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California Energy Commission

DRAFT STAFF REPORT

Voluntary Performance Framework for Low-Power Modes Version 1.0

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PREFACE

On May 11, 2017, the California Energy Commission (CEC) issued an invitation to provide interested parties the opportunity to inform the CEC about the product, market, and industry characteristics of the appliances included in the development of a wide-scope, cross-cutting approach concept to monitor and address inactive power consumption of appliances.

On June 20, 2018, the CEC released an invitation to seek proposals for data collection procedures to measure low-power modes power consumption.

On January 24, 2019, staff conducted a webinar to present the Low-Power Mode (LPM) Roadmap and the framework for the data collection procedure (DCP).

On February 12, 2019, the CEC released a Request for Additional Public Comments on the Data Collection Procedure for Low-Power Modes (DCP-LPM).

On April 2, 2019, the IOU CASE Team docketed the first draft of its data collection procedure (DCP) proposal.

On May 14, 2021, the IOU CASE Team docketed an updated DCP proposal.

On August 25, 2021, staff conducted a webinar on the characteristics of CEC's approach for the framework of voluntary data collection for inactive power consumption for a wide range of devices and appliances.

On November 30, 2023, the IOU CASE Team docketed its DCP V3.0 proposal.

On October 2, 2024, the CEC released a request for information (RFI) to provide participants the opportunity to inform the CEC about the use of DCP V3.0 as the CEC's DCP-LPM.

On August 1, 2025, the IOU CASE Team docketed their DCP V3.1 proposal to address technical recommendations from the RFI.

This staff report includes the implementation strategy of the Voluntary Performance Framework for Low-Power Modes and the data collection procedure for measuring the inactive power consumption of devices and appliances.

ABSTRACT

With the global proliferation of consumer electronics products and miscellaneous electric loads, there is a large and growing set of devices that consume power when not performing the primary (or active-mode) service for a user. Devices with these idle or "low-power mode" functions are responsible for a growing share of total electricity use and often are not already subject to energy efficiency standards; some examples of such devices include, but are not limited to, game consoles, small network equipment, speaker systems, and powered furniture. These electrical devices are often designed around new technologies that continue to evolve rapidly, which can make regulating the energy efficiency of these devices difficult.

This staff report introduces the Voluntary Performance Framework for Low-Power Modes (VPF-LPM), previously referred to as the LPM Roadmap, to gather model-specific data for monitoring, analyzing, and promoting energy efficiency improvements. The VPF is a scalable and flexible framework that allows incremental updates as technologies evolve, reducing the need for frequent, resource-intensive revisions. The VPF-LPM is a method to save energy in devices in the inactive condition, that is, when not performing the primary function for a user. The LPM-VPF proposes a new process of iterative voluntary energy efficiency improvement specifications and other milestones, including product category-specific participation and performance targets. This framework seeks to address the complex and broad topic of passive energy use during off, standby, and similar inactive modes in a variety of devices.

Keywords: Voluntary performance framework, low-power modes, inactive power consumption, standby power consumption, plug load

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EXECUTIVE SUMMARY

Overview

The California Energy Commission (CEC) has developed the Voluntary Performance Framework for Low-Power Modes to address the growing energy consumption of electronic devices in inactive or standby states. With the proliferation of inactive, always-on devices in homes — averaging 65 per household — inactive power consumption now accounts for an estimated $19 billion annually in U.S. electricity costs.

The framework consists of voluntary energy efficiency improvement and participation specifications along with milestones that indicate whether a voluntary approach is sufficient or if mandatory minimum standards may be more appropriate. In this proceeding, the CEC will, after receiving input from stakeholders, publish and subsequently update the staff report, defining the scope, setting participation and performance targets, and encouraging industry to submit energy performance data. This iterative process provides essential flexibility and encourages long-term collaboration with industries to reduce inactive power consumption at the earliest stages of product development. The framework enables the CEC to adapt to rapidly evolving technologies without the need for frequent regulatory updates and influence a wide range of industries without the need for product-specific regulatory actions. The large dataset of model-specific inactive power consumption can also potentially unlock additional energy efficiency improvements.

Scope

The scope of the framework is intentionally broad and only excludes federally regulated appliances subject to preemption and state-regulated appliances with a mandatory requirement for standby power. Federally regulated appliances subject to preemption means the CEC does not have regulatory authority to establish energy efficiency standards for those appliances. State-regulated appliances with a mandatory requirement for standby power already have addressed standby power with a product-specific approach and would not benefit from this voluntary performance framework. These two out-of-scope product categories do not need to participate in this voluntary performance data gathering effort. All other product categories are in-scope, meaning that they are encouraged to perform the specified test for standby power and certify the results to the CEC.

Because so many product categories can participate in the program, the CEC further distinguishes between in-scope products that are "in-focus" and those that are "out of focus." In-focus product categories are appliances for which the CEC specifies participation targets that act as triggers for potential mandatory standards-setting (if they are not achieved within the voluntary framework). The CEC has identified 18 product categories as in scope and in focus for the initial launch of the framework, including game consoles, soundbars, printers, and coffee makers. The CEC does not propose performance or participation targets for out-of-focus product categories, which is the main distinction between the in-focus and out-of-focus product categories.

Participation Targets

The CEC proposes setting a goal of receiving data representing 50 percent of the market for in-scope, in-focus product categories to ensure a substantial and representative data sample for the initial data reporting. Because of the complexities of verifying a market share target, this report presents numerical minimum targets for participating manufacturers and model entries submitted for each in-focus product category. Failure to meet the targets will lead the CEC to investigate the product groups and produce an improvement plan together with the industry. If an improvement plan is not agreed upon or if progress is not satisfactory, the CEC will consider regulatory action for that product category.

Data Collection Procedure

The Data Collection Procedure for Low-Power Modes is a core component of the voluntary performance framework and is the result of multiple stakeholder engagements, public workshops, and technical revisions conducted by staff since 2018. The procedure is reproduced in the appendix of this report, which marks the first document from the CEC that formally incorporates this data collection procedure, and it is hence named DCP-LPM V1.0.

Next Steps

This report serves as the blueprint for CEC's implementation of the framework. The CEC will host a public workshop to present this framework and receive public comments. The CEC will incorporate the comments, publish a revised version of this document, and begin initial data reporting. At the same time, the CEC's Appliance Certification Database will be updated to accept the data submission requested by the framework, and certification instructions will be posted online. The initial data reporting period is planned to last six months, and the collected data will serve as the basis for the next iteration of the framework.

CHAPTER 1:
Voluntary Performance Framework (VPF) Goals and Process

Introduction

As technology evolves and small appliances grow in variety and quantity, more devices that consume electricity around the clock are present in California homes and businesses. The inactive power consumption of devices in standby or sleep modes are estimated to cost about $165 per U.S. household on average each year.[1] The Voluntary Performance Framework for Lower-Power Modes (VPF-LPM) therefore aims to achieve power savings for electronics and appliances in low-power or inactive states.

Modern electronic and connected appliances are evolving rapidly. California Energy Commission staff has observed that mobile products have mastered the art of being idle, even while maintaining network connections and responsiveness to inputs, deploying solutions that are feasible to adapt to other products that are connected to the wall plug and powered directly by the power grid. A comparison of smartphone network standby consumption with that of networked, mains-powered products shows a considerable gap between many of today's connected devices and the battery-powered counterparts.[2]

The VPF-LPM is a new process developed by CEC staff to address this complex and broad topic. The VPF-LPM consists of iterative voluntary energy efficiency improvement and participation specifications; it's iterative since the CEC often revisits the framework, performance targets, participation targets, along with milestones that indicate whether a voluntary approach is sufficient for the desired market transformation. If the voluntary energy efficiency improvement and participation goals are not met, mandatory regulation acts as a backstop for ensuring that feasible, cost-effective measures become the norm in California. The success of the VPF-LPM hinges on constructive engagement of industry stakeholders, energy advocates, and the CEC, and staff encourages robust participation and involvement by industry representatives who have long requested a voluntary approach to minimum performance targets.

Chapter 1 of this report briefly reviews regulatory approaches in other jurisdictions, provides more information on CEC's VPF-LPM proceeding, presents a VPF-LPM flow diagram, and discusses the data collection process and next steps for the proceeding. Chapter 2 discusses and outlines the scope of the VPF-LPM. Chapter 3 sets participation targets for in-scope, in-

1 Delforge, Pierre (National Resources Defense Council) and Lisa and Steve Schmidt (Home Energy Analytics). May 2015. *"Home Idle Load: Devices Wasting Huge Amounts of Electricity When Not in Active Use"*. National Resources Defense Council, https://www.nrdc.org/sites/default/files/home-idle-load-IP.pdf.

2 May-Ostendorp, Peter, Ph.D. (Xergy Consulting) and Eric Rubin (Energy Solutions). July 2019. *Bridging the Network Standby Gap Between Mobile and Mains-Powered Products*. IEA Technology Collaboration Programme on Energy Efficient End-Use Equipment (4E), https://www.iea-4e.org/wp-content/uploads/publications/2019/07/Topic_3_-_Bridging_the_Gap.pdf.

focus product categories, and Chapter 4 (along with Appendix A) discusses the Data Collection Procedure for Low-Power Modes (DCP-LPM).

Regulatory Approaches in Other Jurisdictions

Initiatives to monitor and reduce inactive power consumption are not a novel concept. The U.S. federal appliance efficiency program, administered by the Department of Energy (DOE), sets mandatory minimum energy conservation standards for residential and commercial products. Since 2010, under the Energy Policy and Conservation Act, these standards have included requirements for energy use in off mode and standby mode for all regulated appliances.[3] In addition, the U.S. Environmental Protection Agency's (EPA) ENERGY STAR® program—a voluntary certification initiative—encourages manufacturers to achieve superior energy performance. ENERGY STAR® specifications often incorporate limits on inactive power consumption for qualifying products such as computers, monitors, imaging equipment, and TVs.[4] Through both regulatory measures and voluntary programs, the federal government has increasingly emphasized the importance of reducing off-mode and standby power consumption in recent years.

The European Union (EU) has also implemented both a voluntary code-of-conduct design guideline and an Ecodesign appliance efficiency regulation. The EU Code of Conduct (CoC) is a voluntary initiative focused on reducing energy consumption in information technology (IT) equipment, and it allows the European Commission to publish design guidelines for the industry to use as a reference for design benchmarking. The Ecodesign regulation is an EU mandatory regulation framework for appliance efficiency.

The CoC does not impose regulatory authority and does not collect performance data, although the EU is exploring the possibility of using the performance framework established under the CoC to collect energy efficiency performance data for data centers.[5] In contrast, the Ecodesign regulation is an EU mandatory regulation that sets minimum efficiency requirements for many products sold in the EU, and inactive power consumption is part of the Ecodesign regulation for many devices under the framework of Ecodesign.[6] The EU Ecodesign consumption limits are based on the measurements for a specific low-power mode. Table 1 below shows the EU Ecodesign power consumption limits for standby power consumption.

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3 42 U.S.C. section 6295(gg).

4 U.S. Environmental Protection Agency. 2012. *Product Retrospective: Standby Power*, https://www.energystar.gov/sites/default/files/tools/Standby_Power_Highlights.pdf.

5 European Commission, 2024. *"First Phase of the Establishment of a Common Union Rating Scheme for Data Centres,"* https://eur-lex.europa.eu/eli/reg_del/2024/1364/oj/eng.

6 Maagøe, Viegand (VHK research engineers). April 2017. *Review Study on Standby Regulation*. European Commission, https://www.ecostandbyreview.eu/downloads/Review study standby regulation - draft final report april 2017.pdf

Table 1: EU Ecodesign Power Consumption Limits (2025 and 2027)

Mode	Equipment Type / Description	2025 Limit	2027 Limit
Off	Any equipment	≤ 0.50 W	≤ 0.30 W
Off	With reactivation function or indicator	≤ 0.50 W	Same as 2025
Standby	Info/status display, reactivation function, or both	≤ 0.80 W* *1.00 W for household tumble dryers	Same as 2025
Networked Standby	High Network Availability (HiNA) or HiNA-capable equipment	≤ 8.00 W	≤ 7.00 W
Networked Standby	Other networked equipment	≤ 2.00 W	Same as 2025
Networked Standby	Large printers, thin clients, workstations, servers	Not applicable	Same as 2025

Source: Annex III of Commission Regulation (EU) 2023/826

The CEC VPM-LPM differs from the Ecodesign measurements in three key ways. The VPM-LPM measures general inactive power consumption, whereas Ecodesign measures the standby mode power consumption in designated low-power modes. Secondly, the VPF-LPM collects more specific product information such as telecommunication features, internet interfaces, and information displays. Third, this information along with the inactive power consumption data will be made available to the public through the California Certification Database, an online server hosted by the CEC to receive and display appliance data.

Goals for CEC's VPF-LPM Proceeding

The Voluntary Performance Framework for Low-Power Modes (VPF-LPM) proceeding started in 2017 as a concept to address inactive power consumption using a "horizontal" (i.e., cross-cutting) scoping approach. The proceeding was initially called the Low-Power Mode Roadmap and was originally centered on small networking equipment, and has now been renamed the Voluntary Performance Framework for Low-Power Modes (VPF-LPM) to better capture the essence of the proceeding.

The voluntary nature of the performance framework is foundational: A voluntary proceeding can more easily adjust to changing technologies, rapidly shift focus to identified energy savings potentials, and maintain a significantly broader scope than a regulatory proceeding. The performance framework seeks to motivate the industry to incorporate low inactive power consumption into design criteria in the early stages of product development. Finally, the term "low-power modes" is used as devices can have multiple low-power, sleep, standby or inactive states, and the power consumption of all such modes is of interest to staff.

The VPF-LPM maintains the horizontal approach to setting performance targets for inactive power consumptions proposed by the initial roadmap. Drastically different end-use appliances can have similar functionality in the inactive state, and similar solutions for minimizing standby power consumption or loss are therefore appropriate to apply across product categories. This horizontal approach contrasts with the EPA ENERGY STAR program, which sets specific inactive power requirements for specific appliances. The VPF-LPM also differs from EU's Ecodesign in that the DCP for the VPF-LPM was developed to measure general inactive power consumption of appliances as used by end users, while Ecodesign focuses on the power consumption in a designated low-power mode. In the VPF-LPM, the CEC wants to ensure that the measurements of inactive power consumption reflect actual, practical usage of the appliance so that consumers can benefit from energy efficiency improvements.

The VPF-LPM is a voluntary proceeding in that the CEC does not intend to adopt the DCP or performance specifications into California's Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 through Section 1609). A voluntary proceeding allows for a broadly scoped and flexible performance framework that can navigate changing technologies, dynamic market trends, and numerous technical complexities.

A successful voluntary target reduces the need for the CEC to adopt regulation, noting that the CEC retains the ability to do so if and when needed (for example, if market conditions shift and participation in the voluntary program falls or prevalence of highly consumptive models rises). In such cases, the scope of the regulatory proceeding would necessarily be narrower than the total scope of the VPF-LPM, selecting the specific appliances that fail to deliver appropriate performance to consumers under the voluntary framework. However, with engaged stakeholders and a good-faith effort by industry to reduce energy consumption in low-power modes, unnecessary energy consumption can be avoided while avoiding the costs and overhead of mandatory minimum standards. The CEC hopes that the VPF-LPM will be successful without the need for regulation.

Process: VPF-LPM Flow Diagram

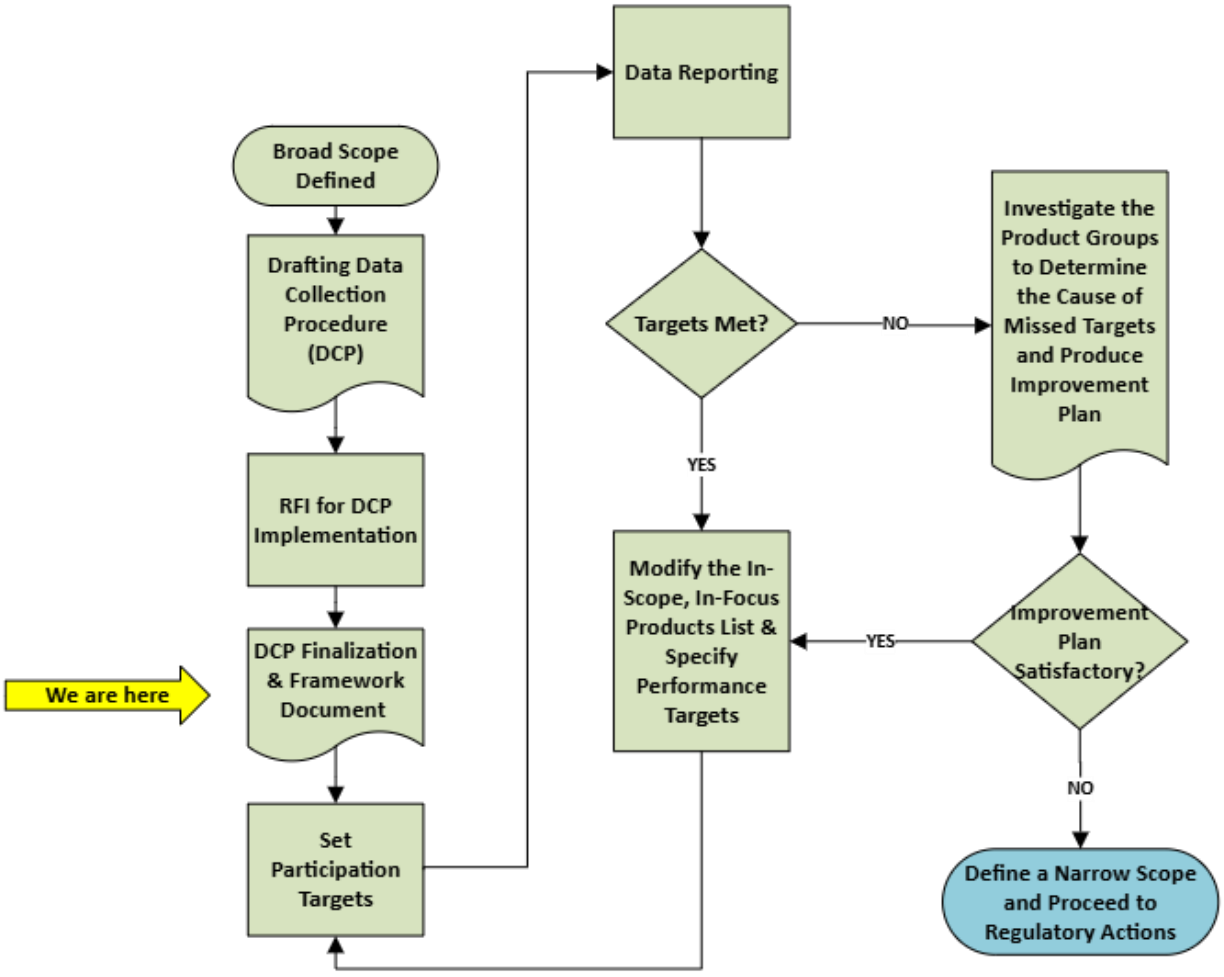
Figure 1 shows the proposed flow diagram of the VPF-LPM, outlining major milestones and decision points. The publication of this framework document would be at the "DCP finalization and framework document" stage. After receiving input on this framework document from stakeholders and interested members of the public, the CEC will make revisions as it deems appropriate, then initiate the first round of data reporting.

For the initial round of data reporting, the CEC will set participation targets for a set of in-scope, in-focus product groups discussed in more detail in Chapters 2 and 3. The focus of the initial data reporting is to gather data, produce an effective snapshot of the current market condition, and analyze the outlook for future development in energy-saving features. For future iterations of the VPF-LPM, the CEC plans to set both participation and performance targets.

Once a data reporting period concludes, the CEC will review the data received and determine whether the data have met staff's expectations for quantity and quality. The CEC will also determine if adjustments should be made to the list of in-focus appliances and any associated participation or performance targets.

In general, if the targets for a particular product group have been met the CEC will review the participation or performance targets, or both, for that product group before the next round of data reporting to ensure they remain appropriate and effective for the product. If any targets are not met, the CEC will work with the industry to address the cause of the shortcoming and work collaboratively to build an improvement plan. If both the CEC and stakeholders agree on an improvement plan and progress is deemed satisfactory, the CEC will continue with the voluntary performance framework. If an agreement cannot be reached or satisfactory progress cannot be made on an improvement plan, the inability to accomplish CEC policy goals through the voluntary framework will act as a trigger for consideration of mandatory minimum standards in regulation.

Figure 1: VPF-LPM Flow Diagram



Source: CEC staff

Process: Data Collection

The CEC plans to use the Modernized Appliance Efficiency Database System (MAEDbS),[7] also known as the California Certification Database, to provide a web-based data submission and

7 California Energy Commission. *"Modernized Appliance Efficiency Database System (MAEDbS) Enhancements and Improvements,"* https://www.energy.ca.gov/programs-and-topics/programs/appliance-efficiency-program-outreach-and-education/modernized.

display platform for VPF-LPM and ensure that the performance data are available to interested stakeholders and the public. The technical data that the CEC intends to collect can be found in Table A-2 in Appendix A. The CEC will also publish instructions for the data submittal processes before data collection begins, and the instructions will have a similar format to the certification packets for appliances available on the CEC website.[8]

While the California Certification Database is associated with numerous programs, including California's Appliance Efficiency Regulations,[9] the platform can also be used to host voluntary data collection, such as the VPF-LPM data. The data submitted for VPF-LPM are not subject to the enforcement authorized by the Appliance Efficiency Regulations, which apply to appliances within the scope of mandatory regulations.[10] With that clarification, the CEC encourages the submittal of accurate and comprehensive data for VPF-LPM, as the success of the proceeding depends on the level of participation it receives. The CEC does intend to sample the accuracy of the data submitted in VPF-LMP, though the purpose for such data sampling will be to test the reproducibility of the data collection procedure (DCP) and improve the DCP process and instructions.

Next Steps

The CEC will host a public workshop to present an overview of this framework and to receive written and verbal public comments. After reviewing the comments received and making appropriate changes to this document, the CEC will publish a revised version of this document and start the initial data reporting. At the same time, the California Certification Database will be updated to accept VPF-LPM data, and certification instructions will be posted online. The initial data reporting period is planned to last six months, and the data collected will form the basis for the next iteration of the VPF-LPM.

8 California Energy Commission. "*Certification Packets for Appliances,*" https://www.energy.ca.gov/files/certification-packets-appliances.

9 California Energy Commission. "*Appliance Efficiency Proceedings — Title 20*," https://www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings.

10 Deliberate submission of information known to be false is a violation of state laws relating to perjury, separate from and unrelated to CEC's enforcement authority relating to California's appliance efficiency standards.

CHAPTER 2:
VPF-LPM Scope

Introduction

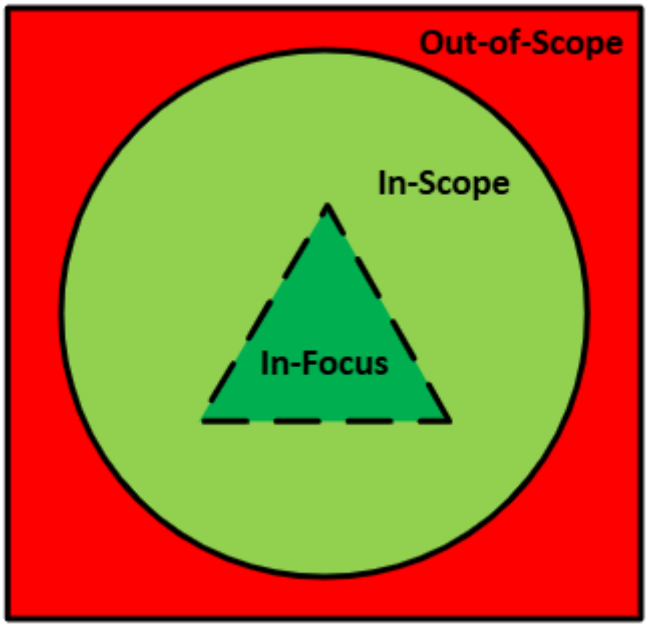
From the early stages of development of the VPM-LPM, setting the scope has been challenging. While the traditional regulatory approach draws a clear line between in-scope and out-of-scope products, this is difficult to apply for the VPF-LPM as the CEC would like the capability to incorporate new product categories into the proceeding as technologies and markets evolve. At the same time, industry stakeholders have a strong desire for clarity regarding scope.

To balance these competing objectives, the CEC has devised a nuanced approach to the proposed scope of the program by developing a three-category scoping system, as seen in Figure 2. Out-of-scope product groups (red area in Figure 2) are excluded from the VPF-LPM, and includes only two groups of products:

- Federally regulated appliances
- State-regulated appliances with a requirement for standby power

That is, products for which the CEC is unable to establish alternate, if voluntary, descriptions of energy use because of federal preemption and products for which a mandatory standby power standard already applies are excluded from the VPF-LPM.

Figure 2: VPF-LPM Scope Diagram



Source: CEC staff

All other appliances are in scope of the VPF-LPM, meaning that they are allowed (and encouraged) to list their standby power use voluntarily within this framework. Within this group, a small subset of in-focus (dark green area in Figure 2) product categories are those for which the CEC establishes participation or performance targets. Participation targets are discussed in Chapter 3.

The in-scope, in-focus product categories represent where the CEC will invest the most attention and focus. As indicated in Figure 2, the boundary between in-scope, in-focus and in-scope, out-of-focus is updated with each iteration of data reporting. Product categories could be added to the in-scope, in-focus group if a clear opportunity for improvement is found. It is also possible that some product categories will be removed from being in focus if the energy savings potential is minimal or if there are compelling technical reasons for doing so.

Product categories that are in in-scope but out-of-focus (light green area in Figure 2) range from product categories that the CEC is unaware of or has not yet considered to product groups the CEC is actively evaluating moving to in-focus in later iterations of the VPF-LPM. Stakeholders responsible for in-scope, out-of-focus product categories that have been vetted for use with the DCP-VPM (Table A-1 in Appendix A) are expected to engage with the CEC and provide some data or technical information. The data or technical information provided by the stakeholders is used by the CEC to evaluate the general inactive power consumption for the product categories, the purposes for which the device consumes power in these modes, and whether it should be put in-focus for future iteration of the VPF-LPM. As stated above, the CEC will reevaluate and republish in-scope, in-focus product categories for each iteration of the VPF-LPM.

The in-scope, out-of-focus product categories also provide an opportunity for the CEC to approach and monitor products that are rising in popularity but have not been on the radar of technical staff, trade organizations, or energy advocates. One example would be electric bidets for toilets, which have gained popularity across the U.S. consumer market in recent years. The CEC would be able to use VPF-LPM as a method to gather data for emerging product groups and encourage stakeholders to engage with the CEC before discussing any rulemaking process and without setting an expectation that regulations will be pursued.

The CEC welcomes data submittals for all in-scope products using the DCP-LPM, including products that are not in-focus.

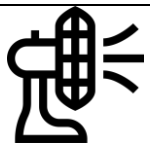
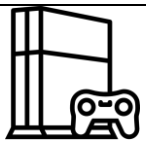
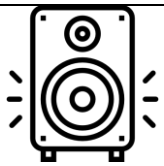
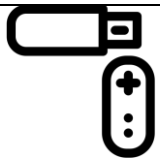
In-Focus Product Categories

Table 2 below lists 18 product categories that are proposed to be in-scope and in-focus, including a brief description of the product category. In Chapter 3, proposed participation targets for these product categories for the initial data reporting will be presented. For all the product categories listed in Table 2, the CEC requests stakeholders to submit performance data in accordance with the DCP-LPM presented in Appendix A, with the only exception being imaging equipment, as discussed below. The descriptions provided in Table 2 are not intended to be "regulatory-grade" scope definitions but rather are designed to help stakeholders understand the general intent of the named product categories.

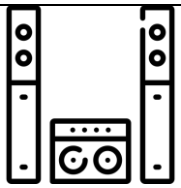
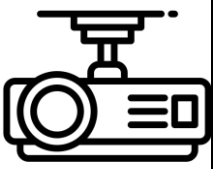
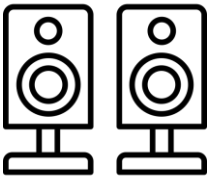
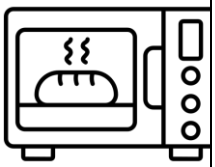
Caveat: ENERGY STAR Imaging Equipment

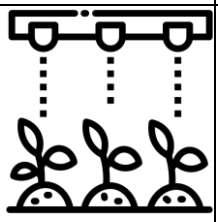
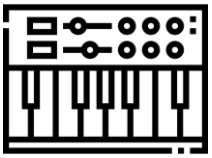
Imaging equipment, including printers and multi-function devices as described in Table A-1, is an established ENERGY STAR product category with an established test method and with significant performance data already available. To avoid redundant testing and take advantage of the well-recognized data within the ENERGY STAR Program, the CEC requests that stakeholders submit data to the CEC for imaging equipment in accordance with the test method established by ENERGY STAR.[11] The CEC requests all applicable ENERGY STAR data for imaging equipment, including energy consumption data for on mode, and request technical product information in alignment with data collected for the DCP-LPM. The CEC expects manufacturers to also upload data for models that do not meet the ENERGY STAR requirements to ensure a better overview of the marketplace.

Table 2: In-Scope, In-Focus Product Categories for VPF-LPM V1.0

Product Category	Icon	Description
Residential standalone fans		A device that uses an electric motor to create artificial air movement for comfort.
Game consoles		A device that provides a platform for digital gaming through user interaction.
Speakers (including smart speakers)		A stand-alone speaker that transforms an electric signal into sound.
Streaming media players		A device that processes online media content and outputs video and audio in real time.
Receivers and audio amplifiers		A device that receives or amplifies an audio signal or both.

11 Environmental Protection Agency. February 2020. *"Final Version 3.0 ENERGY STAR Professional Imaging Equipment Test Method",* https://www.energystar.gov/sites/default/files/asset/document/ENERGY%20STAR%20Version%203.0%20Final%20Professional%20Imaging%20Equipment%20Test%20Method.pdf.

Product Category	Icon	Description
Home-theater-in-a-box systems		A packaged system that creates a home theater acoustic experience.
Soundbars		A compact audio system that is intended to receive an audio signal from a TV.
Video projectors		A device that projects video.
Computer speakers		A speaker system that is intended to play audio for personal computers.
Printers		A device that prints document and graphic content.
Multi-function printing devices		A printer that has various integrated imaging functions, such as scanning and copying.
Coffee makers		A household countertop appliance that produces ready-to-drink coffee.
Toaster ovens, air fryers, and toasters		A household countertop appliance that heats food primarily by hot-air convection.

Product Category	Icon	Description
Robot vacuum		A vacuum cleaner that is capable of autonomous operation.
Irrigation controllers		A device that processes irrigation scheduling information and generates control signals. The CEC intends to focus on the type of irrigation controllers being considered for water-efficiency standards under CEC Docket 17-AAER-10. Please see CEC's "Irrigation Controllers" website for more information: https://www.energy.ca.gov/proceeding/irrigation-controllers.
Exercise equipment		A powered exercise equipment that supports exercise activities for the user.
Powered furniture		A piece of furniture with integrated powered functions to provide enhanced user comfort and convenience.
Musical instruments and production equipment	 12	An electric-powered musical instrument and digital audio content production equipment.

Source: CEC staff

In-Scope, Out-of-Focus Product Categories

As stated earlier in this chapter, in-scope, out-of-focus product categories include products ranging from product categories that the CEC has not considered yet to product groups the CEC is evaluating setting participation targets for. The CEC appreciates any performance data

12 Image: Flaticon.com.

for any product regardless of whether it is in focus or out of focus, including products not specifically called out in this framework. Below are some additional comments about some product categories that are in-scope and out-of-focus, but that the CEC is still paying close attention to.

Small Network Equipment

Small network equipment has experienced significant performance improvement in recent years. The Consumer Technology Association (CTA) organizes a voluntary agreement (VA) effort for small network equipment (SNE) to increase the energy efficiency of equipment used to access residential broadband internet services while promoting rapid innovation and timely introduction of new features for consumers. The VA has been instrumental in continuously reducing inactive power consumption proportional to the increasing data rate and usage.[13] Participants in the agreement include all the largest internet service providers and many major manufacturers.[14]

The CEC recognizes the significant effort of the SNE VA and the progress that has been made to improve energy efficiency while supporting consumer demand for increased speed and wireless coverage. The CEC encourages continued progress in the SNE VA and looks forward to seeing a high compliance rate with the "Tier 4" allowances, which are the defined inactive power consumption targets set by the existing voluntary agreement for SNE that go into effect in 2026.

The SNE product category is not in focus for this iteration of the VPF-LPM. While the CEC welcomes data from SNE submitted to the CEC according to the DCP-LPM, the CEC would like the industry to focus on continuous improvement in inactive power consumption performance of SNE within the current VA structure. If the SNE VA makes satisfactory progress, the CEC will not propose the SNE industry to participate in the VPF-LPM. If the progress of the SNE VA is proven insufficient, though, the CEC will consider moving SNE into the in-scope, in-focus product categories. The CEC would like to stay up to-date on the progress of the SNE VA and welcomes a dialogue about the potential for further energy efficiency improvements within the SNE industry.

Lighting Controls

The DCP-LPM is developed from the industry test procedure IEC 62301. The CEC is aware that the lighting control industry has developed the industry test procedure ANSI C137.63103-2021 to address the need to test the inactive power consumption for lighting controls. ANSI C137.63103-2021 addresses test setup considerations specific to lighting products that are not addressed in IEC 62301 and is the result of a multiyear effort from the lighting industry. The DCP-LPM V1.0 reinstates a manual power-down test for products that do not automatically power down, which was included in a previous version of the DCP and was shown to yield reproducible data for lighting controls products. Before considering putting lighting controls

13 Energy Efficiency Voluntary Agreements. 2025. *"Voluntary Agreement for Ongoing Improvement to the Energy Efficiency of Small Network Equipment*" Available at https://energy-efficiency.us/wp-content/uploads/2025/02/SNE-VA-Amendment-2025.pdf.

14 Energy-efficiency.us. 2025. "*Agreements & Reports*" Available at: https://energy-efficiency.us/#agreement

products in scope and in focus, the CEC would like to better understand the applicability of the DCP-LPM to lighting controls products, specifically:

- Is DCP-LPM V1.0 applicable to lighting controls? If not, why not? The CEC would appreciate data demonstrating the lack of reproducibility for lighting controls products or other issues when DCP-LPM V1.0 is applied to lighting controls.
- Are there ways DCP-LPM V1.0 can be modified to better accommodate the specific technical requirements of testing lighting controls products? Specifically, can the knowledge and insights gained from developing ANSI C137.63103-2021 be leveraged to make appropriate changes to DCP-LPM V1.0 while maintaining the horizontal design approach of the DCP-LPM?

While the lightning controls are not in focus in this iteration of VPF-LPM, the CEC expects the industry to engage with the CEC, help answer the questions above, and, to the extent possible, submit data according to the DCP. In future iterations of the VPF-LPM, the CEC will consider moving lighting controls within the in-scope, in-focus product categories, and the CEC appreciates the expertise of the industry and other stakeholders in how to best do that.

CHAPTER 3:
Participation Targets

Introduction

In the initial data reporting, the CEC seeks to gather a substantial, representative data sample for each in-scope, in-focus product category, enabling an accurate perspective of the inactive power consumption of products currently available in the market. Solid and extensive market data are critical for the success of VPF-LPM and for setting appropriate performance targets in future iterations of the VPF-LPM that vary based on inactive state functionality.

Participation Targets

Table 3 below sets participation targets for all in-scope, in-focus product categories specified in Chapter 2. To achieve the critical data volume necessary for subsequent quality data analysis in VPF-LPM, while not being overly stringent for the initial data reporting, the CEC proposes setting a general goal of having sufficient data entries to cover at least half of the products sold in California. One of the challenges in achieving that goal is the lack of available information on the sales volumes of various product models within each product category.

As a more readily measurable and verifiable proxy for the CEC's market coverage goal, Table 3 lists numerical minimum targets for participating manufacturers and models entries submitted. The CEC seeks input from all stakeholders about whether these numerical minimum targets accurately reflect about 50 percent of the market, and the CEC might adjust these numerical goals either up or down before initiating the initial data reporting.

The minimum target for models is for all manufacturers combined. Industry stakeholders are expected to meet the minimum target of manufacturers and the minimum target of models. The CEC encourages industry to coordinate and submit data to meet the minimum targets. If the minimum targets are not met, but the industry believes that at least 50 percent of the market is represented by the data submitted, the industry may provide information substantiating that claim, which the CEC will evaluate and could potentially deem acceptable.

In addition to clear and convincing information for why more than half of the products sold in California is represented, the CEC would like to know why the specific numerical goals could not be met. Failure to meet the targets will lead the CEC to investigate the product groups to determine the cause of missed targets and produce an improvement plan together with the industry. If an improvement plan is not agreed upon or if progress on meeting the improvement plan is not satisfactory, the CEC may consider regulatory action as shown in the VPF-LPM flow diagram in Figure 1 in Chapter 1.

Table 3: In-Focus Product Category and Minimum Participation Targets for VPF-LPM V1.0

In-Focus Product Categories	General Product Category	Typical Primary Function	Minimum Target of Manufacturers	Minimum Target of Models
Residential standalone fans	Ventilation	Providing fresh air and air circulation	3	15
Game consoles	Multimedia	Playing video games	2	5
Speakers (including smart speakers)	Multimedia	Playing audio or video content	6	30
Streaming media players	Multimedia	Playing audio or video content	3	10
Receivers and Audio amplifiers	Multimedia	Transmitting and transforming audio signals from media players and radio to speakers	5	25
Home-theater-in-a-box systems	Multimedia	Playing audio or video content	5	25
Soundbars	Multimedia	Playing audio or video content	5	25
Video projectors	Multimedia	Transforming video input to light projection and/or playing audio content	4	20
Computer speakers	Computer accessories & peripherals	Playing audio content	5	25
Printers*	Imaging equipment	Printing an image or document	10	75% of ENERGY STAR certified models

In-Focus Product Categories	General Product Category	Typical Primary Function	Minimum Target of Manufacturers	Minimum Target of Models
				25 models not certified to ENERGY STAR
Multi-function printing devices*	Imaging equipment	Copying, scanning, printing, or faxing an image or document	10	75% of ENERGY STAR certified models 25 models not certified to ENERGY STAR
Coffee makers	Small kitchen appliances	Making or heating coffee or water	4	20
Toaster ovens, Air fryers, and toasters	Small kitchen appliances	Cooking or warming food	7	35
Robot vacuum	Electric housewares	Cleaning surfaces	3	15
Irrigation controllers	Outdoor equipment	Moving water for use by plants	3	15
Exercise equipment	Hobby, entertainment, leisure	Allowing fitness activity	2	10
Powered furniture	Hobby, entertainment, leisure	Supporting activities such as seating, eating, storage, or sleeping that have powered function(s) to provide enhanced user comfort and/or convenience	3	15
Musical instruments and production equipment	Hobby, entertainment, leisure	Creating and transforming sound and audio signals	3	15

***Products will follow ENERGY STAR test method, not the DCP-LPM.**

Source: CEC staff

Imaging Equipment

As indicated in Table 3 and discussed in Chapter 2, printers and multifunction printing devices are a unique case for in-scope, in-focus product categories as the CEC will allow test data according to the ENERGY STAR test method instead of the DCP-LPM. Because of this exception, the participation targets set for printers and multifunction printing devices are also different than for other product categories. The CEC requests a minimum of 75 percent of the certified ENERGY STAR models[15] to also be submitted to the California Certification Database to ensure data consistency and as these data should be readily available to manufacturers. The CEC also requests data from a minimum of 25 models not certified by ENERGY STAR to be submitted to the CEC to ensure a more comprehensive understanding of the marketplace.

15 ENERGY STAR Certified Imaging Equipment, https://www.energystar.gov/productfinder/product/certified-imaging-equipment/results?formId=6692968-28-4433-640-4585482926&scrollTo=369.77777099609375&search_text=&product_type_filter=Multifunction+Devices+%28MFD%29&product_type_filter=Printers&brand_name_isopen=0&marking_technology_isopen=0&markets_filter=United+States&zip_code_filter=&product+types+to+select=Select+a+Product+Category&sort_by=brand_name&sort_direction=asc&page_number=0&lastpage=0

CHAPTER 4:
Data Collection Procedure for Low-Power Modes (DCP-LPM)

Introduction

Under the VPF-LPM, the CEC will collect data to evaluate the energy use and savings potential of products within the scope. One important input for this effort is standardized measurements of inactive whole-product power draw and relevant product attributes. To accomplish this approach, CEC staff developed a data collection procedure (DCP) to gather inactive power consumption data for energy savings potential analysis and performance target development.

Most of the focus of the VPF-LPM since the inception in 2017 has been on developing the DCP. Below is a timeline outlining the major milestones of DCP development and a technical overview.

Timeline

- June 2018: The CEC outlined needs for a DCP and asked for stakeholder feedback.
- September 2018: Stakeholders provided feedback, including California investment-owned utilities (IOUs) who stated plans to develop and propose necessary sections of the DCP.
- May 2021: California IOUs docket DCP proposal V1.
- August 2021: The CEC hosts a webinar on DCP requirements and IOU proposal.
- October 2021: Stakeholders provide feedback, and IOUs begin DCP proposal round robin testing.
- February 2023: The California IOUs docket DCP proposal V3.
- October–November 2024: The CEC issues RFI and receives stakeholder feedback.
- August 2025: The California IOUs docket DCP proposal v3.1, which is the basis for DCP-LPM V1.0.

Technical Overview

The DCP-LPM is a standardized method for evaluating the power consumption of a device in an inactive state. The DCP builds on the International Electrotechnical Commission (IEC) test procedure, IEC 62301:2011, which provides limited guidance for making power measurements in low-power operating modes. IEC 62301 lacks setup instructions that apply to many of the newest functions that today's electricity-using products may offer, such as network connectivity, voice activation, and environmental monitoring.

In addition, IEC 62301 is designed to measure power in discrete operational modes rather than in a general inactive condition that may consist of multiple modes. The DCP provides instructions for setting up and carrying out DCP inactive condition power measurements, addressing these two limitations of IEC 62301. The DCP-LPM is not developed for individual parts or devices that are primarily powered by an integrated battery.

Recent Changes to the DCP

The CEC requested stakeholder feedback on the California IOUs' DCP proposal V3 in their October 2, 2024, request for information. In response to that feedback, the California IOUs made the following updates to the current version.

- Reinstated the manual power down test from a previous version docketed in May 2021 for products that do not automatically power down (Section 7.5).
- Corrected figure references (Section 7).
- Clarified that default settings are used when manufacturer instructions do not specify settings that potentially impact inactive state power (Section 3.6).
- Deleted "playing audio or video content" as potential primary functions of game consoles (Table A-1).
- Clarified that if an automatic update starts during a test, the test is invalidated and the product must be retested once the update is complete (Section 9.1.3).

The California IOUs' DCP proposal V3.1 forms the basis for DCP-LPM V1.0, which is presented in Appendix A. The CEC did not make any significant technical adjustments to the most recent proposal submitted by the California IOUs. The CEC will consider appropriate adjustments to DCP-LPM V1.0 based on input from stakeholders before starting the initial data reporting.

GLOSSARY

Terms used in the DCP-LPM are defined below and written in *italic type* in this section.

Active mode: An operational mode of a unit under test (UUT) when it is providing one or more of the primary function(s).[16]

Automatic power down, APD: The capability to automatically switch a product from active mode to a lower power operating condition after a predetermined period (APD timing) has elapsed. APD timing begins when both (1) the UUT has ceased performance of all primary functions, and (2) the last user input has been received (for example, voice command, remote control, or app command). If either a primary function resumes or a user input is received, the APD timing will reset. The intent of APD is that a product will automatically power down into a low-power mode or series of modes when it is not being adjusted by the user, not sensing user activity that would trigger active mode, and not performing a primary function.[17]

DCP inactive condition: The condition of a UUT after performing the setup described in this procedure. Generally, the DCP inactive condition represents the condition of the UUT after user interaction has ceased and the product is not performing the primary function(s). If the UUT continues to perform its primary function after performing the setup described in this procedure, it is tested as such and considered an "always-on" product.

Function: A predetermined operation undertaken by the UUT. A function could have varying actions caused by various factors, as functions may be controlled by interactions of the user, of other technical systems, of the system itself, from measurable outputs from the environment or time, or both.[18]

16 Adapted from IEC 62301:2011, Section 3.8.

17 Adapted from ENERGY STAR Program Requirements – Product Specification for Audio/Video Eligibility Criteria Version 3.0 (Rev. Dec-2014), https://www.energystar.gov/sites/default/files/Final%20Version%203.0%20AV%20Program%20Requirements%20%28Rev%20Dec-2014%29.pdf

18 Based on the definition in IEC 62301:2011, Section 3.1. The definition of a function is intentionally broad because there are many types of services devices perform and many ways of controlling those services. The definitions of "primary function(s)" and "supporting function(s)" below provide more concrete examples of product functions. The IEC definition is also intentionally broad in describing the many possible ways device functions can be controlled. For example, a smart speaker might play music in response to a voice command from a user, a light might turn on in response to a signal from a lighting control, or a monitor might power down its display after a certain amount of time without user interaction.

Primary function: An intended purpose or main service that the UUT provides a user. In general, the primary function defines the product and is often contained in the name. A product may have more than one primary function. Primary functions for product categories are listed in Table A-2. Examples of primary functions are listed below:

Table 4: Examples of Primary Functions

Product	***Primary Function(s)***
Smart speaker	Playing audio content, responding to user requests
Multi-function device	Printing, scanning, copying, faxing
Coffee maker	Making and heating coffee
Toaster oven	Heating food
Router	Passing user-generated Internet Protocol (IP) traffic among various network interfaces

Supporting function: Other functions which may enhance the primary function(s) or can assist with the use and operation.[19] These functions may be essential to the operation of the primary function but do not provide useful information or services to the user by themselves. A non-exhaustive list of supporting functions is included in Table A-2. The table below shows examples of product types that contain common supporting functions. Examples of supporting functions are listed below:

Table 5: Examples of Supporting Functions

Supporting Function	***Applicable Product Type***
Network communication	IP network-connected devices (see definition below)
Display	Any product except stand-alone displays
Sensors	Home security system with motion or occupancy sensing
Voice interface	Any product with vocal user interface

19 Source: Harrington, Lloyd and Bruce Nordman. September 2010. *Standby Power and Low Energy Networks — Issues and Directions.* Prepared by Energy Efficient Strategies for APP and IEA 4E Standby Annex. Section 4.2, https://www.iea-4e.org/wp-content/uploads/publications/2010/08/Network-Standby-2010-09-final.pdf.

***Integrated IP network device**:* A device that possesses multiple primary functions, one of which is to pass IP traffic among various network interfaces to provide a data network.

Example: An LED bulb with Wi-Fi extender has multiple primary functions: illumination and passing IP traffic among various network interfaces.

Local area network, LAN: An IP network that serves to transfer information between devices within a small area, such as a building or campus.

IP network-connected device: A device at an end point of a network that can send and receive IP traffic and whose primary function(s) is(are) function(s) other than passing IP traffic to provide a network.

> Example: A speaker that can connect to a LAN via Ethernet or Wi-Fi is an IP network-connected device.

IP network equipment: A device whose only primary function is to pass IP traffic among various network interfaces to provide a data network. The following types of IP network equipment are used to provide network connections during testing with this DCP:

- ***Wide area network (WAN) equipment:*** Network equipment that connects a LAN or end-user products or both to a WAN, often an internet service provider network. Common WAN equipment includes modems, integrated access devices (IADs), and optical network terminals.
- ***LAN equipment:*** Network equipment that transfers data on a LAN. Common LAN equipment includes routers, access points, range extenders, and Wi-Fi mesh systems. LAN equipment can be used to provide network connections during testing and can also be tested with this DCP.

Non-IP network device: A device that does not have the ability to send and receive IP network traffic. Non-IP network devices may be capable of connecting to a personal area network (PAN) via wired or wireless technologies such as USB or Bluetooth.

> Example: A speaker that cannot be connected to an IP network and can connect to a phone via Bluetooth to play audio content is a non-IP network device.

Off mode: A mode in which the UUT is connected to a power source and is not providing any primary or supporting function, with the exception of an indicator light that shows the user that the product is in the off position.[20] Off mode is normally entered through a hard switch, soft switch, expiration of a timer within the UUT, display-based command on a product, or power command from a data or network link.

Personal area network, PAN: A non-IP network that allows data transfer between products in a small area, such as a room or building. PANs may be wired or wireless. Common communication technologies used on PANs include USB, Wi-Fi Direct, Bluetooth, Zigbee, and proprietary RF protocols.

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[20] Adapted from IEC 62301:2011, Section 3.5.

***Unit under test, UUT*:** The product being tested according to this DCP. A UUT includes all devices and cables, including external power supplies, that are sold together under a single product number or SKU, regardless of whether they are packaged in the same box.

Wide-area network, WAN: An IP network that serves to transfer information between devices over a large geographic area, such as a city or country. The Internet connects multiple WANs.

APPENDIX A:
DCP-LPM V1.0

Scope

The DCP is designed to test the power draw of a wide range of products in the inactive condition similar to how they would be used in the real world, with enough test guidance that the measurements are sufficiently repeatable and reproducible. The CEC considers DCP results within 5 percent (or 0.05 watt if measured power is less than 1 watt) of each other to demonstrate repeatability (for the same instrumentation and tester) or reproducibility (for different instrumentation and testers).

A round-robin test was conducted at two independent third-party laboratories during the development of the DCP-LPM. The results confirmed that the DCP-LPM can generate high-quality and reproducible data across a wide range of products. The CEC plans to continuously improve the DCP-LPM so that it yields reproducible data for more products, which may be included in subsequent rounds of data collection.

Updates to Previously Docketed Version

The following updates were made to the IOU CASE Team's DCP proposal V3 in response to the 2024 request for information.[21]

- Reinstated the manual power down test from the IOU CASE Team's DCP proposal v2 for products that do not automatically power down (Section 7.5). V2 was used in the first round of round robin testing and yielded reproducible data for lighting control products. V2 was not docketed, but the manual power down instructions are like those in IOU CASE Team's proposal V1, which was docketed in May 2021.[22]
- Corrected figure references (Section 7).
- Clarified that default settings are used when manufacturer instructions do not specify settings that potentially impact inactive state power (Section 3.6).
- Deleted "playing audio or video content" as potential primary functions of game consoles (Table A-1).
- Clarified that if an automatic update starts during a test, the test is invalid and must be repeated once the update is complete (Section 9.1.3).

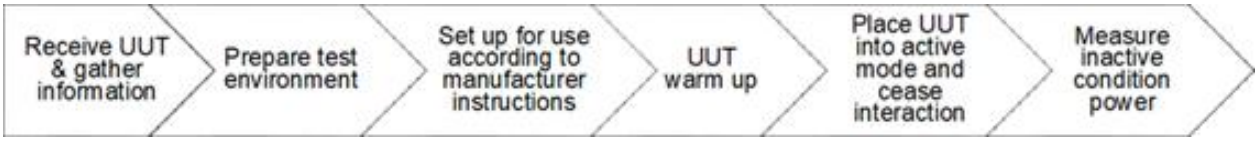
21 https://efiling.energy.ca.gov/GetDocument.aspx?tn=259429&DocumentContentId=95514

22 https://efiling.energy.ca.gov/GetDocument.aspx?tn=237807&DocumentContentId=71046

Overview of the Data Collection Procedure

These instructions guide the tester through a series of steps to prepare the UUT for and carry out DCP-LPM inactive condition power measurements of a wide range of electricity-using products. The DCP-LPM sets up the UUT according to manufacturer instructions, using default settings with some simplifications and specific conditions that facilitate reproducible results. At a high level, the DCP-LPM instructs the tester to follow manufacturer instructions to prepare the UUT for use, allow the UUT to enter the DCP-LPM inactive condition, and measure inactive condition power (Figure A-1).

Figure A-1: General Steps to Be Carried Out in the DCP-LPM



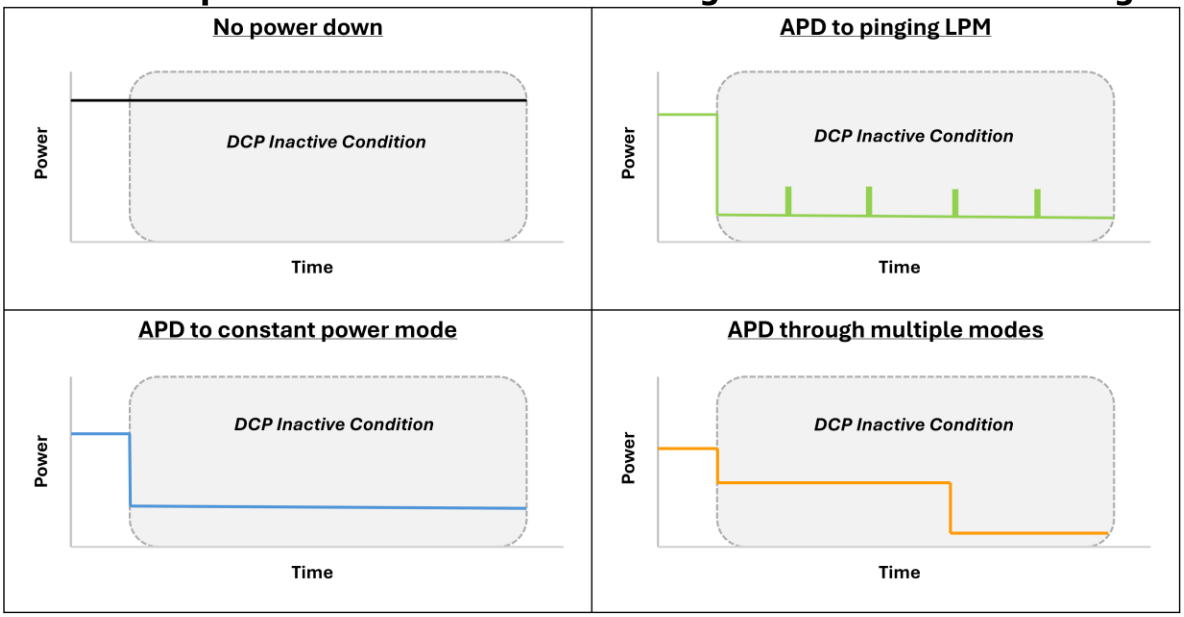
Source: IOU CASE Team

DCP-LPM Goals and Approach

The DCP-LPM measures UUT power in an inactive condition, rather than specific low-power modes as IEC 62301 specifies. The DCP guides testers through examining the UUT to characterize how it draws power when it is not providing the primary function(s) (warmup period analysis), setting up the UUT for testing, and measuring the power over a window of time in which the primary function(s) is not active. Products can show a wide range of behavior and may progress through various operational modes in DCP-LPM inactive condition. Some products may exhibit simple, steady power draw in DCP-LPM inactive condition. Others, especially those that use network connections and sensors to enhance the service provided by the product, may use several modes or otherwise draw time-varying power in DCP-LPM inactive condition as the product activates functions to maintain expected services (Figure A-2).

By measuring the inactive condition, rather than individual modes, the DCP-LPM aims to characterize aggregate power draw over a period when the user is not benefiting from the active mode services that the UUT provides.

Figure A-2: Examples of Power Behavior That Might Be Encountered During Testing



Source: IOU CASE Team

The dashed box indicates the DCP-LPM inactive condition power draw in each of the following scenarios:

- Black line: stable, constant power draw of an always-on product
- Green line: APD to LPM inactive condition "pinging" behavior at regular interval
- Blue line: APD to constant power draw
- Orange line: APD to inactive condition, which consists of two low-power modes

How to Use This DCP

The section below contains the DCP-LPM. Instructions are written in outline form. Informative notes and examples are contained below the pertinent instructions. Information to be recorded during the procedure is noted in bold italics. This information may be recorded in the accompanying data reporting tool (DRT), introduced in the next paragraph.

Reporting

The DCP-LPM data will be reported to the California Certification Database. The CEC website will provide instructions on how to upload the DCP-LPM data.

Safety Note

Pretest safety planning should be performed by the tester to ensure that all hazards have been identified, evaluated, and controlled before the start of UUT setup, warmup, and testing. The tester is responsible for conducting such pretest safety planning and ensuring that the UUT setup is completed by qualified personnel, as specified in product instructions.

Data Collection Procedure

1. Prepare Test Room and Instrumentation

1.1. Power measurements will be made under the test conditions and with the instrumentation specified in IEC 62301:2011 Section 4, with the following additions and modifications:

1.1.1. Ambient relative humidity will be maintained in the range of 10% to 80% throughout each test.

1.1.2. Select all leads used in the test setup as specified in Table B.2 — "Commonly used values for wire gauges and related voltage drops" in IEEE 1515-2000.

1.1.3. Measurement resolution shall be:

- 0.01 watt (W) or better for measurement values less than 10 W.
- 0.1 W or better for measurement values from 10 W to 100 W.
- 1.0 W or better for measurement values greater than 100 W.

1.1.4. Power readings shall be collected at equal intervals of 1 second or less for any measurement conducted in this DCP.[23]

1.1.5. The power meter shall have auto-ranging capability enabled to ensure that the meter uses an appropriate range for measuring DCP inactive condition power upon the UUT transition from active mode to DCP inactive condition.

1.2. AC-powered UUTs: Any UUT that accepts AC input is considered an AC-powered UUT. This category includes UUTs that ship with an external power supply. The appropriate regulated AC power shall be supplied to the UUT, and test point connections shall be made on the AC side of the external power supply (if shipped with UUT).

1.3. Power over Ethernet (PoE) powered UUTs: section deleted.[24]

1.4. DC-powered UUTs: A UUT that accepts DC power and does not ship with an AC-to-DC external power supply shall be powered with DC:

1.4.1. Maximum DC voltage shall not exceed +1% of the average required voltage and the minimum voltage shall not be less than -1% of the average voltage. The AC ripple voltage (RMS) shall be:

- ± 0.2V for DC voltages up to 10 V; or
- ± 2% of the DC voltage for DC voltages over 10 V.

1.4.2. Universal Serial Bus (USB)-powered UUTs: The AC-to-USB power supply shall be powered using a regulated AC power source that meets the requirement of IEC 62301:2011 Sections 4.3 and 4.4. The DC side of the AC-to-USB power supply shall be connected to the power meter by breaking the DC Vcc+ and wiring it through the power meter to measure the DC current drawn by the UUT. Test leads shall be connected to the DC Vcc+ and DC ground- to measure the voltage as close to the UUT as possible. See Figure A-3 for reference.

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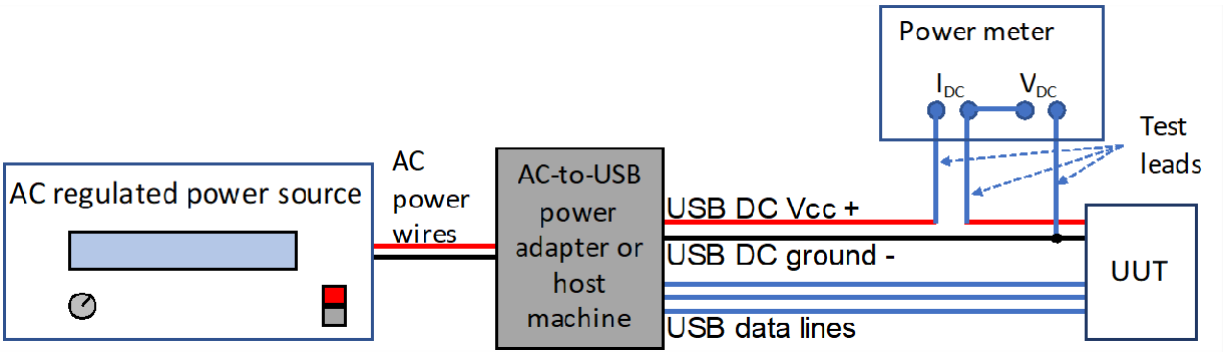
23 Minimum power reading interval adopted from IEC 62301:2011, Section 5.3.2.

24 Instruction blocks in the DCP proposal V1 that were not vetted in the 2022 round robin effort are deleted in this version of the proposal. The instructions may be vetted for readdition later.

Figure A-3: Power, Data, and Test Point Connections for USB-Powered UUT.



AC-to-USB power conversion may be carried out by a power adapter or a host machine with USB power delivery, such as a computer.

Source: IOU CASE Team

1.5. Illuminance meter requirements: Illuminance meters shall have an accuracy of ±2 percent of the digitally displayed value.
1.6. Sound pressure level (SPL) meter requirements: SPL meters shall be capable of data logging, have an accuracy of ±1.5 percent, and have a resolution of 0.1 decibel (dB).
1.7. Instrumentation calibration: Power and illuminance meters shall be calibrated and in good working order. If the test laboratory does not hold ISO/IEC 17025 accreditation, meters shall be calibrated annually or sooner.

2. Receive Unit Under Test (UUT) and Gather Information

2.1. Review manufacturer instructions.
2.2. If the UUT has been previously tested or used, perform factory reset per manufacturer instructions, if available.

The remainder of this section gathers information on the UUT and related functions. This information may be provided by the manufacturer or other party requesting the test. The tester shall confirm any provided information and correct, if necessary.

2.3. **Record or confirm manufacturer, model number, and product category.** Refer to Table A-1 for a list of product categories covered by this version of the DCP-LPM.
2.4. **Record or confirm primary and supporting functions**. Primary functions are related to product category. Use Table A-1 as a guide to determine primary function based on product category. If the product has multiple primary functions, or a primary function that is not listed in Table A-1, add additional primary function(s). Supporting function definitions and examples are listed in Table A-2.
2.5. **Record or confirm whether supporting functions identified are available in the test condition.**
2.6. **Record or confirm whether UUT has an off mode as defined in the Definitions Section.**

Note: The assessment made in Section 2 may be revised as the tester examines, tests, and better understands the UUT.

3. Set up UUT for Use Following Manufacturer Instructions

The UUT shall be tested in the as-shipped, default configuration unless otherwise specified by this DCP. The following instructions include additional guidance where manufacturer instructions are unclear or unspecified. Perform the setup in the order given in the manufacturer instructions.

Note: Some manufacturer setup instructions include a tour of product features. The tester should leave all features and functions in the as-shipped default settings. The tester need not follow instructions that do not pertain to the setup of the UUT in DCP inactive condition described in this section, such as product registration.

3.1. **Connect to power.** Connect UUT to a regulated power source and power meter as specified by Sections 1.1 to 1.4 of this document and IEC 62301.2011 Sections 4.3 and 4.4. If the UUT can accept multiple forms of power, connect the first option available from the following list:

- Mains (120 or 240 Vac, nominal)
- Low-voltage AC
- USB
- Other DC power delivery method besides PoE

3.1.1. AC mains powered products: supply appropriate AC voltage, either 115 V/60 Hz or 230 V/60 Hz if powered from mains according to IEC 62301. If the UUT can accept more than one AC voltage or a range of voltages, supply the lower of 115 V or 230 V, as appropriate. **Record input voltage and current type (AC).**

3.1.2. If the UUT ships with an AC-DC external power supply, connect the power supply to the UUT and provide AC mains power to the power supply. This instruction applies even if the UUT can operate on either AC or DC input. **Record input voltage and current type (AC).**

3.1.3. DC-powered and low-voltage AC-powered products: Supply manufacturer-specified DC or AC voltage with a power source that meets the specifications in Sections 1.1 through 1.4, as applicable. If the manufacturer specifies a DC voltage range, supply the average of the given range. If the manufacturer provides a discontinuous range, supply the average of the smallest given range (for example, if specified DC voltage is 24–30 V or 48–55 V, supply the average of the lower range, 27 V). If the manufacturer does not specify DC voltage, use best judgment and specifications of the connection type. **Record input voltage and current type (DC).**

3.2. **Connect and set up all peripherals that ship with the UUT.** Peripherals may have wired or wireless connections to the UUT. If a peripheral can use either a wired or wireless connection, connect it to the UUT via the wireless connection for the test (after ensuring that any peripheral batteries are fully charged). For a UUT that includes two or more peripherals that cannot be simultaneously connected, connect the peripheral(s) as indicated in the first instance shown in the product instructions.

Examples: Game console controllers, window and door sensors for home security systems, wired security cameras for home security systems.

3.2.1. Peripherals may be battery-powered, draw power from the UUT, or draw power from mains or other separate power source.

3.2.1.1. If a peripheral draws power from mains, rather than from the main UUT, log peripheral and main UUT power on separate channels of a multichannel power meter or on time-synchronized single-channel power meters. Sum the channels to report total power for the UUT.

3.2.1.2. If a peripheral is powered by a rechargeable or nonrechargeable battery, ensure the battery is fully charged before warmup and testing.

3.3. **Connect any additional equipment the UUT requires (but does not ship with) to provide the primary function(s) noted in Section 2.4**. Establish the necessary wired or wireless data or power connection or both between the UUT and the additional product(s).

3.3.1. If the additional product draws power from mains or a battery, do not measure or report the associated power draw. If the additional product can draw power from either mains or the UUT, power the additional product from mains and do not measure or report the power draw. If the only way to power the additional product is from the UUT, note that the UUT power measurement applies to both the UUT and the additional product.
When possible, the tester shall place the additional attached products in an inactive mode for testing. In some cases, however, the additional product must be active to initiate the UUT test.
Examples:

a. Certain network-connected smart lamps must be connected to a mains-powered proprietary network hub. Connect the smart lamp to the hub following manufacturer instructions and connect the hub to the LAN. Power the hub from mains, and do not measure or report power of the hub. During testing, the hub will be in DCP inactive condition (capable of passing IP traffic, but no user traffic will be generated).

b. A game console must be connected to a TV or display to graphically interact with the user. Connect game console to a mains-powered TV or display as directed by the manufacturer's instructions. Do not measure or

report power of the TV or display. The TV or display must be active to initiate the UUT test and shall use its default APD settings during the test.

c. A security camera stores data locally but does not ship with the micro SD card required to do so. Install a micro SD card if the camera cannot perform the primary function without it.

d. An LED lighting controller must be connected to a luminaire to operate but does not ship with a luminaire. Connect controller to a compatible luminaire and note the make and model. During testing, the controller will keep the luminaire turned off.

3.3.2. **EXCEPTION**: for UUTs whose primary function is to provide AC or DC power to another product (including but not limited to plug strips, outlets, smart plugs), no loads shall be attached during the test.

3.3.3. For IP network-connected and non-IP network devices, products that do not ship with the UUT and are not necessary to enable the UUT to perform its primary and DCP inactive condition functions *shall not* be connected for the test.

3.4. **Enroll in services**, such as downloading an app, creating an account, and connecting the UUT to the app. In many cases, the tester will need to use a smartphone to carry this step out and potentially to control the UUT.

3.5. **Update software or firmware and app to the latest available version, if applicable**. If possible, disable automatic software, firmware, app, and any other downloads and updates.

Note: The tester may need to refer to the mobile app for the connected UUT to obtain software or firmware version information.

3.6. **Where manufacturer instructions do not provide specific guidance and the user is given a choice in the UUT setup, use the default option for settings that potentially impact power.** If the UUT does not provide a default setting, select the setting that results in the highest UUT power draw.

Examples:

- Screen brightness
- Screen saver or background image
- Power management settings
- Video quality and bandwidth

3.7. **Voice assistant setup**

3.7.1. If voice input is the main user interface of the UUT or essential to operate the primary function(s) of the UUT, set up according to manufacturer instructions. For many products, the voice assistant may require no additional setup by the tester.

Example: A smart speaker relies on voice control to initiate the primary function, which is to play audio or control other connected devices such as a smart lightbulb.

3.7.2. If the UUT requires another local product to enable the voice assistant (for example, a camera that must be connected to a smart speaker to provide voice control), the voice assistant capability will not be enabled for the testing.

Note: The intent of this instruction is to avoid implementing voice activation in products that are marketed as "works with" a particular voice assistant, but do not contain the circuitry to provide the voice interface and instead rely on a data connection with another product to provide the function.

3.8. **Personal information.** Except for providing an email address or other information or a combination required to set up a UUT or related app, the tester should avoid providing personal information where possible during UUT setup. The tester will note if exclusion of personal information is expected to impact the power measurement.

Examples of information that should not be provided if possible:

- Voice matching, face matching or other features that allow a person to be identified for personalized calendars or settings
- Personal and business tax IDs

3.9. **Product registration, licenses, and subscriptions.**

3.9.1. If prompted to register the UUT, the tester should decline if possible.

3.9.2. If the UUT requires end user license agreements or terms of service/use to enable an app or service, the tester should agree to such agreements.

3.9.3. If prompted to purchase additional licenses, software keys, or subscriptions the tester should decline unless such items are required to complete the UUT setup process and enable the primary function(s) of the UUT.

Examples: (a) A security system should not be registered and enrolled for additional services from the manufacturer, unless necessary to provide primary and DCP inactive condition functions.

(b) In some cases, a voice over Internet protocol (VoIP) phone must be registered with a service provider to provide the primary function (conducting a call).

3.10. If the manufacturer instructions are incomplete, the tester will use best judgement in setting up UUT for use and record how it was completed.

Example: Manufacturer instructions do not give guidance to connect UUT to LAN, but a LAN connection is required for normal use. Tester would connect the UUT to the LAN and record the method employed.

4. Set up network connection.

In many cases, the manufacturer's instructions will be sufficient for setting up network connection(s). This section clarifies which network connections shall be made for testing if multiple options exist.

4.1. For IP network equipment and integrated IP network device UUTs, set up UUT network connections according to Section 7.3 and 7.4 of ANSI/CTA-2049-B test procedure.

Note: CTA-2049-B requires that during testing, the UUT maintains connections to a live WAN, and to "test clients" on the LAN via half (rounded up to the nearest integer) of the Ethernet ports and via one Wi-Fi connection at maximum bandwidth and frequency. A test client may be a dedicated piece of testing hardware that terminates network connections from the UUT, or a discrete end-user product such as a computer or a network switch. If discrete end user products are used as test clients, choose products that do not power down (for example, a switch), or products that maintain network connections when powered down (for example, a computer with network-connected sleep mode). The goal is to maintain all network connections but allow no user- or client-generated traffic during the test. For example, if the UUT has five Ethernet ports and Wi-Fi, the tester will connect three test clients to one Ethernet port each and one test client to the Wi-Fi network of the UUT.

4.2. For IP network-connected devices, connect the UUT to a dedicated LAN with no other connected devices via the network technology that appears first in the following prioritized list. Ensure that the connection allows the UUT to pass the maximum data throughput the UUT is capable of via the network technology.

1) Wi-Fi (IEEE 802.11), maximum frequency and bandwidth supported by UUT
2) Cellular
3) Ethernet (IEEE 802.3)
4) Wireless technology other than Wi-Fi or cellular that provides UUT's highest maximum data throughput rate

4.2.1. IP network-connected UUTs will be allowed to send and receive data as during normal operation without user-generated data traffic. The UUT shall be connected to a LAN and WAN with a router and WAN equipment, or an integrated access device (IAD). The LAN or WAN equipment or both shall have and enable firewall. Connections made with mobile hotspots are not permitted.

4.3. PAN connections: If manufacturer setup instructions direct the user to establish a PAN connection for normal UUT operation, the PAN shall be connected. If the PAN connection is used solely for setting up a Wi-Fi or other IP network connection, the connection will not be established for the test.

Examples:

A smart speaker uses a Bluetooth PAN connection to a smart phone to establish in order set up a Wi-Fi connection to the LAN. The device-to device PAN connection is not part of normal operation and shall be disconnected once the Wi-Fi connection is established and not present during the test.

A printer can use Wi-Fi Direct to receive jobs directly from a connected product. The printer will be connected to the LAN for testing and Wi-Fi Direct will be disabled.

A smart lighting kit contains a dimmer switch that connects to a hub via a proprietary RF protocol. The hub connects to the LAN via Wi-Fi. Establish both the dimmer switch-to-hub RF and the hub-to-LAN Wi-Fi connections for the test.

4.4. The network equipment and cabling used to connect the UUT to the LAN and WAN will have the following capabilities and specifications:

4.4.1. Ethernet connections will be made with a Cat 5e or Cat 6 cable.

4.4.2. Wireless IP network connections will be established between the UUT and a router or IAD within 5 meters of the UUT.

4.4.3. The network equipment will support the highest and lowest data transfer rates that the UUT can employ.

4.4.4. The network equipment will support Link Layer Discovery Protocol (LLDP) for IEEE 802.3az or other power management functions supported by the UUT.

5. Prepare Test Environment

Prepare the test environment to ensure that the UUT remains in DCP inactive condition and is not triggered to enter an active mode unless intentionally directed by the tester. The conditions required of the test environment depend on the functionality of the UUT and how active mode is triggered. If the UUT is triggered into active mode by any of the following environmental conditions, perform the following measures to prevent the trigger.

5.1 **Ambient Light**

5.1.1. Binary UUT response: If the UUT changes from active mode to DCP inactive condition in response to a discrete light level or change in light level, provide an ambient light level that keeps the UUT in DCP inactive condition. If the UUT changes its inactive power draw in response to a discrete light level, test the UUT first in the bright light condition. Repeat the test for the dim light condition as directed in Section 7.6. **Report power and room illuminance**

(lux) for each measurement separately.

> **Example of ambient light causing product to enter active mode:** A night light that turns on in a dark room should be tested in a bright room to prevent the light from turning on.
>
> **Example of ambient light causing product to alter inactive condition power:** A security camera has day and night modes. Provide ambient light to keep the camera in day mode. Repeat test in night mode as directed in Section 7.6.

5.1.2. Scaled UUT response: section deleted.[25]

5.2. **Ambient sound:** Ensure test environment does not have ambient sound that would cause the UUT to resume a primary function during the warmup or test periods.

5.3. **Motion or occupancy:** Ensure no person or moving object is in the vicinity of the UUT during warmup or test periods.

5.4. **Voice interface:** Ensure the wake phrase is not spoken during warmup or test periods. Maintain test room ambient sound below 50 dB (unweighted) or 50 dB C-weighted.

5.5. **Gestures:** Ensure no gestures are performed in front of the UUT during warmup or test periods.

5.6. **Hinge or entry sensors:** Ensure the sensor is not triggered during warmup or test periods.

5.7. **App:** Close the UUT app during warmup or test periods. Disable PAN connections (for example, Bluetooth, NFC) between the UUT and the product containing the app.

6. UUT warmup.

6.1. After setup, place the UUT in active mode and allow the UUT to remain powered and connected to the LAN, WAN, and test clients as applicable to allow the UUT to settle into normal operation. The UUT may power down to lower power operating states. Ensure that the test environment will not trigger the UUT to re-enter active mode during the warmup period. Data collected during the warmup will help the tester determine how the UUT will be tested.

6.1.1. The length of the warmup period shall be determined by the greater of: (a) the amount of time needed to observe UUT power behavior in DCP inactive condition, up to 12 hours, or
(b) the manufacturer's recommended provisioning time.

6.1.2. If the UUT has a rechargeable battery and the ability to indicate the condition of charge to the user, for example via an indicator light or a battery icon, check that it is fully charged at the end of the warmup time. The battery must be fully charged prior to the DCP inactive condition test; continue the warmup period until battery charging is complete. If the UUT does not report condition of charge information to the user, the tester should review the warmup data log for obvious signs of battery charging events and extend the warmup period as necessary to ensure the battery is fully charged prior

25 Instruction blocks in the DCP proposal v1 that were not vetted in the 2022 round robin effort are deleted. The instructions may be vetted for readdition later.

to testing.

6.2. During warmup, collect timeseries power readings over the entire period at equal intervals of 1 second or less.

6.3. Review the warmup period data to determine (a) whether any lab conditions caused the UUT to enter active mode and need to be further controlled during DCP inactive condition power measurement, and (b) whether the UUT automatically enters DCP inactive condition via one or more APD events. If so, estimate the time to APD (t_{APD}) for reference during the power measurement of Section 7, during which t_{APD} will be measured and reported.

Note: Warmup data is used to determine UUT behavior prior to testing. It may not be submitted as test data.

7. DCP inactive condition power measurement.

7.1. Place the UUT into active mode by direct input or by using one of the triggers discussed above. For network equipment, check that the network connection between the UUT and test client(s) is active by using the test client(s) to request data (e.g., load a web page). If using a voice command to initiate active mode, make a vocal request that results in a brief response, such as asking for a weather report rather than a song. **Do not mute microphones for the test.**

7.2. Cease interaction with the UUT and begin logging power.

7.3. Allow or force the UUT to enter DCP inactive state. If one or more APD events were observed during the warmup period, follow Section 7.4. If the UUT does not APD but can be manually powered down, for example via a button, switch, or selection of a menu setting, follow Section
7.5. If the UUT does not APD or manually power down, follow Section 7.6.

7.4. For products that perform one or more APD events during the warmup period, continue the test for 60 minutes after the first APD event occurs (A-4).

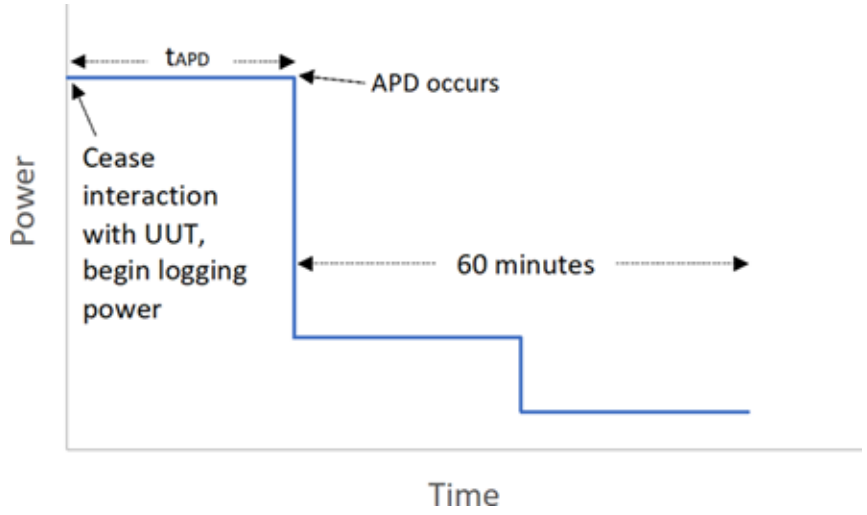
7.4.1. **Record the following measurements:**

APD time (tAPD), measured as the time from the last user interaction with the UUT to the time when the UUT has displayed its first distinct (usually stepwise) power reduction indicating that the UUT has automatically powered down.

Pavg. average power over 60 minutes after the first APD event.

Plast15, average power over the last 15 minutes of the test if Pavg does not equal **Plast15.**

Figure A-4: Example of power as a function of time if UUT is allowed to APD.



Source: IOU CASE Team

Power logging begins when the tester ceases interaction with the UUT. The first APD event occurs at time tAPD. Average power is calculated over a period that characterizes UUT power in DCP inactive condition, starting from the first APD event and continuing for 60 minutes. In DCP inactive condition, the UUT may power down to lower power operational modes or exhibit other types of variable behavior.

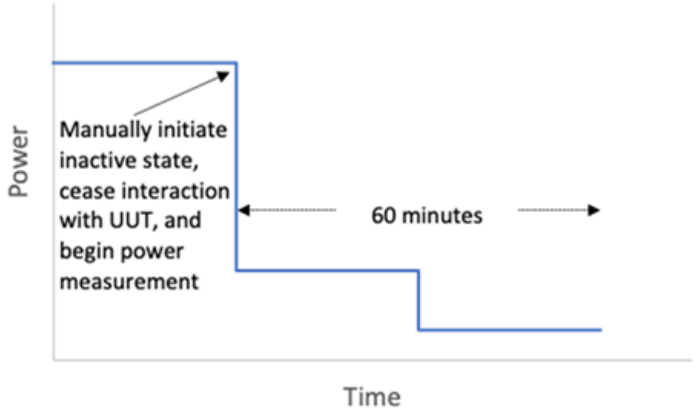
7.5. For products that do not perform APD during the warmup period but can be manually powered down, continue the test for 60 minutes after the manual power down (A-5).

7.5.1. **Record the following measurements:**

Pavg. average power over 60 minutes after the manual power down.

Plast15, average power over the last 15 minutes of the test if P_{avg} does not equal ***Plast15***.

Figure A-5: Example of power as a function of time if the UUT is manually forced into DCP inactive state.



Source: IOU CASE Team

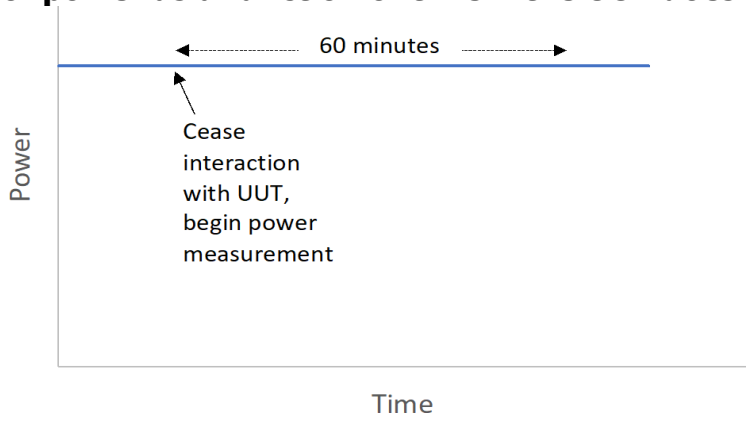
The power measurement begins when the tester initiates DCP inactive state and ceases interaction with the UUT. Average power is calculated over a period that characterizes UUT power in DCP inactive state, starting from the manual power down event and continuing for 60 minutes. In DCP inactive state, the UUT may power down to lower power operational modes or exhibit other types of variable behavior.

7.6. If APD events were not observed during the warmup period and the UUT cannot be manually powered down, continue the test for 60 minutes after ceasing interaction with the UUT (Figure A-6).

7.6.1. **Record the following measurement:**

Pavg: average power during the 60-minute test.

Figure A-6: Example of power as a function of time if the UUT does not exhibit APD.



Source: IOU CASE Team

The power measurement begins when the tester ceases interaction with the UUT. Average power is calculated by averaging power for 60 minutes after the tester has ceased interaction with the UUT.

7.7. Special instructions for media players: if the UUT spends an extended period of time in active mode to deliver audio or video content in response to a user interaction, the tester may stop, but not pause, the primary function manually. The tester will begin logging data upon halting the primary function (Section 7.2) and measure t_{APD} as the time between halting the primary function and the first power down event (Section 7.3).

> **Example:** In active mode, a media player plays a movie or show. The tester may halt active mode by pressing the stop button (not the pause button). The tester will begin logging data upon pressing the stop button, and measure t_{APD} as the time between pressing the stop button and the first power down event.

7.8. Special instructions for products that modify inactive power in response to ambient light: conduct one power measurement (Section 7.3 or 7.4) for each ambient light condition specified in Section 5.1. Record measurements for each ambient light conditions separately.

7.9. If the UUT is network equipment, allow the UUT and test clients to sit undisturbed and maintain their network connections in the absence of user-generated traffic. Test clients may enter sleep mode if they are configured to maintain network connections while in sleep mode. The tester shall not interact with the UUT or the test clients during the test.

7.9.1. Log power for 60 minutes.

7.9.2. Calculate and record average power (P_{avg}) in inactive condition.

7.9.3. If the UUT exhibits stepwise or other power decreases over the measurement interval, additionally report the average power during the last 15 minutes (P_{last15}) of the test.

If a stepwise power decrease occurs in the last 15 minutes of a test, the test may be extended up to 15 minutes in order to capture the lowest power level observed in the P_{last15} measurement.

8. Off mode power measurement. If the UUT has an off mode, place the UUT in off mode. Measure off mode power for 15 minutes and ***report average off mode power, P_{off}.***

9. Invalid tests.

9.1. The tester may invalidate or need to repeat a test for a variety of reasons, including:

9.1.1. The UUT cannot be set up according to the DCP and provide its primary function(s). If the tester determines that the UUT can be placed in an inactive condition, the tester will make note that active mode was not achieved and continue testing the UUT according to the DCP. If the UUT cannot be set up to provide primary or supporting function, for example because a necessary app is no longer available for download, the tester will note that the UUT cannot be tested.

9.1.2. During the DCP inactive condition test, the product was triggered into active mode. The tester will determine the active mode trigger and work to eliminate it from the test environment. The test will be rerun until all triggers are removed from the environment and the UUT remains in DCP inactive condition for the entire test period. For multi- component UUTs, the tester shall review data collected from each mains-powered component to ensure that all components have remained in inactive condition during the test.

9.1.3. Any test interrupted by a software, firmware, or other update shall be invalid and must be invalidated and repeated once all updates are complete.

10. Additional guidance.

Requirement: Minimum data reporting.

The minimum data reported for a valid test includes:

- UUT details: manufacturer, model, software version (if available), product category, primary function(s), supporting function(s), supporting function(s) available in the inactive test condition.
- Test details: test date, condition tested (inactive or off), voltage supplied and current type (AC or DC), lighting conditions (if test requires controlled ambient lighting), time to APD (t_{APD}), P_{avg}, P_{last15} (if applicable).

Recommendation: Include supplemental information when useful.

If the test setup or power draw behavior is out of the ordinary, document with photos or other means in the test report and submit the information to the CEC through the VPF-LPM docket for later reference if questions on the data arise.

Recommendation: Reset UUT after testing

Once tests on a UUT are complete and the data is confirmed complete and accurate, performing a factory reset on the UUT is recommended to remove any information provided by the tester. This may include resetting the UUT to factory default settings and deleting or deactivating user accounts on the UUT, in an app, or on a cloud service.

Table A-1: Vetted product categories* and likely primary function(s)

End Use	General product category	Typical Primary Function	Product category
HVAC	Space Conditioning	Maintaining indoor comfort	Portable heaters
	Ventilation	Providing fresh air and air circulation	Residential standalone fans
	Controls	Allowing occupant management of indoor temperature, humidity, and ventilation	Programmable and connected thermostats and humidity controls
	Other	Maintaining indoor air quality	Air purifiers
Lighting	Controls	Allowing manual control of lighting	**Light switches**
		Transmitting lighting commands, luminaire information, and sensor data	Wireless adapters
		Gathering occupancy data for lighting controls	Occupancy sensors
		Gathering environmental conditions data for lighting controls	Environmental & light level sensors
Electronics	Multimedia	Playing video games	**Game consoles**
		Playing audio content	Speakers (including **smart speakers**)
		Playing audio or video content	Streaming media players
		Transmitting audio signals from media players and radio to speakers	Receivers
		Reading audio signal from records	Turntables
		Playing audio or video content	Home-theater-in-a-box systems
		Playing audio or video content	Soundbars
		Playing audio or video content	MP3 speaker docks
		Transforming audio signals to power levels required for speaker input	Audio amplifiers
		Transforming video input to light projection and/or playing audio content	Video projectors
	Computers & peripherals	Playing audio content	**Computer speakers**
		Reading or writing data	External hard drives
		Providing power and signals to a computer	Docking stations
	Imaging equipment	Printing an image or document	**Printers**
		Copying, scanning, printing, or faxing an image or document	Multi-function devices
	Network equipment	Passing user-generated IP traffic	**LAN equipment**

End Use	General product category	Typical Primary Function	Product category
Household devices	Small kitchen appliances	Making or heating coffee or water	**Coffee makers**
		Reducing coffee beans or other food to smaller size	Coffee grinders
		Stirring or pureeing foods and beverages	Blenders
		Cooking or warming food	Electric grills
		Cooking or warming food	Toaster ovens and toasters
		Cooking or warming food	Air fryers
		Cooking or warming food	Pressure cookers, rice cookers, slow cookers, and multicookers
		Chopping or pureeing foods and beverages	Food processors
	Electric housewares	Cleaning surfaces and upholstery	Vacuum cleaners
		Connecting fabric and other materials by stitched thread	Sewing machines
Infrastructure	Power	Providing power to another product	Power strips, outlets, plugs
		Detecting fires, life safety and indoor air quality issues	Smoke & carbon monoxide detectors
		Recording and alerting for device energy consumption	Energy monitoring systems
Miscellaneous	Business equipment	Destroying paper documents	Shredders
		Sharpening pencils	Pencil sharpeners
	Personal care	Cutting or styling hair	Hair stylers, trimmers, clippers
		Drying hair	Hair dryers
		Removing hair	Epilators
	Outdoor equipment	Moving water for human aesthetic appreciation	Outdoor water features
		Moving water for use by plants	Irrigation controllers
	Bathroom devices	Drying and warming towels	Heated towel racks
		Delivering water	Faucets
		Delivering water	Showerheads
		Waste disposal	Toilets
	Hobby, entertainment, leisure	Allowing fitness activity	Exercise equipment
		Moving or pressurizing water	Water pumps less than one horsepower, excluding dedicated pool and spa pumps
		Supporting activities such as seating, eating, storage, or sleeping	Heated or motorized furniture

End Use	General product category	Typical Primary Function	Product category
		Creating and transforming sound and audio signals	Musical instruments and production equipment

*This list does not indicate In-Scope, In-Focus product categories of the VPF-LPM.

Table A-2: Supporting functions*

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
Bluetooth, Cellular, Other wireless communication technologies including IEEE 802.15.4 variants, Wi-Fi (IEEE 802.11), Z-Wave, Zigbee / Matter	Communication	The ability to connect to a wireless communication network, including an IP, personal area, or cellular network, to send and receive data	Any end user product	Connected to live network via upstream network equipment such as a router	The ability to connect to a wireless IP or cellular network with the purpose of acting as a node to pass user generated traffic between upstream network equipment and downstream network equipment or end user devices	Network equipment, integrated network devices	Connected to live network via upstream network equipment such as a modem and downstream end user equipment (test clients)
Ethernet (IEEE 802.3)	Communication	The ability to connect to a wired IP network to send and receive data	Any end user product	Connected to live network via upstream network equipment such as a router	The ability to connect to a wired IP network with the purpose of acting as a note to pass user generated traffic between upstream network equipment and downstream network equipment or end user devices	Network equipment, integrated network devices	Connected to live network via upstream network equipment such as a modem and downstream end user equipment (test clients)
HDMI	Communication	The ability to send and receive audio	Any product	Not connected unless UUT	n/a	None	n/a

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
		and video data via one or more high-definition multimedia interface (HDMI) ports		must be connected to another product via HDMI to provide its primary function, or if multiple components comprise the UUT and manufacturer instructions call for connecting components via an HDMI cable.			
USB Port	Communication	The ability to send and receive data via one or more universal serial bus (USB) ports	Any product	Not connected unless UUT must be connected to another product via USB to provide its primary function, or if multiple components	n/a	None	n/a

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
				comprise the UUT and manufacturer instructions call for connecting components via an USB cable.			
Other wired communication technology including MoCA and audio cabling	Communication	The ability to send and receive data via one or more wired connections	Any product	Not connected unless UUT must be wired to another product to provide its primary function, or if multiple components comprise the UUT and manufacturer instructions call for connecting components via wired connection.			

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
Indicator Light(s)	User Interface	The ability to relay UUT status information to the user via one or more lights	Any product	No setup required. Allow the indicator light to operate as normal.	n/a	None	n/a
Fixed Pixel Display	User Interface	The ability to relay product status or other information to the user via an integrated display that produces an image using a 2-dimensional array of pixels	Imaging equipment, small appliances	The display may or may not be showing an image in inactive condition. The tester shall allow the UUT to operate the display as it normally would in the absence of user interaction. If the display scales its brightness to ambient light, test with room illuminance at 300 lux.	A stand-alone display that produces an image using a 2-dimensional array of pixels to show information to the user	Computer monitor Signage display TV	n/a - these products are out of scope

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
				Perform a second test with room illuminance at 10 lux.			
Segment Display	User Interface	The ability to relay product status or other information to a user via an integrated display that uses a small number of segments (typically 7 to 16) to display numbers or letters	Microwave clock	The display may or may not be showing an image in inactive condition. The tester shall allow the UUT to operate the display as it normally would in the absence of user interaction.	A stand-alone display, that uses a small number of segments (typically 7 to 16) to display numbers or letters	Stand-alone clock	Set up UUT according to manufacturer instructions. If the UUT always displays the time, as most clocks do, it is tested with the time shown and considered an always-on product.
Dot Matrix Display	User Interface	The ability to relay product status or other information to a user via an integrated display that uses a dot matrix to	Printer screen	The display may or may not be showing an image in inactive condition. The tester shall allow	A stand-alone display contained within a product that uses a dot matrix to display number and letters	Stand-alone clock	Set up UUT according to manufacturer instructions. For a clock or clock-radio, this includes setting the time. If the UUT always displays the time, as most clocks do, it is tested with the time shown and considered an always-on product.

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
		display number and letters		the UUT to operate the display as it normally would in the absence of user interaction.			
Voice interface	User Interface	The ability of a product to accept and respond to verbal commands from a user	Smart speaker	No one shall speak in the vicinity of the UUT during a test	n/a	none	n/a
Remote Control	User Interface	The ability of a product to be controlled remotely	Smart speaker	The UUT is set up so that it may be controlled remotely (e.g., IR remote has batteries installed, app connected), but is not controlled via the remote during the test	n/a	none	n/a

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
Ambient Light, Ambient Sound, Environmental, Face Recognition, Gesture Recognition, Hinge, Door, or Window, Motion or Occupancy, Other	Sensing	The ability to monitor the UUT's surroundings for certain conditions that trigger an action within the UUT	Ambient light sensor on smart display to control display brightness, occupancy sensor in home security system to monitor for presence	Prevent conditions that cause sensor to trigger action within the UUT	The ability to monitor the UUT's surroundings	Light meter	Prevent the conditions that the UUT monitors
AC-DC or AC-AC power conversion	Power	The ability to convert AC mains power to lower- or higher-voltage AC power or DC power.	Any electronic product that draws mains power	Connect to mains power as directed by the manufacturer	The ability to convert AC mains power to lower- or higher-voltage AC power or DC power.	External power supply that is sold by itself, without an accompanying product to be powered	n/a - these products are out of scope
Energy storage	Power	The ability of a product to store energy for later (on the order of hours to years) consumption for mobile use	Any product with a rechargeable, disposable, or other battery	Ensure the battery is fully charged at the beginning of the test, maintain mains or other primary	The ability of a product to store energy for later (on the order of hours to years) consumption for mobile use or as a backup source	Whole home storage battery	Battery is fully charged at the beginning of the test

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
		or as a backup source		power source during the test			
Energy harvesting	Power	The ability of a product to harvest energy from its surroundings to power itself	An outdoor path light with solar PV module	Prevent conditions that cause energy harvesting to occur	The ability of a product to harvest energy from its surroundings	Solar PV panel	n/a
Power delivery	Power	The ability of a product to deliver power to another product	A speaker with a USB charging port	No charging occurs during the test, generally because no product is connected for charging. If a product must be connected for the test and has a rechargeable battery, the battery must be fully charged at the beginning of	The ability of a product to deliver power to another product	Stand-alone battery charger	n/a - these products are out of scope

Function technologies	Supporting function	Definition as supporting function	Supporting function product examples	Supporting function test setup	Definition as a primary function	Primary function product examples	Primary function test setup
				the test (example: game console controller)			
Maintain Memory State (instant on)	Power	The ability of a product to maintain memory in order to resume the primary function quickly	A game console that suspends the game to RAM to maintain system state while reducing power draw	Maintain default settings for the function	n/a	none	n/a

*Note: The list of supporting functions is not exhaustive. If the UUT exhibits supporting functions besides those listed below, the tester shall document the function technology, applicable characteristics, and how it was set up for testing.

Table A-3: Data Documentation for DCP Inactive Condition Measurements*

Data field type	*Required Information*	*Possible Answers*
General information	Manufacturer's Name	
	Brand Name	
	Model Number	
	Product Category	Portable heaters Residential standalone fans Programmable and connected thermostats and humidity controls Light switches Wireless adapters Occupancy sensors Environmental & light level sensors Game consoles Speakers (including smart speakers) Streaming media players Receivers Turntables Home-theater-in-a-box systems Soundbars Audio amplifiers Video projectors Computer speakers External hard drives Docking stations Printers Multi-function devices LAN equipment Coffee makers Coffee grinders Blenders Electric grills Toaster ovens and toasters Air fryers Pressure cookers, rice cookers, slow cookers, and multicookers Food processors

Data field type	*Required Information*	*Possible Answers*
General information	Product Category	Vacuum cleaners Sewing machines Power strips, outlets, plugs Smoke & carbon monoxide detectors Energy monitoring systems Shredders Pencil sharpeners Hair stylers, trimmers, clippers Hair dryers Epilators Outdoor water features Irrigation controllers Heated towel racks Exercise equipment Water pumps less than one horsepower, excluding dedicated pool and spa pumps Heated or motorized furniture Musical instruments and production equipment Other
	Product Category - Other	
	UUT Has Off Mode	True, False
Communication	Number of Wireless Interfaces (by protocol)	
	Wireless Networking Protocol 1	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n (Wi-Fi 4) IEEE 802.11ac (Wi-Fi 5) IEEE 802.11ad IEEE 802.11af IEEE 802.11ah IEEE 802.11ax (Wi-Fi 6) IEEE 802.11ay IEEE 802.11be (Wi-Fi 7) IEEE 802.15.4 IEEE 802.15.5 Bluetooth 3 Bluetooth 4

Data field type	*Required Information*	*Possible Answers*
Communication	Wireless Networking Protocol 1	Bluetooth 5 Bluetooth 6 Bluetooth LE Zigbee/Matter Z-Wave Cellular 3G Cellular 4G Cellular 5G Other Not Applicable
	Wireless Networking Protocol 2	IEEE 802.11a IEEE 802.11b IEEE 802.11g IEEE 802.11n (Wi-Fi 4) IEEE 802.11ac (Wi-Fi 5) IEEE 802.11ad IEEE 802.11af IEEE 802.11ah IEEE 802.11ax (Wi-Fi 6) IEEE 802.11ay IEEE 802.11be (Wi-Fi 7) IEEE 802.15.4 IEEE 802.15.5 Bluetooth 3 Bluetooth 4 Bluetooth 5 Bluetooth 6 Bluetooth LE Zigbee/Matter Z-Wave Cellular 3G Cellular 4G Cellular 5G Other Not Applicable
	Wireless Networking Protocol 3	IEEE 802.11a IEEE 802.11b IEEE 802.11g

Data field type	*Required Information*	*Possible Answers*
Communication	Wireless Networking Protocol 3	IEEE 802.11n (Wi-Fi 4) IEEE 802.11ac (Wi-Fi 5) IEEE 802.11ad IEEE 802.11af IEEE 802.11ah IEEE 802.11ax (Wi-Fi 6) IEEE 802.11ay IEEE 802.11be (Wi-Fi 7) IEEE 802.15.4 IEEE 802.15.5 Bluetooth 3 Bluetooth 4 Bluetooth 5 Bluetooth 6 Bluetooth LE Zigbee/Matter Z-Wave Cellular 3G Cellular 4G Cellular 5G Other Not Applicable
	Number of Wired Networking protocols	
	Wired Networking Protocol 1	IEEE 802.3 (Ethernet) MoCA (COAX) Powerline DSL Other Not Applicable
	Wired Networking Protocol 1 – Number of ports	
	Wired Networking Protocol 1 – Max Network speed	10 Mb/s 100 Mb/s 1000 Mb/s 2.5 Gb/s 5 Gb/s 10 Gb/s

Data field type	*Required Information*	*Possible Answers*
Communication	Wired Networking Protocol 1 – Max Network speed	Other - Less than or equal to 1000 Mb/s Other - More than 1000 Mb/s Not Applicable
	Wired Networking Protocol 2	IEEE 802.3 (Ethernet) MoCA (COAX) Powerline DSL Other Not Applicable
	Wired Networking Protocol 2 – Number of ports	
	Wired Networking Protocol 2 – Max Network speed	10 Mb/s 100 Mb/s 1000 Mb/s 2.5 Gb/s 5 Gb/s 10 Gb/s Other - Less than or equal to 1000 Mb/s Other - More than 1000 Mb/s Not Applicable
	HDMI	True, False
	HDMI – Number of Ports	
	USB Port Type 1	USB 2.0 USB 3.0 USB 3.1 USB 3.2 USB PD Hub Other Not Applicable
	USB Port Type 1 – Number of Ports	
	USB Port Type 2	USB 2.0 USB 3.0 USB 3.1 USB 3.2 USB PD

Data field type	*Required Information*	*Possible Answers*
Communication	USB Port Type 2	Hub Other Not Applicable
	USB Port Type 2– Number of Ports	
	Number of Other Analog Wired Communication interfaces	
	Other Analog Wired Communication Interface 1 - Name	
	Other Analog Wired Communication Interface 1 – Data type	Video only Audio only Video and Audio
	Other Analog Wired Communication Interface 1 – Number of Ports	
	Other Analog Wired Communication Interface 2 - Name	
	Other Analog Wired Communication Interface 2 – Data Type	Video only Audio only Video and Audio
	Other Analog Wired Communication Interface 2 – Number of Ports	
User Interface	Indicator Light(s)	True, False
	Fixed Pixel Display	True, False
	Fixed Pixel Display - Screen Area (square inches)	
	Fixed Pixel Display - Screen Resolution	
	Fixed Pixel Display - Screen Technology Fixed Pixel Display - Screen Technology	LCD - TN LCD - VA LCD – IPS Mini-LED OLED Other
	Fixed Pixel Display - Screen	

Data field type	*Required Information*	*Possible Answers*
User Interface	Technology - other	
	Touch Screen Type	Resistive Capacitive Not applicable
	Segment Display	True, False
	Dot Matrix Display	True, False
	Voice interface	None Alexa Bixby Cortana Google Assistant Siri Other
	Voice Interface - Other	
	Remote Control	IR Remote Bluetooth Zigbee None Other
	Remote Control - Other	
	Other User Interface(s)	
Sensing	Motion or Occupancy	True, False
	Ambient Light Sensor	True, False
	Ambient Sound Sensor	True, False
	Gesture Recognition	True, False
	Hinge Sensor	True, False
	Face Recognition	True, False
	Environmental Sensors 1	None Temperature Humidity CO2 VOC Smoke Other
	Environmental Sensors 2	None Temperature Humidity

Data field type	*Required Information*	*Possible Answers*
Sensing	Environmental Sensors 2	CO2 VOC Smoke Other
	Environmental Sensors 3	None Temperature Humidity CO2 VOC Smoke Other
	Camera	
	Camera – Max Resolution	
	Other sensors	
Power	Type of power drawn by UUT	AC DC
	Power Supply - Type	Internal External
	Power Supply – Rated Output Power (W)	
	Secondary Power Source	Rechargeable Battery Disposable Battery Other
	Secondary Power Source – List for Other	
	Energy harvesting – List all	
	Wireless charging – List all	
	Maintain Memory State (instant on)	
	Other Power sources – List all	
Other Functions	List any other UUT functions	
Supporting Functions that are Active During the Test	List All Supporting Functions that are Active During the Test	
Setup Condition	Input Voltage Supplied	
	Software Version/Firmware Version	

Data field type	*Required Information*	*Possible Answers*
Setup Condition	Settings selected if defaults unavailable	
Measurement Run Conditions and Results (This Field Type Does Not Apply to Imaging Equipment-Printers and Imaging Equipment-Multi-Function Devices)	State or Mode Tested	DCP inactive condition Off mode
	Room illuminance	Dark Bright
	Time to APD (minutes)	
	UUT average power (P_{avg}) (W)	
	UUT power averaged over last 15 minutes of test (P_{last15}) (W)	
Energy Star Test Data for Imaging Equipment - Printers	Energy Star Certified	Yes No
	Page Format Size	Small Standard Large
	Marking Technology	Direct Thermal (DT) Electro-photographic (EP) High Performance IJ Impact Ink Jet (IJ) Thermal Transfer (TT)
	Color Capability	Monochrome Color
	Print Speed (ipm or mppm)	
	Automatic Duplex Output Capable	Yes No
	Typical Electricity Consumption (TEC) (kWh/wk)	
	Power in Sleep (Watts)	
	Power in Off (Watts)	
	Default Delay Time to Sleep (minutes)	
Energy Star Test Data for Imaging Equipment - Multi-function Devices	Energy Star Certified	Yes No
	Page Format Size	Small Standard Large

Data field type	*Required Information*	*Possible Answers*
Energy Star Test Data for Imaging Equipment - Multi-function Devices	Marking Technology	Direct Thermal (DT) Electro-photographic (EP) High Performance IJ Impact Ink Jet (IJ) Thermal Transfer (TT)
	Color Capability	Monochrome Color
	Print Speed (ipm or mppm)	
	Automatic Duplex Output Capable	Yes No
	Typical Electricity Consumption (TEC) (kWh/wk)	
	Power in Sleep (Watts)	
	Power in Off (Watts)	
	Default Delay Time to Sleep (minutes)	