ENERGY STAR Small Network Equipment Discussion Guide December 2020

Overview

The U.S. Environmental Protection Agency (EPA) and Department of Energy (DOE) are sharing this ENERGY STAR Small Network Equipment (SNE) Discussion Guide to invite early stakeholder input on aspects under consideration for a Version 2.0 revision of the SNE test method and specification. Version 1.0 was finalized in November 2013 and there have been significant updates in terms of the technology, as well as testing methods, for these products. The goal of this revision is to identify opportunities to simplify the current test method while maintaining its representativeness, repeatability, and reproducibility, followed by updating product energy efficiency requirements in the specification to address technological progress in the market over the past several years. EPA believes that these proposed changes have the potential to reduce testing burden, while differentiating the top performing products in the market for consumers.

Through discussion with stakeholders, EPA and DOE have learned that stakeholders find the existing ENERGY STAR Version 1.0 SNE test method burdensome. EPA and DOE have identified alternate, industry test methods for SNE that may be less burdensome than the existing ENERGY STAR test method. One option under consideration is the European Commission's requirements for broadband equipment, the EU Code of Conduct on Energy Consumption of Broadband Equipment: Version 7.0[1] (EU CoC), published in January 2019.

When conducting this review, EPA and DOE did evaluate the test method associated with the SNE Voluntary Agreement[2], first signed by industry partners in June 2015. However, the government found this test method inadequate for the purposes of ENERGY STAR as the Voluntary Agreement only addresses energy consumption of SNEs during idle state, referencing the industry standard ANSI/CTA-2049[3] to measure power consumption in idle state. Idle state is the state in which an SNE is in on mode, but there is no transfer of data (*i.e.,* the data rate is 0 kb/s). While SNEs do spend time in idle state, it is also important to capture the energy consumption of these devices while passing traffic to recognize meaningful energy savings. Therefore, EPA and DOE believe it is important to continue to test SNEs in idle state and during data transfer.

Accordingly, EPA and DOE are proposing to harmonize with the testing requirements in the EU CoC for the ENERGY STAR Version 2.0 SNE test method. Overall, the EU CoC provides a more comprehensive list of setup instructions with a wider scope covering more up to date network protocols, but with reduced number of tests required. EPA and DOE believe aligning with the requirements in the EU CoC would encourage greater participation in the ENERGY STAR program. This discussion guide discusses the following topics related to an updated ENERGY STAR Version 2.0 Draft 1 SNE test method and solicits stakeholder feedback on each topic:

- Specification discussion
  - Scope
  - Base power allowances and functional adders
- Test method discussion

[1] Bertoldi, P., Code of Conduct on Energy Consumption of Broadband Equipment, Version 7.0, European Commission, Ispra, 2019. Available at:https://e3p.jrc.ec.europa.eu/communities/ict-code-conduct-energy-consumption-broadband-communication-equipment.
[2] Energy Efficiency Voluntary Agreements. Available at: https://www.energy-efficiency.us/.
[3] Determination of Small Network Equipment Average Energy Consumption. Published February 2015. Available at: https://shop.cta.tech/products/determination-of-small-network-equipment-average-energy-consumption. This standard is a simplified version of the current ENERGY STAR Version 1.0 SNE test method.

- Comparison of ENERGY STAR Version 1.0 SNE test method and EU CoC
- High data rate test
- Low data rate and idle state tests
- Half ports test
- Wireless test
- Update to wireless protocols
- Traffic generator profile

EPA and DOE will host a webinar on January 7, 2021 from 1:30-3:30 Eastern Time to engage with stakeholders on the content included in this discussion guide. Stakeholders are requested to share written feedback with EPA and DOE by January 22, 2021. As always, stakeholder engagement is a vital ingredient in the success of the ENERGY STAR program and EPA and DOE look forward to working with all parties to develop the ENERGY STAR Version 2.0 SNE test method and specification.

Specification Discussion:

Scope

The EU CoC covers several product areas which are not in scope of the Version 1.0 SNE Specification, including:

- Cable and ONT service provider equipment (CCAP, CMTS, Edge-QAM)
- G.fast DSL
- MSAN where POTS interface is combined with DSL broadband interface
- VoIP gateways and VoIP telephones
- Powerline adapters
- HPNA, MoCA, and optical LAN adapters
- GSM/EDGE, WCDMA/HSDPA and LTE focused cellular network equipment

VoIP telephones are covered in the ENERGY STAR telephony specification, but the rest of the products above are not currently covered by any ENERGY STAR specification.

> **Question 1**: Of the product types listed above, do stakeholders recommend adding any of them to the scope of the ENERGY STAR Version 2.0 SNE specification? If so, stakeholders are asked to share supporting product energy data for those product types, ideally collected using the EU CoC test method, to support initial level setting in a Draft 1 specification.

> **Question 2**: Are DSL modems and DSL based IAD products still sufficiently relevant in the U.S. market that they should continue to be included in scope for the ENERGY STAR Version 2.0 SNE specification?

Base Power Allowances and Functional Adders

The ENERGY STAR Version 1.0 SNE specification contains a combined 15 base allowances and functional adders, while the latest version of the EU CoC contains nearly 250. The discrepancy in granularity of the functional adders is particularly notable in the EU CoC which contains many adders for product types and functions captured later in this document (in the Test Method Discussion section) that are currently out of the ENERGY STAR Version 1.0 SNE specification's scope, as well as a major expansion of adder complexity for DSL technologies that are less common in the U.S. market.

> **Question 3**: EPA aims to significantly reduce the number of adders from those included in the EU CoC without negatively affecting functionality. With this in mind, what are the most ripe targets for simplifying functional adders compared to what is presented in the EU CoC? This could include consolidating ONT adders or reducing the variation and/or duplicity of Wi-Fi radio configuration adders among other options.

Test Method Discussion:

Comparison of ENERGY STAR Version 1.0 SNE Test Method and EU CoC

The current ENERGY STAR Version 1.0 SNE test method specifies three on mode tests – idle state, low data rate, and high data rate. Additionally, each of these tests need to be repeated in the half-port configuration (*i.e.,* half port tests) and wireless configuration, for SNE products that have these functionality. That is, a given SNE unit could be required to run as many as nine tests under the current ENERGY STAR Version 1.0 SNE test method.

On the other hand, the EU CoC specifies only idle state and active state energy consumption tests for all broadband equipment including SNE, large network equipment, and telecommunication base stations. For SNEs, stakeholders would only conduct these two tests, which is a significant decrease from the current ENERGY STAR Version 1.0 SNE test method..

The key differences between the current ENERGY STAR Version 1.0 SNE test method and EU CoC would be as follows:

- The EU CoC does not include low data rate and half ports tests.
    - EU CoC's idle state testing requires some insignificant handshake traffic to be present. Depending on the amount of traffic present, the insignificant handshake traffic can be similar to ENERGY STAR Version 1.0 SNE test method's low data rate test, but without a consistent traffic pattern.
    - EU CoC tests LAN ports during on state testing; therefore, eliminating the need for a separate half ports test.
- The EU CoC implements different data generation methods compared to the ENERGY STAR Version 1.0 SNE test method.
    - ENERGY STAR Version 1.0 SNE test method utilizes Internet traffic mix (IMIX) profiles to transfer random data at random intervals with a variety of datagram sizes (or frame sizes) for low data rate tests and increases datagram size up to maximum transmission unit for high data rate tests. This ensures its accurate representation of real-life usage scenarios.
    - In general, EU CoC only has data rate requirements with no frame size requirements, other than for Fast Ethernet WAN and Gigabit Ethernet WAN ports, which has additional 25 back-to-back 500 bytes frame size and 250 back-to-back 500 bytes frame size requirements, respectively.
- The EU CoC's test setup requirements for units connected to a wireless network does not incorporate the use of a shielded enclosure with attenuation, which can decrease test setup time and cost.

A full list of setup differences between the ENERGY STAR Version 1.0 SNE test method and EU CoC is shown in Table 1 and Table 2, with Table 2 showing testing setup requirements that are unique to the ENERGY STAR Version 1.0 SNE test method.

Table 1: Setup Differences Between the ENERGY STAR Version 1.0 SNE Test Method and EU CoC

Standard / Description	ENERGY STAR Version 1.0 SNE test method on mode (including idle state, low data rate and high data rate states)	EU CoC on state (does not include idle state)	EU CoC idle state
Central functions (processor and memory: routing, firewall, OAM, user interface)	• None specified.	• Processing user traffic via WAN and LAN.	• Not processing user traffic.

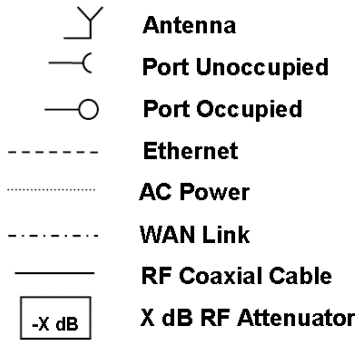
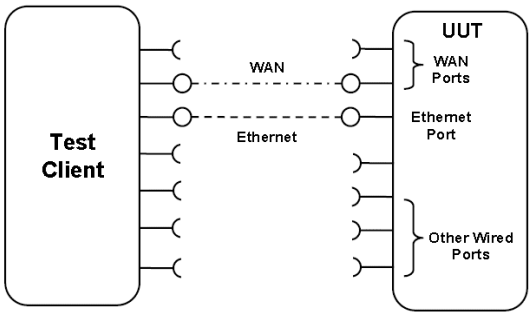
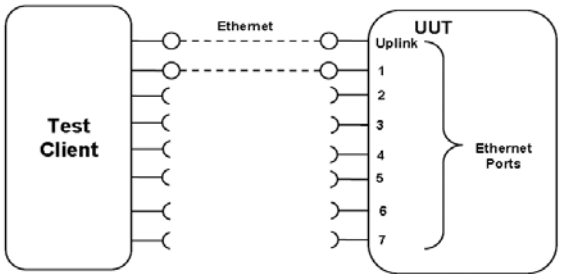
Standard / Description	ENERGY STAR Version 1.0 SNE test method on mode (including idle state, low data rate and high data rate states)	EU CoC on state (does not include idle state)	EU CoC idle state
WAN port	• Connect to a live source with continuously maintained network links. • Configure to operate at maximum possible speed. • Connect only one WAN port. • If multiple WAN ports exist, choose the first available from the following order: DOCSIS, PON, DSL, Ethernet.	• Single WAN: link established and passing traffic. • Dual WAN: only one port connected and passing traffic with the other port disconnected or not passing traffic. • Only set up both ports to be active for dual WAN simultaneous operation.	• Single WAN: link established but not passing user traffic. • Dual WAN: only one port in idle state; second port is disconnected or not active unless dual WAN simultaneous operation is required, in which case both ports are in idle state.
ADSL2plus	• Follow WAN port specifications.	• Select a specific profile from TR-100[4] Table 8-3, configure in rate adaptive mode with a test loop of 1250m. • Set DSL line to active and passing 1 Mb/s each way.	• Follow WAN port specifications.
VDSL2 (8, 12a, 17a)	• Follow WAN port specifications.	• Select a specific profile from TR-114[5] Table 9, configure in rate adaptive mode with a test loop of 300m for 8 MHz profile and 150m for each 12 and 17 MHz profiles. • Set DSL line to active and passing 10 Mb/s each way.	• Follow WAN port specifications.
VDSL2 (35b)	• Follow WAN port specifications.	• Configure line as Broadband Forum Recommendation Amendment 2 to TR-114 Issue 3, using Annex Q PSD mask, configure in rate adaptive mode with a test loop of 100m. • Set DSL line to active and passing 10 Mb/s each way.	• Follow WAN port specifications.
G.fast 106a, 106b, 106c	• Follow WAN port specifications.	• Configure line with 28 Mds, 7Mus, 36Mf; operating in 2 MHz – 106 MHz frequency; test loop of 50m. • Set line active and passing traffic 10 Mb/s each way.	• Follow WAN port specifications.
G.fast 212a, 212c	• Follow WAN port specifications.	• Configure line with 28 Mds, 7Mus, 36Mf; operating in 2 MHz - 212 MHz frequency; test loop of 50m. • Set line active and passing traffic 10 Mb/s each way.	• Follow WAN port specifications.
Fast Ethernet WAN	• Follow WAN port specifications.	• Link established at 100 Mb/s and passing traffic 1 Mb/s each way sent in bursts of 25 back-to-back 500 bytes Ethernet Frames (CRC included).	• Follow WAN port specifications.

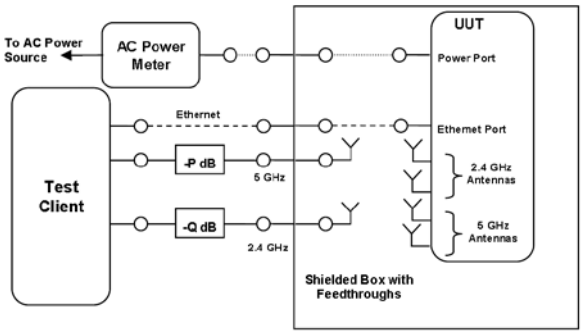
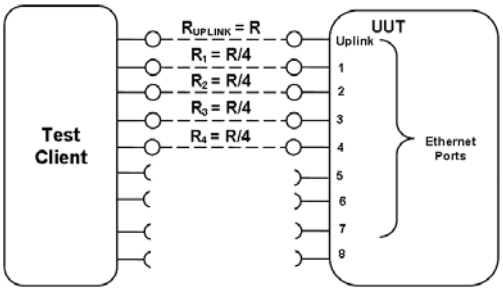
[4] ADSL2/ADSL2plus Performance Test Plan Issue 2. Issued August 2012. Available at: https://www.broadband-forum.org/technical/download/TR-100_Issue-2.pdf.
[5] VDSL2 Performance Test Plan Issue 2. Issued November 2012. Available at: https://www.broadband-forum.org/technical/download/TR-114_Issue-2.pdf.

Standard / Description	ENERGY STAR Version 1.0 SNE test method on mode (including idle state, low data rate and high data rate states)	EU CoC on state (does not include idle state)	EU CoC idle state
Gigabit Ethernet WAN	• Follow WAN port specifications.	• Link established at 1000 Mb/s and passing traffic 10 Mb/s each way sent in bursts of 250 back-to-back 500 bytes Ethernet Frames (CRC included).	• Follow WAN port specifications.
Fibre PtP Fast Ethernet WAN	• Follow WAN port specifications.	• Link established at 100 Mb/s and passing traffic 10 Mb/s each way.	• Follow WAN port specifications.
Fibre PtP Gigabit Ethernet WAN	• Follow WAN port specifications.	• Link established at 1000 Mb/s and passing traffic 10 Mb/s each way.	• Follow WAN port specifications.
PON (all types such as GPON, EPON, XG-PON1, etc.)	• Follow WAN port specifications.	• Passing traffic 10 Mb/s each way.	• Follow WAN port specifications.
DOCSIS 3.0	• Test in an environment that allows energy management 1x1 capability to operate at low data traffic rates for enabled devices.	• 4 downstream channels with 256 QAM modulation; 4 upstream channels with 64 QAM. • A symbol rate of 5.12 Ms/s, and a transmit level of 45 dBmV per channel. • Modem passing traffic at 10 Mb/s each way.	• Follow WAN port specifications.
DOCSIS 3.1 - without FDX	• Follow WAN port specifications.	• Requires a high-split plant configuration and CM using a diplexer with 204 MHz cutoff; • 2 OFDM downstream channels: 4K FFT, 190MHz BW, 4096 QAM, RxPower 0dBmV, CF 600/800MHz; • 24 SC-QAM downstream channels: 2K FFT, 8MHz BW, 256 QAM, RxPower 0dBmV, CF 300-438MHz; • 2 OFDMA upstream channels: 2K FFT, 48MHz BW, 1024 QAM, TxPower 45dBmV, CF 100/150MHz; • 8 SC-QAM upstream channels: 6.4MHz, 64 QAM, TxPower 45dBmV, CF 8.2-53 MHz. • Passing user traffic 10 Mb/s each way.	• Follow WAN port specifications.
LAN Fast Ethernet ports	• Connected at the maximum supported link rate unless otherwise specified. • All Ethernet cables used shall be Cat5e and between 1 and 2 meters in length. • See Table 2 for additional half ports test setup.	• All ports established at 100 Mb/s; cable length 10m and passing traffic 1Mb/s each way, each port, with bursts of 25 back-to-back 500 bytes Ethernet Frames.	• Ports not connected but with detection active.
LAN Gigabit Ethernet ports (1G through 10G)	• Connected at the maximum supported link rate unless otherwise specified. • All Ethernet cables used shall be Cat5e and between 1 and 2 meters in length. • See Table 2 for additional half ports test setup.	• All ports established at 1000 Mb/s. • Cable length 10m and passing traffic 10 Mb/s each way, each port, with bursts of 250 back-to-back 500 bytes Ethernet Frames.	• Ports not connected but with detection active.

Standard / Description	ENERGY STAR Version 1.0 SNE test method on mode (including idle state, low data rate and high data rate states)	EU CoC on state (does not include idle state)	EU CoC idle state
Wi-Fi 802.11g or 11a	• UUT in a shielded enclosure with connected feedthroughs. • RF receiving and transmitting signal strength should be attenuated to -50 dBm +/- 5dB. • Ensure only one Ethernet port connected and establish a single client device connection. • See Table 2 for additional wireless test setup.	• Beacon on, 1 Wi-Fi client 1-5m away from AP in the same room with no interference and a user traffic of 1 Mb/s each way.	• Beacon on but no client connected, nor traffic transmitted.
Wi-Fi 802.11n, 11ac, or 11ax		• Beacon on, 1 Wi-Fi client 1-5m away from AP in the same room with no interference and a user traffic of 10 Mb/s each way.	
Alternative LAN technologies (e.g., HPNA, MoCA, Powerline, POF)	• Disconnect all peripheral devices unless a secondary device and cable are shipped with the UUT.	• Technology activated with user traffic 10 Mb/s each way.	• Technology activated but no traffic.
FXS		• 1 phone connected (200 Ohm / loop current of 20 mA / 5m max cable length), off hook, 1 active call. Rest of the FXS ports disconnected.	• 1 phone connected (200 Ohm / 5m max cable length), phone on-hook, off hook detection active. Rest of the FXS ports disconnected.
FXO		• 1 active call.	• No active call with incoming call detection enabled.
DECT interface		• 1 active call.	• No active call with incoming call detection enabled.
DECT charging station for DECT handset		• DECT handset not on cradle, not charging.	• DECT handset on cradle, trickle charging.
Backup battery	• Fully charged and left in place.	• Battery fully charged (trickle charging).	• Battery fully charged (trickle charging).
USB	• Disconnect all peripheral devices unless a secondary device and cable are shipped with the UUT.	• No USB device connected; port idle.	• No USB device connected; port idle.
Low speed power line		• Active.	• None specified.
Bluetooth	• Disconnect all peripheral devices unless a secondary device and cable are shipped with the UUT.	• Active, with traffic 10 kb/s.	• None specified.
Zigbee		• Active, with traffic 10 kb/s.	
Narrowband-IoT		• Active.	
WAN port (for modems and NTs)	• Follow WAN port specification above.	• Active with corresponding WAN configuration above.	• Idle as aforementioned.
LAN port (for modems and NTs)	• Follow LAN port specification above.	• Active with same amount of traffic for WAN port.	• Link is physically and logically established with 10m cable length. No user traffic but negligible handshake traffic allowed.
Ethernet port (for other home networking devices)	• None specified.	• Active to support VoIP and print server functions below with 10m cable.	• 1 port in idle state as LAN port for modems and NTs with the rest disconnected.
VoIP/telephony (for other home networking devices)	• None specified.	• 1 active call.	• No active call with incoming call detection enabled, inactive display.
Print server (for other home networking devices)	• None specified.	• Print job active.	• None specified.

Table 2: ENERGY STAR Version 1.0 SNE Test Method's Additional Setup Requirements

ENERGY STAR Version 1.0 SNE Test Method's Additional Setup Requirements		
For Wired Network:	1. Enable NAT for IPv4 networks; 2. Enable IPv6 Link Local, Neighbor Solicitation, Neighbor Discovery, Router Solicitation and Router Advertisement; 3. Enable Single Class C Subnet; 4. Enable single hop (router TTL +1) to source on WAN side; 5. Enable DHCP; 6. Disable IPsec.	
One Port Test for Modem or ONT:	Connect one WAN port and one LAN port as prescribed for one port test.	
One Port Test for Switch/Router:	Connect two of the available ports with one being uplink or WAN port. If no uplink or WAN port specified on the device, the first port shall be used as uplink.	

ENERGY STAR Version 1.0 SNE Test Method's Additional Setup Requirements		
Wireless Test for IAD or Access Point:	Connect the uplink Ethernet port as prescribed for AP; Connect one WAN port and the first Ethernet port with traffic passing over the Ethernet link but not the WAN link. Refer to Wi-Fi requirements for wireless link setup.	
For Half Ports Test:	Configure all upstream traffic to pass over single uplink or WAN port; downstream traffic to be evenly distributed between the other connected Ethernet ports.	
Test Client Configuration:	Configure test client to provide statistics on data reliability (% of packets received successfully); configure test client to transmit variable length packets or frames using IMIX given in Table 7 of the TP. The packet content shall be random. Configure the test client to test in a modified aggregation mode for multilink (half ports) tests.	

Question 4: EPA and DOE request stakeholder comments on all aspects of the aforementioned test setup differences between the current ENERGY STAR Version 1.0 SNE test method requirements and EU CoC. In particular, comments are welcomed on whether the ENERGY STAR Version 2.0 SNE test method should align with all the set up requirements of the EU CoC, or if there are any requirements that should be different for the ENERGY STAR Version 2.0 SNE Program (either retaining the current ENERGY STAR requirements or specifying requirements different from those in the EU CoC)?

Question 5: Are any additional requirements in the EU CoC that should be considered for inclusion in the ENERGY STAR Version 2.0 SNE test method?

Question 6: Are there any additional industry SNE standards that should be considered, either in part or as a whole?

High Data Rate Test

The ENERGY STAR Version 1.0 SNE test method specifies a high data rate test, which is intended to represent scenarios in which the SNE is actively passing high network traffic, commonly seen during downloads, streaming, and/or loading webpages. The ENERGY STAR Version 1.0 SNE test method requires manufacturers to conduct high data rate tests using the highest data rate, as specified in Table 3. If the maximum device supported data rate is higher or lower than those shown in Table 3, then the

ENERGY STAR test method states that manufacturers shall use Equation 1 below to determine the appropriate data rate.

Table 3: Test Rate Selection

Direction	Rate (Mb/s)								
Downlink or Symmetric Link	1.0	2.0	5.0	10	20	50	100	200	500
Uplink	0.5	1.0	2.0	5.0	10	20	50	100	200

Equation 1: Alternate Data Rate Selection

$$Data\ Rate = Z * 10^{Y}\ (in\ bits\ per\ second)$$

Where:
Z is 1, 2, or 5; and
Y is an integer. Adjust as required to achieve the desired data rate.

In contrast to the requirements specified in the ENERGY STAR Version 1.0 SNE test method, the EU CoC specifies an on state test, which requires each individual port to be setup based on the per port data rate requirements shown in Table 1 previously. The per port data rate requirements are based on the specification of each port. Although EU CoC's per port data rate requirements use high data rates, they are not the highest supported data rates of each corresponding port, as specified in the current ENERGY STAR Version 1.0 SNE test method. Therefore, EPA and DOE request stakeholder comments on the following aspects:

> **Question 7:** Is it appropriate to change the highest data rate selection criteria used in the ENERGY STAR Version 1.0 SNE test method to be the individually defined data rates based on different ports as specified in EU CoC section B.1.3[6]. In other words, are the individually defined per port data rates from the EU CoC sufficient to mimic high data rate usage scenarios?

> **Question 8:** Should the ENERGY STAR Version 2.0 SNE test method also align its unit link rate, channel, and WAN profile (*i.e.*, ADSL/VDSL, DOCSIS) selection requirements from Table 1 to that of the EU CoC's on state test? If not, what unique value do stakeholders see in the current ENERGY STAR Version 1.0 SNE test method setup requirements that prevents this alignment?

Low Data Rate and Idle State Tests

The low data rate test specified in the current ENERGY STAR Version 1.0 SNE test method represents common consumer network use scenarios in which the connection is established but the devices are only passing insignificant network traffic (*i.e.*, handshake traffic). In comparison, the EU CoC does not specify a separate low data rate test. Instead, the idle state test specified in the EU CoC allows some insignificant handshake traffic in idle state, which can be similar to ENERGY STAR Version 1.0 SNE test method's low data rate test if the handshake traffic is consistent.

ENERGY STAR Version 1.0 SNE test method's low data rate test captures the scenario in which some handshake traffic is present, but not passing high data rate. Given that the handshake traffic varies from different protocols and devices, and the fact that the ENERGY STAR Version 1.0 SNE test method requires the traffic rate to be consistent during testing, EPA and DOE are proposing to keep the separate low data rate test requirements for the ENERGY STAR Version 2.0 SNE test method regardless of whether the ENERGY STAR program aligns with the EU CoC test method.

> **Question 9:** Do stakeholders agree with the approach to retain both the low data rate and idle state tests in the ENERGY STAR Version 2.0 SNE test method?

[6] Available at https://e3p.jrc.ec.europa.eu/communities/ict-code-conduct-energy-consumption-broadband-communication-equipment

Half Ports Test

The current ENERGY STAR Version 1.0 SNE test method also specifies a half ports test, which mimics real-life workloads for local network ports. ENERGY STAR Version 1.0 SNE test method's half ports test measures the energy consumption of a SNE's LAN Ethernet ports. In comparison, the EU CoC specifies per port data rate requirements for different LAN ports for the on state test (discussed previously in the High Data Rate Test section), which obviates the need of a separate half ports test as the LAN Ethernet functions would be tested in the on state test already. Therefore, if the ENERGY STAR Version 2.0 SNE test method were to align with EU CoC, the current ENERGY STAR Version 1.0 SNE test method's half ports test and high data rate test would be integrated into a single, on state test, wherein each available LAN Ethernet port would be configured according to EU CoC's requirements as listed in Table 1.

> **Question 10:** Would a separate half ports test be required if the ENERGY STAR Version 2.0 SNE test method incorporates the EU CoC's on state test instead? If so, what needs are not addressed by the on state test?

Wireless Test

In addition to the tests mentioned previously, the ENERGY STAR Version 1.0 SNE test method specifies a separate test for wireless network equipment, which requires the wireless SNE under test to be placed in a shielded box with transmitting signals attenuated to -50 dBm ± 5 dB, and each of the idle state test, low data rate and high data rate tests to be performed again with wireless connection only. Stakeholders have indicated that this requirement is burdensome. Therefore, EPA and DOE are considering aligning the wireless unit setup requirements with the EU CoC's on state test, which specifies that one Wi-Fi client per band must be setup 1-5 meters away from the access point in the same room, without same band interference. Furthermore, by aligning with the EU CoC's on state test, the separate wireless test currently specified in the ENERGY STAR Version 1.0 SNE test method would be eliminated. This would reduce test burden.

> **Question 11:** EPA and DOE request comment on their consideration of simplifying the wireless setup requirements. Are there scenarios that stakeholders could foresee that would cause interference with test results under this approach?

Update to Wireless Protocols

Newer versions are available for some wireless network protocols that were only in development phase when the ENERGY STAR Version 1.0 SNE test method was finalized. These include, the recently prevalent Wi-Fi 6 standard, or Wi-Fi 802.11ax[7]. Therefore, EPA and DOE are considering updating the networking protocols to include wireless link precedence for IEEE 802.11ax in the ENERGY STAR Version 2.0 SNE test method.

> **Question 12:** Are there any updated network protocols other than IEEE 802.11ax that should be considered for inclusion in the ENERGY STAR Version 2.0 SNE test method?

Traffic Generator Profile

The ENERGY STAR Version 1.0 SNE test method, prescribed specific traffic profiles to test SNE units (listed in Table 7 of the ENERGY STAR Version 1.0 SNE Test Method), which is constituted by a mix of three different data packets to mimic real-life network patterns and packet distributions. Although these IMIX profiles were designed to mimic real-life network use scenarios to measure a device's network performance, EPA and DOE are unaware of any energy consumption impact of these IMIX profiles. In comparison, the EU CoC's traffic profile only has data rate requirements with no frame size requirements

[7] IEEE P802.11ax - IEEE Draft Standard for Information Technology -- Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks -- Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment Enhancements for High Efficiency WLAN. Available at: https://standards.ieee.org/project/802_11ax.html.

other than for Fast Ethernet WAN and Gigabit Ethernet WAN ports, which has additional 25 back-to-back 500 bytes frame size and 250 back-to-back 500 bytes frame size requirements, respectively.

> **Question 13:** Are the data transfer requirements included in the ENERGY STAR Version 1.0 necessary if the program adopts the EU CoC test?

Final Thoughts on Test Method

The result of the changes discussed in the preceding sections, specifically regarding aligning the testing requirements with those specified in the EU CoC, would be that the total number of tests would be reduced from the previous maximum of nine tests to a maximum of three tests. Stakeholders would also require less equipment and the overall test burden would be lower, while maintaining the representativeness and repeatability of the test method itself. EPA and DOE believe this approach is feasible and would encourage greater participation in the ENERGY STAR SNE Program.

> **Question 14:** In addition to the topics discussed in this guide, are there any other alternative requirements that stakeholders recommend be considered when developing the ENERGY STAR Version 2.0 SNE test method?