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LPM DCP Proposal V3

Additional submitted attachment is included below.

Low-Power Modes

Codes and Standards Enhancement (CASE) Initiative
For PY 2017: Title 20 Standards Development

Updated Data Collection Procedure Proposal
Low Power Mode
17-AAEER-12

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Proposal: Data Collection Procedure for Inactive Condition Power, Version 3

Background

Motivation and Scope

In their low-power modes (LPM) Roadmap (hereinafter "Roadmap" or "LPM Roadmap"), the California Energy Commission ("CEC") is investigating the energy savings potential of products in an "inactive" condition—when not performing their primary function for a user. The Roadmap is a new process developed by the CEC to address this complex and broad topic. The Roadmap consists of iterative voluntary energy efficiency improvement and participation specifications, and milestones that, if met, are expected to continue to be voluntary. It includes a mandatory regulation backstop if the CEC's voluntary energy efficiency improvement and participation goals are not met (Figure 1). The CEC has established its initial scope by excluding any product that is subject to Department of Energy or CEC Title 20 regulations that include limits on standby or inactive mode power or is being addressed by other CEC energy efficiency Roadmaps. All other products are currently in the LPM Roadmap scope.

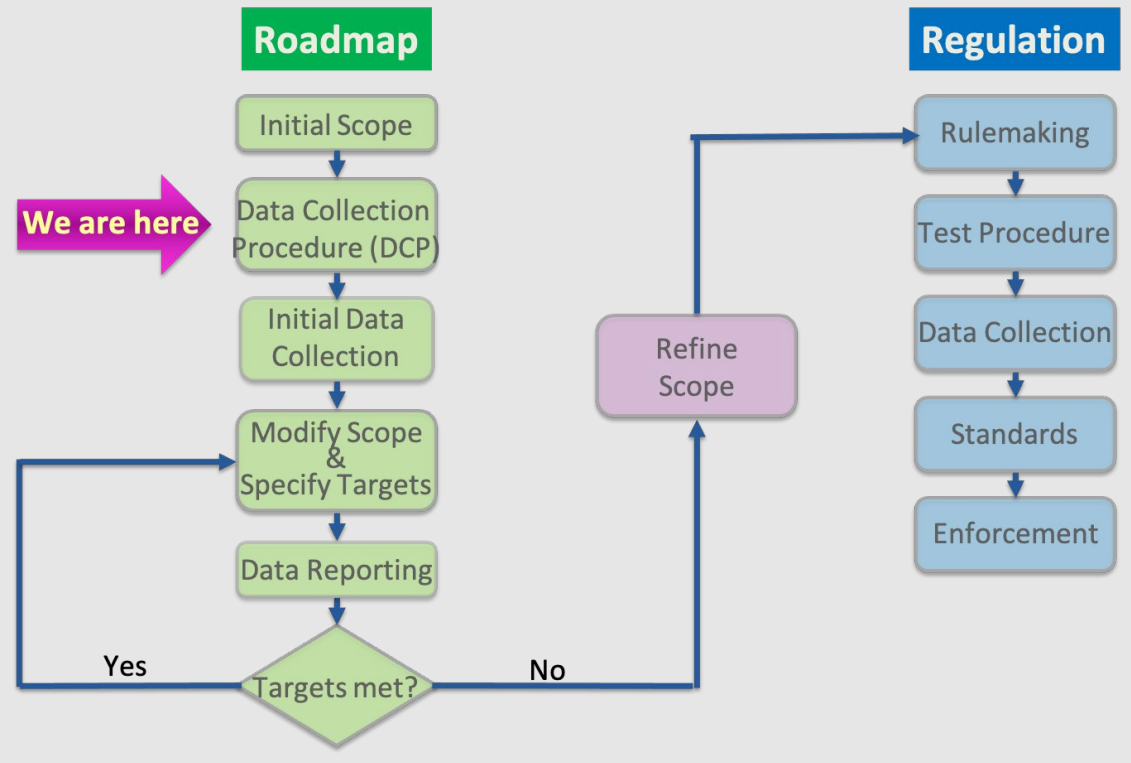

Figure 1: The CEC's LPM Roadmap plan. Source: CEC
https://efiling.energy.ca.gov/GetDocument.aspx?tn=239448&DocumentContentId=72910

Standardizing LPM Data Collection

Next, the CEC must collect data to evaluate the energy use and savings potential of products within the initial scope. One important input for this effort is standardized measurements of inactive whole-product power draw and relevant product attributes. The CEC is developing a data collection procedure (DCP) that will allow any stakeholder who can meet the DCP's instrumentation and test condition requirements to collect and submit data. The California investor-owned utilities' Codes and Standards Enhancement (CASE) Team has developed the DCP contained in this document (the "CASE Team DCP") for the CEC's consideration.

The CASE Team DCP is designed to test the power draw of a wide range of products in their inactive condition, similar to how they would be used in the real world, but with enough test guidance that the measurements are sufficiently repeatable and reproducible. The CASE team considers DCP results within 5% (or 0.05 Watt if measured power is less than one watt) of each other to demonstrate repeatability (for the same instrumentation and tester) or reproducibility (for different instrumentation and testers). The CASE Team DCP includes best practice instrumentation and measurement tolerance requirements. It is intended to be a means for stakeholders to collect and submit data to the CEC to enable discussion of the power draw and energy savings opportunities of products in the Roadmap scope. In the future, it can be used to evaluate whether products meet voluntary targets set by the CEC.

The CASE Team DCP builds on the International Electrotechnical Commission (IEC) test procedure, IEC 62301:2011, which provides some 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 CASE Team DCP provides instructions for setting up and carrying out inactive condition tests, addressing these two limitations of IEC 62301. Furthermore, it allows products to be tested in a consistent and reproducible manner under conditions that represent typical usage in the real world.

Scope

The study team has vetted the reproducibility of the CASE Team DCP by completing round robin testing at two third-party labs. Based on the results of the testing and additional analysis, the CASE Team is providing a list of products for which this DCP has been directly shown or inferred to yield reproducible data and could therefore be considered for inclusion in the first round of the Roadmap. The CASE Team plans to continue to refine the DCP so that it yields reproducible data for more products, which may be included in subsequent rounds of the Roadmap.

Updates to Previously Docketed Version

The Statewide CASE Team submitted an early version (v1) of its DCP to the LPM docket on May 14, 2021.[1] The Team made the following updates to the current version (v3) based on feedback from test labs and collaborating manufacturers.

Terminology modifications

- Change: name of the test configuration was changed from *DCP inactive state* to *DCP inactive condition* to reduce confusion between the UUT test configuration and processor or component operating states (Definitions section).
- Change: *secondary function* was changed to *supporting function* to better recognize the role of such functions in providing expected services to the user (Definitions section).
- Clarification: guidance for identifying primary and supporting functions is provided in new Appendices (Appendix A and B).
- Addition: option for manufacturer or organization ordering test provide primary and supporting function information to test lab (Section 2).

Instrumentation and test environment modifications

- Addition: illumination meter specifications for testing products that respond to ambient light (Section 1.5).
- Addition: sound pressure level meter requirements (Section 1.6).
- Addition: ambient sound level requirement of 50 dB or less for testing products that respond to voice or other sounds (Section 5.2).
- Deletion: PoE instrumentation specifications (Section 1.3).

UUT setup modifications

- Addition: instructions for products with multiple setup options for peripherals (Section 3.2).
- Clarification: all rechargeable batteries (including those within peripherals) shall be fully charged prior to testing (Section 3.2.1).
- Addition: instructions for UUTs whose primary function is to provide power to another product (Section 3.3.2)
- Addition: instructions to update app and record version (Section 3.5).
- Addition: instructions to disable automatic updates (Section 3.5).
- Addition: instructions for UUTs that do not have default settings (Section 3.6).
- Deletion: test specifications for products that scale power to ambient illuminance (Section 5.1.2)

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

Test conduct modifications

- Warmup time reduced from 24 hours to 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.
- Test length fixed to 60 minutes, rather than requiring the tester to decide a test length sufficient to capture the unit under test's (UUT's) LPM behavior.
- Number of tests per UUT reduced to at most three: one inactive condition test if the UUT does not respond to ambient light, two inactive condition tests (under bright and dark room illuminance conditions) if the UUT inactive condition power depends on ambient light levels, and one off mode test, if applicable.

Definitions

Terms used in the CASE Team DCP 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 its *primary function(s)*.[2]

***Automatic power down, APD*:** The capability to automatically switch a product from *active mode* to a lower power operating condition after a predetermined period of time (*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 (e.g., 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*.[3]

DCP inactive condition: The condition of a *UUT* after performing the setup described in this procedure. Generally, the *DCP inactive condition* represents the *UUT*'s condition after user interaction has ceased and the product is not performing its *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.

[2] Adapted from IEC 62301:2011, section 3.8.

[3] 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

***Function*:** A predetermined operation undertaken by the *UUT*. *Functions* may be controlled by an interaction of the user, of other technical systems, of the system itself, from measurable outputs from the environment and/or time.[4]

***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 its name. A product may have more than one *primary function*. *Primary functions* for product categories are listed in Appendix A.

Examples:	
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.[5] These *functions* may be essential to the operation of the *primary function*, but they do not provide useful information or services to the user by themselves. A non-exhaustive list of *supporting functions* is included in Appendix B. The table below shows examples of product types that contain common *supporting functions*.

Examples:	
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

[4] Source: IEC 62301:2011, section 3.1.

[5] Source: Harrington and Nordman (2010). Standby Power and Low Energy Networks – issues and directions. Prepared by Energy Efficient Strategies for APP and IEA 4E Standby Annex. https://www.iea-4e.org/wp-content/uploads/publications/2010/08/Network-Standby-2010-09-final.pdf. Section 4.2.

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 geographic 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* and/or end user products to a *WAN*, often an Internet service provider network. Common *WAN equipment* includes modems, integrated access devices (IADs), and optical network terminals (ONTs).

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.[6] *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.

[6] Adapted from IEC 62301:2011, section 3.5.

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.

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*.

Overview of the Data Collection Procedure

These instructions guide testers through a series of steps to prepare the UUT for and carry out DCP inactive condition power measurements of a wide range of electricity-using products. The goal of the DCP is to set up the UUT according to manufacturer instructions, using default settings and with some simplifications and specific conditions that facilitate reproducible results. At a high level, the DCP instructs the tester to follow manufacturer instructions to prepare the UUT for use, allow the UUT to enter the DCP inactive condition, and measure inactive condition power (Figure 2).

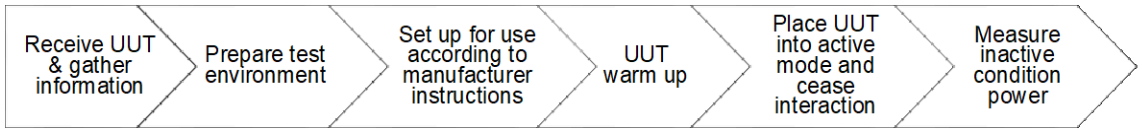

Figure 2: General steps to be carried out in the DCP.

DCP goals and approach

The goal of the DCP is to measure UUT power in an inactive condition, rather than specific low power *modes* as IEC 62301 specifies. The DCP guides testers through a process of examining the UUT to characterize how it draws power when it is not providing its 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 inactive condition. Some products may exhibit simple, steady power draw in their DCP inactive condition. Others, especially those that utilize network connections and sensors to enhance the service provided by the product, may use a number of modes or otherwise draw time-varying power in DCP inactive condition as the product activates functions to maintain expected services (Figure 3).

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

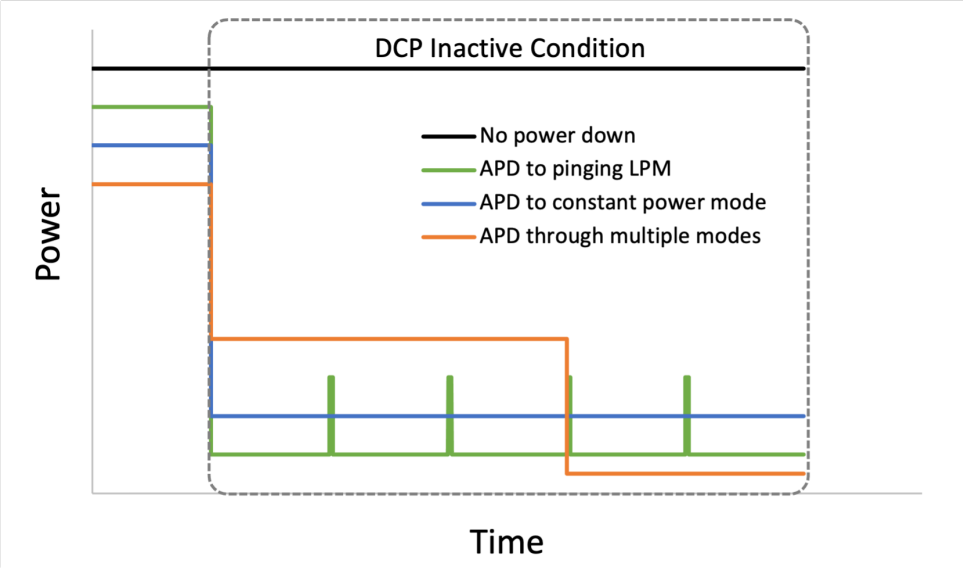

Figure 3: Illustrative examples of power behavior that might be encountered during testing. The dashed box indicates the DCP inactive condition power draw in each of the following scenarios:
Black line: stable, constant power draw of an always-on product.
Green line: APD to DCP inactive condition "pinging' behavior at regular interval.
Blue line: APD to constant power draw.
Orange line: APD to inactive condition, which consists of two distinct low power modes.

How to use this DCP

The section below contains the CASE Team DCP. Instructions are written in outline form. Informative notes and examples are contained in boxed text 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 CEC has indicated that LPM Roadmap data will likely be reported to the Modernized Appliance Efficiency Database System (MAEDS). The Statewide CASE Team has developed a list of proposed reporting requirements, provided in the "Additional Guidance" Section. The team developed a DRT to accompany this DCP, in spreadsheet format, to collect the proposed data.

Safety note

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

Normative References

The following standards are referenced in the DCP.

- ANSI/CTA-2049-A. Determination of Small Network Equipment Average Energy Consumption. December 2020. https://shop.cta.tech/products/determination-of-small-network-equipment-average-energy-consumption.
- IEC 62301, Edition 2.0. Household electrical appliances – Measurement of standby power. January 2011. https://webstore.iec.ch/preview/info_iec62301%7Bed2.0%7Db.pdf
- IEEE 1515-2000. IEEE recommended Practice for Electronic Power Subsystems: Parameter Definitions, Test Conditions, and Test Methods. Revised 2008. https://webstore.ansi.org/standards/ieee/ieee15152000r2008
- IEEE 802.3-2018. IEEE Standard for Ethernet. June 2018. https://ieeexplore.ieee.org/document/8457469
- U.S. EPA ENERGY STAR Test Method for Displays. Revised November 2021. https://www.energystar.gov/sites/default/files/asset/document/Displays%20Version%208.0%20Program%20Requirements%20Rev.%20Nov-2021.pdf

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; and
- 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.[7]

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's 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 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 made on the AC side of the external power supply (if shipped with UUT).

1.3. Power over Ethernet (PoE) powered UUTs: section deleted[8]

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 though the power meter to measure the DC current drawn by the UUT. Test leads shall be connected to the

[7] Minimum power reading interval adopted from IEC 62301:2011, section 5.3.2.

[8] 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 Statewide CASE Team will continue to work to vet these instructions for re-addition at a later date.

DC Vcc+ and DC ground- to measure the voltage as close to the UUT as possible. See Figure 4 for reference.

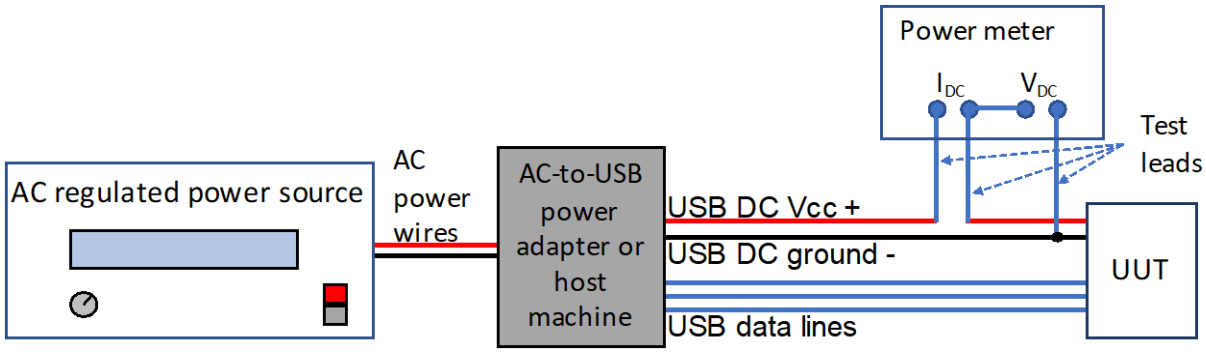

Figure 4: Power, data, and test point connections for USB-powered UUT. AC-to-USB power conversion may be carried out by a power adapter or a host machine with USB power delivery, such as a computer.

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 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 its 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 Appendix A for a list of product categories covered by this version of the CASE Team DCP.
2.4. ***Record or confirm primary and supporting functions***. Primary functions are related to product category. Use Appendix A 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 Appendix A, add additional primary function(s). Supporting function definitions and examples are listed in Appendix B.
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 its 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 (e.g., 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 judgement 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 multi-channel 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 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 and/or power connection 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 its 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 its 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.

> **Note:** 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 in order 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 in order 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 its 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 its 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 smart phone 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 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 UUT's main user interface or essential to operate the UUT's primary function(s), 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 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 in order 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.** With the exception of providing an email address and/or other information required to set up a UUT or its 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 UUT's primary function(s).

> **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 a sufficient guide to 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 7.5 of ANSI/CTA-2049-A test procedure.
Note: CTA-2049-A 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 (e.g., a switch), or products that maintain network connections when powered down (e.g., 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 5 Ethernet ports and Wi-Fi, the tester will connect 3 test clients to one Ethernet port each and one test client to the UUT's Wi-Fi network.

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, absent 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 and/or WAN equipment shall have and enabled 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 it is not triggered to enter an active mode unless intentionally directed by the tester. The conditions required of the test environment depend on the UUT's functionality 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 nightlight 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

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's app during warmup or test periods. Disable PAN connections (e.g., 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 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. If one or more APD events were observed during the warmup period, continue the test for 60 minutes after the first APD event occurs (Figure 6).

7.4. ***Record the following measurements:***

APD time (t_{APD}), 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.

P_{avg}. average power over 60 minutes after the first APD event.

P_{last15}, average power over the last 15 minutes of the test if P_{avg} does not equal P_{last15}.

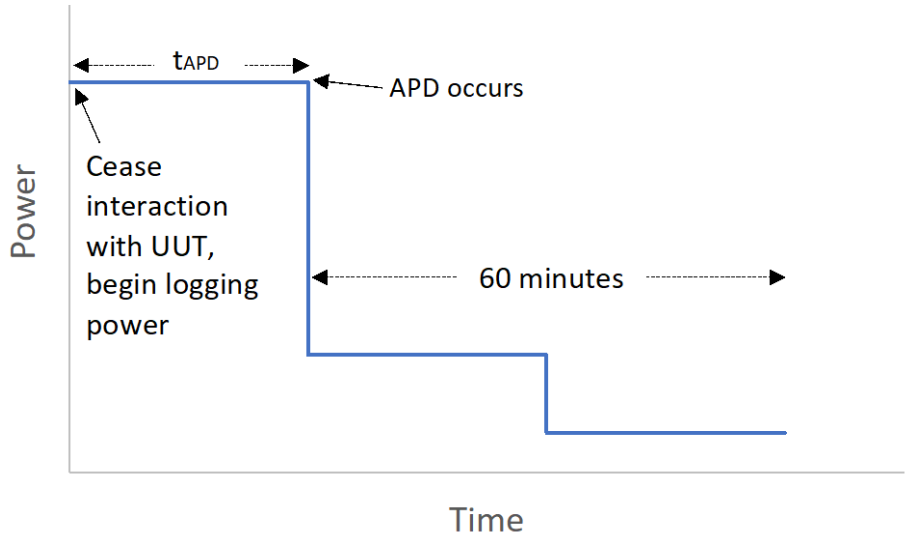

Figure 5: Example of power as a function of time if UUT is allowed to APD. Power logging begins when the tester ceases interaction with the UUT. The first APD event occurs at time t_{APD}. Average power is calculated over a period that characterizes UUT power in DCP inactive condition, starting from 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. If APD events were not observed during the warmup period, continue the test for 60 minutes after ceasing interaction with the UUT (Figure 7).

7.6. ***Record the following measurement:***

P_{avg}: average power during the 60-minute test.

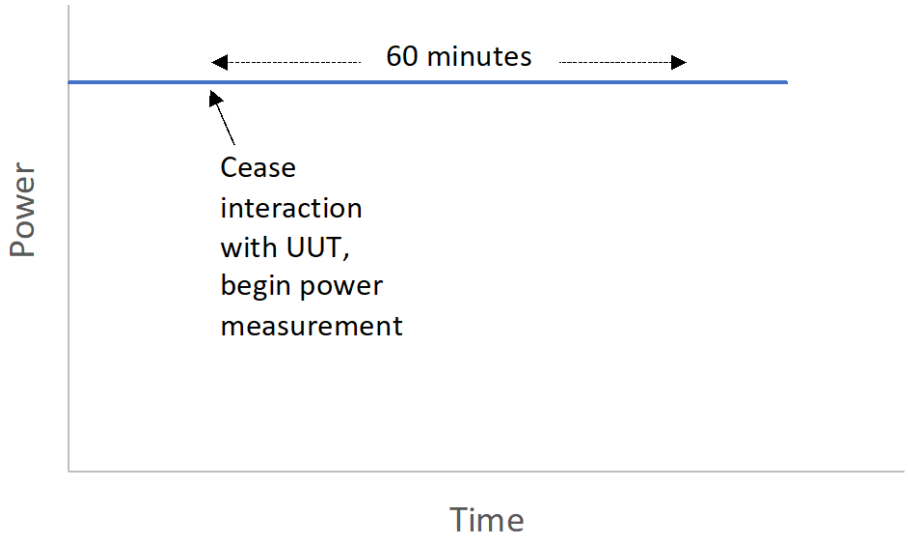

Figure 6: Example of power as a function of time if the UUT does not exhibit APD. The power measurement begins when the tester ceases interaction with the UUT. Average power is calculated by averaging power for 60 minutes after the tester has ceased interaction with the UUT.

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.

7.10. 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}.***

8. Invalid tests.

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

8.1.1. 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.

8.1.2. 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. 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}), average power.

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 test report 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.

Appendix A: 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 or streaming video or audio content	**Game consoles**
		Playing audio or video 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**
Household devices	Small kitchen appliances	Making or heating coffee or water	**Coffee makers**
		Reducing coffee beans or other food to smaller size	Coffee grinders

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

Appendix B: Supporting functions

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.

Supporting function	Function technology	Characteristics to record in DRT or test report	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
Communication	Wi-Fi (IEEE 802.11)	By protocol and number of radios	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)
	Bluetooth	By version						
	Zigbee / Matter							
	Z-Wave							
	Cellular	By generation						
	Other wireless communication technologies including IEEE 802.15.4 variants	Technology and version/protocol						
	Ethernet (IEEE 802.3)	By speed and number of ports	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)

Supporting function	Function technology	Characteristics to record in DRT or test report	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
	HDMI	Version Number of Ports	The ability to send and receive audio and video data via one or more high-definition multimedia interface (HDMI) ports	Any product	Not connected unless UUT 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.	n/a	None	n/a
	USB Port	Version Number of Ports	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 comprise the UUT and manufacturer instructions call for connecting components via an USB cable.	n/a	None	n/a
	Other wired communication technology including MoCA and audio cabling	Type	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			

Supporting function	Function technology	Characteristics to record in DRT or test report	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 wired connection.			
User Interface	Indicator Light(s)	(Y/N)	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	Screen Area (square inches) Resolution Screen technology (LCD, OLED) Touch Screen Type (Resistive, Capacitive)	The ability to relay product status or other information to the user via an integrated display that produces an image using a 2-dimentional 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. Perform a second test with room illuminance at 10 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

Supporting function	Function technology	Characteristics to record in DRT or test report	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
	Segment Display	(Y/N)	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	(Y/N)	The ability to relay product status or other information to a user via an integrated display that uses a dot matrix to display number and letters	Printer screen	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 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.
	Voice interface	Voice Assistant	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	IR remote	The ability of a product to be	Smart speaker	The UUT is set up so that it may be controlled	n/a	none	n/a

Supporting function	Function technology	Characteristics to record in DRT or test report	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
		App	controlled remotely		remotely (e.g., IR remote has batteries installed, app connected), but is not controlled via the remote during the test			
		Other, including other RF signaling						
	Other	Describe additional UIs						
Sensing	Motion or Occupancy	Type of Sensor	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
	Ambient Light	(Y/N)						
	Ambient Sound	(Y/N)						
	Gesture Recognition	2D or 3D						
		Camera Technology						
	Hinge, Door, or Window	(Y/N)						
	Face Recognition	Camera Technology						
	Environmental	Type (e.g., temperature, humidity, carbon monoxide, carbon dioxide, smoke)						
	Other	Type						

Supporting function	Function technology	Characteristics to record in DRT or test report	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
Power	AC-DC or AC-AC power conversion	Type of conversion (AC-DC, AC-AC) Type of supply Rated output power (W)	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	Type and size of battery	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	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 power source during the test	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
	Energy harvesting	Type and max production rate	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
	Other Power Source	Type						
	Power delivery	Wireless charging, list protocol USB power delivery Other	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	The ability of a product to deliver power to another product	Stand-alone battery charger	n/a - these products are out of scope

Supporting function	Function technology	Characteristics to record in DRT or test report	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
					battery, the battery must be fully charged at the beginning of the test (example: game console controller)			
	Maintain Memory State (instant on)	Default State	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
	Other	Type						