



I. Overview

The U.S. Environmental Protection Agency (EPA) is sharing this ENERGY STAR Version 4.0 Audio/Video discussion document to invite stakeholder input on key topics to inform the development of the Version 4.0 Draft 1 Specification. **EPA will host a webinar on July 17, 2017 from 1 – 3:30 PM Eastern Time** to seek input from stakeholders on the topics outlined below. Please submit feedback and relevant data to audiovideo@energystar.gov by July 26, 2017.

Based on feedback and questions stakeholders provided on both the test method and specification since the Version 3.0 specification took effect, EPA is highlighting key issues for discussion prior to developing and releasing a Draft 1 Version 4.0 this summer. In particular, EPA seeks input on potential test method revisions to better account for multi-channel systems, wireless systems, and products that include additional product enclosures. Specific to the ENERGY STAR eligibility criteria, EPA seeks information on new product features and product types and the power consumption of select products in Idle and Active Modes.

Stakeholder engagement is key to the success of the ENERGY STAR program. As such, EPA looks forward to working with all stakeholder to revise the ENERGY STAR AV Specification and Test Method.

II. Testing Issues

1) Amplifier Efficiency Testing

- A) Multi-Channel Systems: A stakeholder has noted that the current test method may not be repeatable in multi-channel systems.

- 1) Connect an input of the UUT to a generated 1 kHz sine wave input signal per Section 5.F).
...
iii) If 1 kHz is outside the range of any bandwidth-limited channel in the UUT and the UUT has AV inputs, sweep the input signal frequency between the upper and lower -3 dB points of each channel. Record the input signal frequency when the UUT input power is at its maximum and use this frequency for the bandwidth-limited channel for the remainder of the test.

A stakeholder noted that a single 1 kHz input waveform, even if it falls within the pass band of low-frequency channels, may not drive each channel in a representative fashion. Each channel in a multi-channel system may not have the same input sensitivity to an audio signal that is received, which would result in varying levels of output power. And if multiple frequencies are used because the 1 kHz is outside the range of the pass band, the ratio of their amplitudes is not specified.

As a result, one or more channels may not be fully exercised using the current test procedures, such that the total measured input power of the device at 1/8th of Maximum Undistorted Power (MUP) may be below 20 W. If the total measured input power is below 20 W, there is no efficiency requirement. Thus, the current test method may not adequately capture the MUP, resulting in the product not being subject to an efficiency requirement that it should be.

Discussion Questions

- EPA seeks feedback from stakeholders on how the test procedure can better account for multi-channel systems so it captures an accurate MUP from all output channels simultaneously. As such, EPA seeks feedback on the following:
 - Can MUP be obtained from all output channels at the same time?
 - Should an input signal be specified for a given frequency range that might provide the best average MUP (e.g., If the complete channel circuit responds to a frequency range of 500 Hz to 5 kHz, then should a 1 kHz signal be used)?
 - EPA seeks feedback on the following potential approach to determine the proportion of output power contributed by each channel at representative levels:
 - a. Measure each channel's output power capacity relative to the other channels (possibly with the other channels disconnected). Calculate the percentage of each channel's output power relative to the overall total.
 - b. Bring all channels to the MUP at the same time in the proportion calculated above (within a reasonable tolerance).
 - c. Measure the MUP for each channel and divide by 8 (1/8th of MUP)
 - d. Measure the efficiency.

B) Load: The test method currently requires the use of a resistive load when testing an amplifier that ships without speakers. However, EPA has received feedback that this approach may not correctly model the response of a typical speaker.

Discussion Questions

- One option EPA is considering is requiring the use of an LR (inductive-resistive) circuit rather than simply a resistive circuit as a load. Would this provide a result that is more reflective of the response of a typical load?
- Alternatively, EPA is considering the use of a reference speaker as a load. To that end, EPA seeks feedback on whether use of a reference speaker and the proposed approach for doing so, noted below, would be an appropriate way to demonstrate the response of a typical speaker.
 - Select two different reference speaker designs (e.g., a lower cost, small 2-way design and a higher end, larger, 3-way design)
 - Place them in an anechoic chamber
 - Connect each, in sequence to the amplifier under test
 - Play a standardized reference signal through the amplifier and steadily increase the volume until particular target decibel levels are achieved that reflect assumed maximum listening volumes among end users. Plausible levels could be 85 to 95 decibels.
 - Assemble a standard audio test clip of a few minutes in length
 - Play the test clip at the volume levels determined earlier with the signal and record average power consumption over that period with a laboratory power analyzer. Efficiency could be calculated on the basis of which products achieve the lowest average AC power consumption while playing the test clip at those volume levels (average across the two reference speakers and the two volume levels). EPA requests feedback from stakeholders on the feasibility of assembling a representative standard audio test clip that would produce results comparable to those based on a range of typical listening content.

2) Wireless Testing

The Version 3.0 AV Test Method permits testing of wireless products and permits testing multi-component systems. These types of products are instructed to be “connected together in a typical end-use configuration” in Section 5.D). However, stakeholders have noted that it is unclear whether “connected together in a typical end-use configuration” includes being connected via routers, an existing home network, or other networking

equipment that is intended to be used for transmission. As such, EPA is considering clarifying the test set up and protocols as reflected in A and B below.

- A) Wireless audio products may be deployed with other system components that are not necessarily packaged together, so the testing may not reflect their typical deployment. As such, EPA is considering specifying minimum system components that shall be procured and used by the laboratory to replicate a typical setup.

Discussion Questions

- Which components should be included (or excluded) from a 'minimum system' that could apply to all wireless audio products to best represent a typical end-use configuration?
- B) Wireless audio products are likely to be used with wireless connections (e.g., Wi-Fi, Bluetooth, AirPlay); however, the test method currently prioritizes wired connections (Section 5.E) and 5.M)).

EPA seeks feedback on the possibility of EPA changing the test method to prioritize wireless connections over wired in products that support those. In addition, EPA seeks feedback on including language in Section 5 Test Conduct that describes testing a product that has network connection capabilities, as in the following example from the ENERGY STAR specification for Displays:

- c) **Networking:** If the UUT has networking capability (i.e., it has the ability to obtain an IP address when configured and connected to a network) the networking capability shall be activated, and the UUT shall be connected to a live physical network (e.g., WiFi, Ethernet, etc.). The physical network shall support the highest and lowest data speeds of the UUT's network function. An active connection is defined as a live physical connection over the physical layer of the networking protocol. In the case of Ethernet, the connection shall be via a standard Cat 5e or better Ethernet cable to an Ethernet switch or router. In the case of WiFi the device shall be connected and tested in proximity to a wireless access point (AP). The tester shall configure the address layer of the protocol, taking note of the following:
- i. Internet Protocol (IP) v4 and IPv6 have neighbor discovery and will generally configure a limited, non-routable connection automatically.
 - ii. IP can be configured manually or by using Dynamic Host Configuration Protocol (DHCP) with an address in the 192.168.1.x Network Address Translation (NAT) address space if the UUT does not behave normally when autoIP is used. The network shall be configured to support the NAT address space and/or autoIP.
 - iii. The UUT shall maintain this live connection to the network for the duration of testing unless otherwise specified in this Test Method, disregarding any brief lapses (e.g., when transitioning between link speeds). If the UUT is equipped with multiple network capabilities, only one connection shall be made in the following order of preference:
 - a. WiFi (Institution of Electrical and Electronics Engineers - IEEE 802.11- 2007²)
 - b. Ethernet (IEEE 802.3). If the UUT supports Energy Efficient Ethernet (IEEE 802.3az-2010³), then it shall be connected to a device that also supports IEEE 802.3az
 - c. Thunderbolt
 - d. USB
 - e. Firewire (IEEE 1394)
 - f. Other

Discussion Questions

- What additional instructions regarding configuring network connections would be helpful to partners?
- Should EPA continue to require that all available network protocols be engaged during testing or include a list of preferences like in the above language?
- If a list of preferences would be more appropriate, which protocols should be included and in which order?

3) Other Questions

- Should the test method be updated to include testing for Dc-powered products?

III. New Product Types

1) Multi-room speakers or whole-home audio products + audio routers

Wireless whole-home audio and wireless home theater audio require the synchronization of several amplifiers so there is no noticeable delay in the sound emitted through their associated speakers. Some systems can furthermore receive audio input wirelessly from a user's smartphone, tablet, or computer. There are various methods to achieve this synchronization and reception, including AirPlay, Wi-Fi, Play-Fi, Bluetooth, and numerous proprietary protocols. Whole-home audio and wireless home theater systems are wireless in terms of their connection to a network or audio source; however, they still require a wired connection to the ac mains to supply power to run the network connection.

Some or all of the following components are necessary to enable a whole-home system¹:

- Network bridge if the system uses the home Wi-Fi network for all or part of its connectivity;
- Alternatively, a router or hub if the system uses its own dedicated network for any of its connectivity;
- As a final option, some products can receive signals directly from another device using a point-to-point wireless communication protocol such as Bluetooth²;
- Wireless amplifier modules/speakers capable of connecting to the bridge without a physical connection;
- Wireless music source; and
- Control device.

Most wireless speakers and whole-home audio components are included in the scope of the Version 3.0 ENERGY STAR Audio/Video Specification. However, the specification does not cover whole-home systems or dedicated whole-home audio bridges and hubs/routers. EPA is interested in reviewing the power demands of the wireless functionality of wireless whole-home audio systems to ensure that the specification requirements reflect top performing products, especially as the majority of products will be redesigned to provide wireless functionality in the future. Furthermore, although the test method can accommodate these products, it may not test them in a manner representative of typical use.

Discussion Questions

- How can the ENERGY STAR Version 4.0 AV Test Method better account for dedicated audio bridges and hubs? For example, does the specification need to include dedicated whole-home audio bridges and hubs/routers in scope to better account for power draw of the wireless functionality of the whole-home system? Should dedicated bridges and hubs be considered as unique products or as a part of a wireless home audio system? (See Section II on Wireless Testing above for more information regarding wireless products).

¹ J. Richardson, "Multi-room Audio Buying Guide", *Crutchfield*, <http://www.crutchfield.com/S-FTC0Sr0z2TN/learn/multi-room-audio-buying-guide.html>.

² This can be an end-user device such as a cell phone, or one of the system components, such as a soundbar or home theater receiver.

2) “Prosumer” Products

In the previous AV specification revision, some stakeholders concluded that certain products remained out of scope, or that it was difficult for them to meet the criteria, since such products were considered neither strictly consumer nor strictly commercial, according to the definitions in the specification.

Discussion Questions

- EPA is interested in understanding the extent to which these ‘prosumer’ products have evolved since the last AV specification revision to determine if an opportunity exists for developing more appropriate criteria for such products. Please share information regarding the current state of the technology and energy use for these products as well as the market.

IV. Other Items for Consideration

1) Multi-enclosure products

Currently, the specification requires all enclosures of a system to be tested and qualified against the requirements separately. However, doing so results in products appearing side-by-side on the ENERGY STAR Product Finder (e.g., soundbars with and without powered subwoofer) without clear information on the power draw when products are intended to be used together as a system. As a result, to provide consumers with more accurate information on the power draw of their AV products, EPA is considering requiring that all enclosures be tested and qualified against the requirements as a whole system.

Discussion Questions

- What benefits and drawbacks exist in requiring that all enclosures be tested and qualified as a system?
- Is there a better way to make it easy for consumers and other users of the ENERGY STAR Product Finder to compare the energy use of the whole products or systems they are considering?

2) Soundbars

It was estimated that 5.8 million soundbars shipped in 2015. Given the prevalence of this product type, EPA is interested in ensuring that the specification and test method accurately account for these products in the Version 4.0.

Discussion Questions

- Recognizing the broad adoption of this product type in recent years, EPA wants to ensure that the ENERGY STAR test method continues to be appropriate for today’s sound bars including their likely deployments and operation (i.e., connected to a TV and always awaiting a signal). Please share feedback on updates to the test method that you believe are needed.
- EPA seeks data on the newest soundbar products to determine criteria that recognizes the most efficient soundbars on the market today.

3) Applicability of Efficiency Requirements in the Specification

Currently, the specification requires products with audio amplification to meet requirements in Sleep, Idle, and Active modes. However, the Idle requirement does not apply to products that have Automatic Power Down (APD) enabled by default where its timing cannot be increased past 30 minutes. Furthermore, the Active (efficiency) requirement does not apply to products with input power less than 20 W at 1/8 of Maximum Undistorted Power.

As a result, a large proportion of products are available on the market that only need to meet the Sleep Mode requirement. EPA exempted such products in the past from meeting energy efficiency criteria in other modes since the energy consumption proved negligible. At this time, EPA seeks more information on such products' energy consumption in different modes to assess if any new energy savings opportunities may exist among products currently available in the market.

Discussion Questions

EPA is interested in better understanding the power consumption associated with 1) Idle Mode for products that are currently exempt due to having APD enabled by default where the timing cannot be increased past 30 minutes, and, 2) in Active Mode for products with input power less than 20 W at 1/8 of Maximum Undistorted Power. Since AV products may be in use multiple times per day by many users, the total time spent idling each day could exceed 30 minutes. Additionally, power consumption associated with Active Mode may also be significantly higher than Idle Mode power consumption for many audio products, making Active Mode a meaningful contributor to total annual energy. As such, EPA seeks more information on the power draw and use profile of such products to determine if a greater energy savings opportunity exists in extending Idle and Active mode requirements to this broader set of products.

4) Voice Activated Digital Assistants

Voice activated digital assistants, also called virtual assistants, are expected to be used at least once monthly by 60 million people in the U.S. this year. Example products include Amazon Echo and Google Home. The unit sales for these types of products have been predicted to reach 4.5 million units in 2017, which is a 52% increase over 2016³. EPA is currently exploring opportunities related to the role these products are currently or could potentially play as home energy assistants and the impacts they may have on energy use in a home.

Discussion Questions

- How are voice activated digital assistants serving/able to serve as hubs for home energy management today, and how can they expand or improve in serving this function?
- What additional benefits/services can they provide to help consumers save and manage energy use in the home?
- Are there any technological or market challenges preventing them from serving as the ultimate home energy hub?

V. Request for Feedback

EPA requests feedback on these and any other related issues **by Wednesday, July 26, 2017**. Please send comments to audiovideo@energystar.gov. Registration for the AV Program Discussion Document Version 4.0 webinar on **July 17, 2017 from 1 - 3:30 PM Eastern Time**, is available [here](#). For any questions, please contact Verena Radulovic, EPA, at Radulovic.Verena@epa.gov or (202) 343-9845, or Emmy Feldman, ICF, at Emmy.Feldman@icf.com or (202) 862-1145.

³ <https://www.cta.tech/News/Press-Releases/2016/January/Record-Year-Ahead-Consumer-Enthusiasm-for-Connect.aspx>