set” to read as follows:

**§ 430.2 Definitions.**

\* \* \* \* \*

Television set (also referred to as “TV”): A product designed to be powered primarily by mains power having a diagonal screen size of fifteen inches or larger that is manufactured with a TV tuner, and that is capable of displaying dynamic visual information from wired or wireless sources including but not limited to:

(1) Broadcast and similar services for terrestrial, cable, satellite, and/or broadband transmission of analog and/or digital signals; and/or

(2) Display-specific data connections, such as VGA, DVI, HDMI, DisplayPort, used typically for a computer or workstation that is not physically attached to the display; and/or

(3) Media storage devices such as a USB flash drive, memory card, or a DVD;  
and/or

(4) Network connections, usually using Internet Protocol, typically carried over  
Ethernet or WiFi.

A TV may contain, but is not limited to, one of the following display technologies:  
liquid crystal display (LCD), light-emitting diode (LED), cathode-ray tube (CRT), and  
plasma display panel (PDP). TV also includes TV Combination units that DOE has  
further defined in appendix H to subpart B of this part.

\* \* \* \* \*

3. Section 430.3 is amended by:

- a. Redesignating paragraphs (h) through (o) as (i) through (p);
- b. Adding a new paragraph (h);
- c. Adding a new paragraph (j)(6); and
- d. Adding new paragraphs (l)(3), (l)(4)

The additions and revisions read as follows:

**§ 430.3 Materials incorporated by reference.**

\* \* \* \* \*

(h) CEA. Consumer Electronics Association, 1919 South Eads Street Arlington, VA 22202, (866) 858-1555, or go to <http://www.ce.org>.

(1) CEA Procedure for DAM Testing: For TVs, Revision 0.3 (8 September 2010), IBR approved for appendix H to subpart B.

(2) Reserved.

\* \* \* \* \*

(j) \* \* \*

(6) ENERGY STAR Program Requirements for Televisions, Versions 5.3, approved August 2010, Section 6.2, IBR approved for Appendix H to Subpart B.

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(l) \* \* \*

(3) International Electrotechnical Commission (IEC) Standard 62087, (“IEC 62087-2011”), Methods of measurement of the power consumption of audio, video, and related equipment (Edition 3.0, 2011-05), Section 11.5.5, 11.5.6, and 11.6 and annex c.3, IBR approved for appendix H to subpart B.

(4) International Electrotechnical Commission (IEC) Standard 62031, (“IEC 62031-2011”), Household electrical appliances – Measurement of standby power (Edition 2.0, 2011-01), Section 5.3.1, IBR approved for appendix H to subpart B.

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4. Section 430.23 is amended by revising paragraph (h) to read as follows:

**§ 430.23 Test procedures for the measurement of energy and water consumption.**

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(h) *Television Sets.* (1) The energy consumption of a television set, including on mode, standby mode and off mode energy consumption levels expressed in watts, shall be measured in accordance with section 4 of appendix H of this subpart.

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5. Appendix H to subpart B of part 430 is added to read as follows.

**Appendix H to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Television Sets**

1. *Scope*

This appendix covers the test requirements used to measure the energy consumption of Television Sets.

2. *Definitions and Symbols*

- 2.1. Additional functions are functions that are not required for the basic operation of the device. Additional functions include, but are not limited to a VCR unit, a DVD unit, a HDD unit, a FM-radio unit, a memory card-reader unit, or an ambient lighting unit.
- 2.2. CEA Procedure for Download Acquisition Mode Testing means the test standard published by the Consumer Electronics Association, entitled “CEA Procedure for Download Acquisition Mode Testing: For TVs,” Revision 0.3, September 8, 2010 (incorporated by reference, see §430.3).
- 2.3. Download acquisition mode is the power mode in which the product is connected to a mains power source, produces neither sound nor picture, and is actively downloading data. Data downloads may include channel listing information for use by an electronic programming guide, TV setup data, channel map updates, firmware updates, monitoring for emergency messaging/communications or other network communications.
- 2.4. Home picture setting (or default picture setting) is the picture setting which is recommended by the manufacturer from the initial set up menu or the mode that the television comes shipped in if no setting is recommended.
- 2.5. IEC 62087-2011 means the test standard published by the International Electrotechnical Commission, entitled “Methods of measurement of the power consumption of audio, video, and related equipment,” IEC 62087- 2011 (incorporated by reference, see §430.3).

- 2.6. IEC 62087-2011 Blu-Ray Dynamic Broadcast-Content Video Signal means the test clip published by the International Electrotechnical Commission, entitled “IEC 62087-2011, video content\_BD, video content for IEC 62087-2011 on Blu-ray Disc,” IEC 62087-2011(incorporated by reference, see §430.3).
- 2.7. IEC 62301-2011 means the test standard published by the International Electrotechnical Commission, entitled “Household electrical appliances – Measurement of standby power,” IEC 62301- 2011 (incorporated by reference, see § 430.3).
- 2.8. Luminance is 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<sup>2</sup>).
- 2.9. Off mode is the mode where the TV is connected to a power source, produces neither sound nor picture and cannot be switched into any other mode with the remote control unit, an external or internal signal.
- 2.10. On mode is the power mode in which the TV is connected to a mains power source, has been activated, and is providing one or more of its principal functions.
- 2.11. Retail picture setting is the preset picture setting in which the TV produces the highest luminance during the on mode conditions.

- 2.12. Standby-passive mode is the mode in which the TV is connected to a power source, produces neither sound nor picture but can be switched into another mode with the remote control unit or an internal signal.
- 2.13. Standby-active, high mode is the mode in which the TV is connected to a power source, produces neither sound nor picture but can be switched into another mode with the remote control unit or an internal signal, and with an external signal, and is exchanging/receiving data with/from an external source.
- 2.14. Standby-active, low mode is the mode in which the TV is connected to a power source, produces neither sound nor picture but 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.
- 2.15. Symbol usage. The following identity relationships are provided to help clarify the symbols used throughout this test procedure.

ABC – Automatic Brightness Control

DAM– Download Acquisition Mode

DVD – Digital Video Disc

DVI – Digital Visual Interface

HDD – Hard Disk Drive

HDMI – High-Definition Multimedia Interface

$L_{\text{retail}}$  – Luminance of TV in retail picture setting

$L_{\text{home}}$  – Luminance of TV in home picture setting

$L$  – Ratio of  $L_{\text{home}}$  to  $L_{\text{retail}}$

LMD – Luminance Measurement Device

$P_{\text{on}}$  – Power consumed for on mode with ABC disabled

$P_{10}$  = Power consumed for on mode, ABC enabled, 10 lux, with a direct light source

$P_{50}$  = Power consumed for on mode, ABC enabled, 50 lux, with a direct light source

$P_{100}$  = Power consumed for on mode, ABC enabled, 100 lux, with a direct light source

$P_{300}$  = Power consumed for on mode, ABC enabled, 300 lux, with a direct light source

$P_{\text{standby-passive}}$  – Power consumption for standby-passive mode

$P_{\text{standby-active, high}}$  – Power consumption for standby-active, high

$P_{\text{off}}$  – Power consumption for off mode

THD – Total Harmonic Distortion

TV – Television Set

USB – Universal Serial Bus

VCR – Videocassette Recorder

VGA – Video Graphics Array

$W_{10}$  – Percent Weighting for on mode, ABC enabled, while the Room Illuminance is 10 lux

$W_{50}$  – Percent Weighting for on mode, ABC enabled, while the Room Illuminance is 50 lux

$W_{100}$  – Percent Weighting for on mode, ABC enabled, while the Room Illuminance is 100 lux

$W_{300}$  – Percent Weighting for on mode, ABC enabled, while the Room Illuminance is 300 lux

- 2.16. TV combination unit is a TV in which the TV and one or more additional devices (e.g., DVD player, Blu-ray Disc player, Hard Disk Drive) are combined into a single enclosure, and which meets the following criteria: (a) it is not possible to measure the power of the individual components without removing the product housing; and (b) the product connects to a wall outlet via a single power cord.

## 2. Accuracy and Precision of Measurement Equipment

### 3.1. Electrical Energy Supply

- 3.1.1. Power Supply. Carry out measurements using a power supply providing voltage of 115 V at 60 Hz.

The fluctuation of the voltage supplied during the tests shall not exceed  $\pm 1$  percent.

The frequency fluctuation and the harmonic components of the supplied power shall not exceed  $\pm 1$  percent and 5 percent respectively.

3.1.2. Power Meter. The measurement shall be carried out directly by means of a wattmeter, a wattmeter with averaging function, or a watt-hour meter, by dividing the reading by the measuring time. For TVs for which the input video signal varies over time, use a wattmeter with an averaging function to carry out the measurement.

3.1.2.1. The sampling rate of the watt-hour meter or wattmeter with averaging function should be one measurement per second or more frequent.

3.1.2.2. The power measurement instrument used shall measure the power factor and the real power consumed regardless of the power factor of the device under test.

3.1.2.3. Power measurements of 0.5 W or greater shall be made with an uncertainty of less than or equal to 2 percent (at the 95 percent confidence level). Measurements of power of less than 0.5 W shall be made with an uncertainty of less than or equal to 0.01 W (at the 95 percent confidence level).

The power measurement instrument shall have a resolution of:

0.01 W or better for power measurements of 10 W or less;

0.1 W or better for power measurements of greater than 10 W up to 100 W;

1 W or better for power measurements of greater than 100 W.

3.1.3. Light Measurement Device. All LMDs shall have an accuracy of  $\pm 2$  percent  $\pm 2$  digits of the digitally displayed value and repeatability within 0.4 percent  $\pm 2$  digits of displayed value. LMDs must also have an acceptance angle of 3 degrees or less.

4. Test Room and Set-Up Criteria.

4.1. Installation. Install the TV in accordance with manufacturer's instructions.

4.2. Dark Room Conditions. All luminance testing (with a non-contact meter) and on mode testing (with ABC enable by default) shall be performed in dark room conditions, meaning the display screen illuminance measurement in off mode must be less than or equal to 1.0 lux.

4.3. Ambient Temperature Conditions. For all testing, maintain ambient temperature conditions between  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

4.4. Ambient Relative Humidity Conditions. For all testing, maintain the ambient relative humidity between 10 and 80 percent.

4.5. Input Cable. Testing shall be performed using an HDMI input cable. If the TV does not have an HDMI input, the following inputs shall be used, in the following order:

HDMI/DVI, VGA, component, S-Video, and composite.

4.6. 2D Testing Signal Source. The signal source shall be able to generate a Blu-ray signal.

5. Test Measurements.

5.1. For on mode and luminance testing, connect the signal source generator to the TV via the input cable.

5.2. Warm-up. TVs shall be warmed-up prior to testing using the IEC 62087-2011 (incorporated by reference, see §430.3) dynamic broadcast-content video signal for at least one hour, found in annex C.3 of IEC 62087-2011. If the TV has not reached a stable state with respect to power within the one hour time period, the warm-up shall last until the TV reaches a stable state. For the purposes of this rulemaking, the TV is considered to be in a stable state if the average power consumption over two consecutive plays of IEC 62087-2011 dynamic broadcast-content video signal does not vary by more than 2 percent.

5.3. Luminance Test.

5.3.1. Luminance Test. The luminance test shall be performed immediately following the warm-up period. The luminance test shall first be performed with the TV in the

retail picture setting, followed by the TV in home picture setting. The ABC sensor must be disabled during this test.

5.3.1.1. LMD Setup. Align the LMD perpendicular to the center of the display screen. If a distance meter is being used for testing, the LMD shall be at a distance capable of achieving the desired specifications outlined in section 3.1.3.

5.3.1.2. Three Bar Video Signal Measurement. The TV shall be measured in both the home and retail picture settings using IEC 62087-2011 (incorporated by reference, see § 430.3) three bar video signal found in section 11.5.5 of IEC 62087-2011. Record the luminance immediately after the three bar video signal is displayed in the retail picture setting first, as  $L_{\text{retail}}$ , followed by the home picture setting as  $L_{\text{home}}$ .

#### 5.4. On Mode Test for TVs without ABC Enabled By Default.

5.4.1. On mode testing shall be performed with the TV in home mode, while displaying the full 10-minute duration of IEC 62087-2011 Blu-ray dynamic-broadcast video signal (incorporated by reference, see §430.3). Measure the energy consumption and record the value as  $P_{\text{on}}$ .

5.5. On Mode Test for TVs with ABC Enabled By Default. The following test shall be performed if the TV is shipped with ABC enabled by default:

5.5.1. On mode testing shall be performed with the TV in home mode, while displaying IEC 62087-2011 Blu-ray dynamic-broadcast video signal for 10 minutes (incorporated by reference, see §430.3) with 10 lux ( $\pm 1$  lux) entering the ambient light sensor. Measure the energy consumption and record the value as  $P_{10}$ . Repeat the measurements with 50 lux ( $\pm 2$  lux), 100 lux ( $\pm 5$  lux), and 300 lux ( $\pm 9$  lux) entering the ambient light sensor and record the values as  $P_{50}$ ,  $P_{100}$ , and  $P_{300}$  respectively.

5.5.2. To create the ambient lighting, a halogen incandescent light must be positioned in front of the ABC sensor so that the light may be focused directly into the sensor. The light source must be able to achieve a range between 10 - 300 lux at the ABC sensor. The room illuminance shall be measured at the sensor in the direction of the light source while the TV is on and displaying the main menu of IEC 62087-2011.

#### 5.6. Standby Mode Tests.

5.6.1. Standby-Passive Mode Test. The standby-passive test shall be performed according to section 5.3.1 of IEC 62301-2011 standby test (incorporated by reference, see §430.3). Measure the energy consumption and record the value as  $P_{\text{standby-passive}}$ .

5.6.2. Standby-Active, High Mode Test. The standby-active, high test shall be performed according to the CEA Test Procedure for Download Acquisition Mode

Testing (incorporated by reference, see §430.3). Measure the energy consumption and record the value as  $P_{\text{standby-active, high}}$ .

5.6.2.1. The standby-active, high test shall be performed using the following inputs, in the following order: Wi-Fi, Ethernet. Ethernet. If the UUT supports an Energy Efficient Ethernet, then it shall be tested using that connection., Thunderbolt, USB, Firewire, and other when more than one connection can be used to conduct testing.

#### 5.7. Off Mode Test.

5.7.1. The off mode test shall be performed according to section 5.3.1 of the IEC 62301-2011 off mode test (incorporated by reference, see §430.3). Measure the energy consumption and record the value as  $P_{\text{off}}$ .

#### 6. Calculations.

6.1. Calculate the Luminance ratio,  $L$ , as the ratio of  $L_{\text{home}}$  to  $L_{\text{retail}}$

