VOLUNTARY AGREEMENT
FOR ONGOING IMPROVEMENT TO THE ENERGY EFFICIENCY OF
SMALL NETWORK EQUIPMENT

As Amended Effective January 1, 2025

This document sets out a Voluntary Agreement between the undersigned Signatories to continue improvements in the energy efficiency of Small Network Equipment (SNE) used by consumers of residential broadband Internet access services in the United States.

1. Purpose

1.1 The purpose of this Voluntary Agreement is to continue improvements in the energy efficiency of SNE, thereby further reducing potential environmental impact and increasing benefits to consumers. Fostering device and service functionality while encouraging innovation and competition by Service Providers and SNE manufacturers are equally important objectives of this Voluntary Agreement.

1.2 Energy efficiency improvements will be pursued provided that such improvements do not jeopardize the intended uses and functionalities of SNE; that they preserve or enhance the customer experience; and that they are sufficiently flexible to adapt to technological options and market competition, to improve functionality, to offer service enhancements, and to foster rapid innovation.

1.3 The Signatories agree that this Voluntary Agreement is an effective means for addressing the energy consumption of complex and rapidly changing networked devices that consumers use and purchase for residential Internet access.

1.4 The Signatories agree that energy efficiency measures should not create undue burdens or competitive disadvantages for service providers or manufacturers.

1.5 Nothing in this Voluntary Agreement shall preclude any party from implementing energy efficiency measures that exceed the requirements of this Agreement or from withdrawing from the Agreement at any time.

1.6 Each individual signatory has made the decision to participate in this Agreement based on its own independent interests and such decision is not conditioned on any understanding, tacit or express, on the participation of any other signatory.

2. Equipment Covered

2.1 This Voluntary Agreement covers the following types of SNE for residential use in the United States: Broadband Modems, Integrated Access Devices (IADs), and Local Network Equipment, as defined in Annex 1.

2.2 This Voluntary Agreement has no retroactive effect on equipment that is Sold, Purchased, deployed, or in inventory prior to January 1, 2015. In addition, the commitments of Section 3 have no retroactive effect on equipment that is Sold, Purchased, deployed, or in inventory prior to January 1, 2016. There is no requirement to retire or change existing equipment or to change existing equipment that is returned to a Service Provider and refurbished, repaired, and/or upgraded, and then redeployed. SNE that is returned from a retail channel

to a Vendor and refurbished, repaired, and/or Sold shall be deemed to have been manufactured and Sold on its original date of manufacture and Sale.

3. Commercial Signatory Commitments for Small Network Equipment

3.1 Ninety percent (90%) of all SNE that Service Providers Purchase after December 31, 2015 shall meet the efficiency levels set forth in Annex 2 of this Voluntary Agreement.

3.2 Ninety percent (90%) of all SNE that Vendors Sell after December 31, 2015 shall meet the efficiency levels set forth in Annex 2 of this Voluntary Agreement.

3.3 Annex 2 includes Tier 3 levels that apply to both Service Provider Purchases and Vendor Sales commitments after December 31, 2022 and Tier 4 levels that apply after December 31, 2025.

3.4 Commercial Signatories will engage in reasonable steps to inform their retail consumers about the general energy consumption characteristics and performance of SNE as described in Section 6.1.

3.5 Vendor Signatories that provide SNE to Service Provider Signatories will use reasonable efforts to design and manufacture energy efficient SNE while meeting the Service Providers' functional and operational specifications.

4. Signatories to the Voluntary Agreement

4.1 The current Signatories are set forth in Annex 4.

4.2 Additional commercial parties that provide facilities-based residential fixed Internet access services in the United States or Sell SNE in the United States that they manufacture or contract to have manufactured may become Signatories upon signature, with the effective date of such party's commitments established in the signing document. Additional Energy Advocates may become signatories upon the approval of the Steering Committee.

4.3 Each Signatory endorses the purposes of the Voluntary Agreement and agrees to its commitments set out herein.

4.4 Each Signatory commits only to the areas which are under its individual control and responsibility.

5. Testing

5.1 To demonstrate satisfaction of the Voluntary Agreement efficiency levels, devices shall be tested in their typical as-deployed configuration using the Test Method as defined in Annex 1 (Consumer Technology Association standard ANSI/CTA-2049-B, Determination of Small Network Equipment Average Energy Consumption, or such successor standard as is approved by the Steering Committee) and the procedures set forth in Annex 2 (Program Requirements) and Annex 3 (New Features Process). Test results must be retained for a period of at least two years.

5.2 Commercial Signatories may conduct their own testing for their annual statements as described in Section 6. All tests used for such statements and for lab verification pursuant

to Section 7 must be conducted using the Test Method.

5.3 The Signatories agree that consumers and stakeholders are best served by the consistent use of the same test method to measure the energy use of SNE.

6. Reporting

6.1 Service Providers and Vendors that Sell SNE at retail shall provide their subscribers and potential customers with reasonable access to energy efficiency information about the SNE subject to the Voluntary Agreement. For any new Commercial Signatories, this commitment will become effective six months after signature. The energy efficiency information to be made available under this section shall include test results in the Ready State applicable to each model under the Test Method. Different configurations of a model should be reported separately if energy use materially varies by configuration. This information shall be made publicly available by Service Providers for each model Purchased by that Service Provider as such models are made available to the Service Provider's subscribers, and shall be made available by Vendors for each model Sold (through retail channels) as such models are Sold by such Vendor. The information should not include confidential or commercially sensitive information, such as features that have not been publicly announced.

6.2 Each Service Provider and Vendor that Purchased or Sold SNE during the prior Reporting Period shall prepare a confidential annual statement containing the data for the prior Reporting Period during which it was a Signatory and submit the statement by April 1 of each year to the Independent Administrator as set forth in Section 6.4 below. The information in the annual statement shall include:

6.2.1 For Service Providers:

6.2.1.1 Total number of SNE units Purchased by the Service Provider during the Reporting Period, by device category.

6.2.1.2 Total number of SNE units Purchased by the Service Provider during the Reporting Period that meet the applicable efficiency levels set forth in Annex 2, by device category.

6.2.1.3 Test results in the Ready State applicable to each Purchased model under the Test Method, with a list of features sufficient to calculate applicable allowances.

6.2.1.4 Number of residential wireline broadband Internet access subscribers served during the Reporting Period.

6.2.2 For Vendors:

6.2.2.1 Total number of SNE units Sold during the Reporting Period, by device category.

6.2.2.2 Total number of SNE units Sold during the Reporting Period that meet the applicable efficiency levels set forth in Annex 2, by device category. In order to avoid duplicate reporting, Vendor annual statements shall

report Sales through retail channels and shall not report units provided at wholesale to Service Providers. If the total number of SNE units Sold by a Vendor during the Reporting Period is less than 5% of its total SNE units distributed for use in the United States during such period, in lieu of reporting only its devices Sold at retail, it may also separately report devices provided to Service Providers during the Reporting Period for purposes of demonstrating satisfaction of the 90% Sales commitment set forth in Section 3.2. The Independent Administrator shall use such data to determine whether the Vendor has satisfied its Sales commitment, but shall not otherwise include the Vendor's wholesale units in the Independent Administrator's annual report as described in Section 6.9.

6.2.2.3 Test results in the Ready State applicable to each Sold model under the Test Method, with a list of features sufficient to calculate applicable allowances. In order to avoid duplicate reporting, except as provided in Section 6.2.2.2, Vendor annual statements shall not report test results for models provided at wholesale to Service Providers.

6.2.2.4 Vendor Signatories are encouraged to transition early to manufacturing SNE that will meet new Tier energy levels prior to the effective date of such levels. At the same time, it would be counterproductive to the objectives of energy and resource efficiency to require the disposal of Vendor SNE that is manufactured prior to the date on which new Tier allowances become effective but that remain in inventory and have not been Sold prior to such date. Accordingly, a Vendor may choose to report such SNE in the year of its manufacture rather than its Sale, or it may report such SNE separately in the year of its Sale but request application of the Tier allowances that applied at the time of its manufacture.

6.2.3 Recommended reporting templates shall be approved by the Steering Committee.

6.3 A Reporting Period covers a single calendar year.

6.4 By April 1 of each year, NCTA - The Internet & Television Association (NCTA) and the Consumer Technology Association (CTA) shall provide the Independent Administrator with the estimated total number of U.S. residential wireline broadband Internet access subscribers served by all Service Providers (including those outside of the Voluntary Agreement) during the Reporting Period.

6.5 Annual statements shall be provided to the Independent Administrator for the 2028 Reporting Period by April 1, 2029, and the Independent Administrator shall provide a report to the Steering Committee in 2029 for the 2028 Reporting Period, notwithstanding any expiration of the Voluntary Agreement.

6.6 The Independent Administrator shall at least annually verify that the information required by Section 6.1 is posted and is readily accessible to consumers. If the Independent Administrator is not able to verify that the Signatory has satisfied its commitment, it shall request a report from the Signatory demonstrating satisfaction of the commitment. If the Independent Administrator finds that there has been insufficient improvement within 60 days of its request, it shall report that finding to the Steering Committee.

6.7 All reporting arrangements shall protect the confidentiality of commercially sensitive information. The Independent Administrator must sign a confidentiality agreement in relation to any confidential information supplied by the Signatories.

6.8 The Independent Administrator will review submissions and will raise concerns to the reporting Signatory within 30 days of submission.

6.9 The Independent Administrator will publish a public annual report that will:

6.9.1 Identify participating members during the Reporting Period.

6.9.2 Identify the aggregate percentage of SNE devices Purchased and Sold that meet the applicable efficiency levels set forth in Annex 2 of this Voluntary Agreement.

6.9.3 Identify the aggregate number of wireline broadband customers served by Service Provider Signatories compared with the number of U.S. residential wireline broadband subscribers served by all Service Providers (including those outside of the Voluntary Agreement) during the Reporting Period.

6.9.4 In accordance with the terms of Section 10, indicate whether any Commercial Signatory failed to meet its commitments under the Voluntary Agreement during the Reporting Period, describe such party's progress in remediating its missed commitment, and provide an update on the implementation or completion of remedial plans from any prior Reporting Periods that had not been completed as of the Independent Administrator's prior annual report. In reporting missed commitments and remedial plans, the annual report will not identify any party by name or disclose other information that would enable identification of such party.

6.9.5 Include an Appendix of models of SNE devices Purchased by Service Provider Signatories and Sold by Vendor Signatories during the Reporting Period, including their test results and a list of features sufficient to calculate applicable allowances. The Independent Administrator's report shall not include confidential or commercially sensitive information, such as shipping and volume reports and features that have not been publicly announced.

7. Audit and Verification

7.1 The Independent Administrator will randomly select one model from each Commercial Signatory's annual statement that meets the energy efficiency levels of the applicable Tier for verification testing. The Independent Administrator may in its discretion exclude from selection any model that was successfully tested pursuant to this section in a prior year. Verification testing shall be conducted by, or under the observation of, a qualified third party approved by the Independent Administrator, which shall seek the recommendation of the Steering Committee. Verification testing must be conducted using the Test Method as defined in Annex 1 and may occur in the Signatory's lab or a third-party lab. The cost of verification testing shall be borne by the Commercial Signatory.

7.2 Either the Independent Administrator or an independent auditor approved by the Steering Committee will conduct an audit of procurement or sale figures reported by one Commercial Signatory selected at random each year. The same Signatory shall not be randomly selected two years in a row.

7.3 In addition, on request of the Steering Committee, the Independent Administrator or independent auditor approved by the Steering Committee shall conduct an audit of the information and test results supplied by any Commercial Signatory's annual statement.

7.4 Commercially sensitive information with respect to an individual Signatory, as designated by that Signatory, shall remain confidential both during and after the audit. Signatories agree to provide reasonable assistance to the auditor. Upon request, the independent auditor must sign a confidentiality agreement in a form reasonably satisfactory to the Signatory. The Steering Committee shall bear the cost of such audit.

8. Steering Committee

8.1 A Steering Committee will provide administrative functions regarding the operation of the Voluntary Agreement, and it shall not have any authority to direct the commercial functions of any Signatory.

8.2 Each Signatory, NCTA and CTA may designate a representative to the Steering Committee and alternate representatives that may attend meetings and vote in the absence of the representative. A Signatory may replace its representatives on notice.

8.3 The Steering Committee will elect a Chair from among its Members.

8.4 The Chair will be responsible for convening the Steering Committee meetings at least once each calendar year, and for running meetings of the Steering Committee.

8.5 At the request of any Signatory, the Chair may authorize any person to attend meetings of the Steering Committee as a non-voting participant.

8.6 The Steering Committee will operate in accordance with the written bylaws adopted by its Members.

8.7 The Steering Committee may delegate any of its duties under the Voluntary Agreement to specific individuals or to subcommittees established by the Chair. Any actions by such individuals or subcommittees may be appealed to the full Steering Committee.

8.8 The Steering Committee shall designate an Independent Administrator to be responsible for the collection and processing of information supplied directly or indirectly by Signatories and determining a Signatory's satisfaction of its commitments under the Voluntary Agreement.

8.9 The costs of attending Steering Committee meetings will be borne by each attendee.

8.10 The costs of operating the Steering Committee shall be allocated in cost-recovery only annual dues set by the Steering Committee and assessed equally on each Signatory, except that the Steering Committee may waive or approve lower dues for Energy Advocates or Vendor Signatories that did not Sell SNE during the prior Reporting Period.

8.11 The Commercial Signatories and the Energy Advocates will seek regular joint consultation and engagement with representatives of appropriate regulatory authorities and other stakeholders to provide updates regarding the implementation of this Agreement.

9. Amendment of the Voluntary Agreement

9.1 The Voluntary Agreement may be amended in accordance with the procedure set out in this Section 9. The Steering Committee will consult on proposed amendments to the Voluntary Agreement prior to any vote on an amendment.

9.2 The Members of the Steering Committee will negotiate in good faith when considering amendments to the Voluntary Agreement.

9.3 A proposed amendment will be adopted if there is at least agreement of two-thirds of the Commercial Signatories and such two-thirds includes at least one Service Provider that Purchases a substantial volume of SNE equipment affected by the proposed amendment and at least one Vendor that Sells a substantial volume of SNE equipment affected by the proposed amendment.

9.4 Once an amendment to the Voluntary Agreement has been adopted, the Voluntary Agreement will be amended with the newly adopted amendment taking effect on the next anniversary of the Effective Date or such other date as may be adopted with the amendment.

10. Independent Administrator Evaluation

10.1 Satisfaction of a Commercial Signatory's commitments under the Voluntary Agreement shall be assessed by the Independent Administrator based upon data for the most recently completed Reporting Period (as adjusted pursuant to Sections 10.4 or 10.5) and data collected under the audit and verification testing programs described in Section 7. The Independent Administrator will follow written procedures that provide written notice of a missed commitment to the Signatory with at least a thirty day opportunity to respond and demonstrate satisfaction of the commitments. If the Independent Administrator thereafter confirms a commitment was missed, it shall request the Commercial Signatory within ninety days to propose a remedial plan.

10.2 The Independent Administrator will provide its evaluation of the proposed remedial plan to a review panel that consists of the NCTA, CTA, and Energy Advocate Members of the Steering Committee. The plan must be approved by the review panel by a majority vote that must include at least one Energy Advocate. Commercial Signatories will be afforded flexibility to develop remedial plans using any reasonable and appropriate means to fulfill the remediation plan while also meeting their business objectives. The Independent Administrator will monitor the implementation of approved remedial plans through their completion.

10.3 A Signatory may appeal any decision or action of the Independent Administrator under the Voluntary Agreement to the review panel described in Section 10.2.

10.4 Energy usage identified by a Signatory as incident to patches released to SNE to address security and cybersecurity issues shall be disregarded in measuring its SNE devices against Voluntary Agreement energy allowances and commitments.

10.5 In evaluating satisfaction of commitments under the Voluntary Agreement or a remedial plan, a Signatory shall be credited for alternative energy efficiency steps which the Signatory demonstrates will provide net energy efficiency gains in the delivery of services

that are superior to those required by the Voluntary Agreement. The Independent Administrator shall adopt procedures for evaluating such alternative energy efficiency steps.

10.6 A Signatory that fails to fulfill its remedial plan or that does not timely pay dues established under Section 8.10 may have its Signatory status terminated by a mutual decision of the Independent Administrator and Energy Advocate Signatories. Such termination constitutes the sole remedy with respect to any alleged noncompliance with any commitment, term, provision or obligation of the Voluntary Agreement by a Signatory.

11. Term and Termination

11.1 The initial term of this Voluntary Agreement began on January 1, 2015. Effective January 1, 2025, the Voluntary Agreement was extended through December 31, 2028. The Voluntary Agreement may be renewed by mutual agreement.

11.2 Any Signatory may terminate its Signatory status on written notice to the Chair of the Steering Committee. Such termination shall immediately terminate all of that Signatory's rights and obligations under the Voluntary Agreement except that all confidentiality obligations arising from this Voluntary Agreement shall survive such termination.

11.3 The Chair of the Steering Committee will notify all Members of the Steering Committee and such other persons as the Chair may deem appropriate of the termination of any Signatory.

12. Voluntary Agreement Commitments as an Alternative to Regulatory Approaches

12.1 All commitments of Signatories are contingent on the termination and continued absence of all U.S. Federal and State proceedings considering the adoption of regulations or legislation covering SNE energy use unless otherwise mutually agreed by the Signatories.

13. Miscellaneous

13.1 Force Majeure. If a Signatory is prevented or delayed in performance of its commitments hereunder as a result of circumstances beyond such Signatory's reasonable control, including, without limitation, acts of God, war, terrorism, acts of the government, or failure of suppliers, subcontractors, or carriers, such failure or delay will not be deemed to constitute a failure to meet a commitment under the Voluntary Agreement.

13.2 Legal Effect. The Voluntary Agreement sets out a course of action for each Signatory to improve the energy efficiency of SNE. The Voluntary Agreement is not a commercial agreement and does not in itself create any contractual relationship, partnership, joint venture or other agency relationship among the Signatories. Nothing in this Voluntary Agreement shall be deemed to create a third-party beneficiary relationship. Nothing in this document shall limit a party's rights pursuant to the separate, enforceable Confidentiality Agreement related to information exchanged under this agreement.

13.3 Notice. All legal notices to Signatories in relation to the Voluntary Agreement should be addressed and sent to the relevant contact point specified in Annex 5. Communications to Signatories regarding the ordinary business of the Steering Committee may be sent to the email addresses provided by the Signatory.

SCHEDULE OF ANNEXES

ANNEX 1 – GENERAL DEFINITIONS

ANNEX 2 – PROGRAM REQUIREMENTS

ANNEX 3 – NEW FEATURES PROCESS

ANNEX 4, Part A – SERVICE PROVIDER SIGNATORIES

ANNEX 4, Part B – VENDOR SIGNATORIES

ANNEX 4, Part C – ENERGY ADVOCATE SIGNATORIES

ANNEX 5 – CONTACT INFORMATION FOR NOTICES (Confidential)

ANNEX 1 – GENERAL DEFINITIONS

1. "Commercial Signatories" means Service Provider Signatories and Vendor Signatories.

2. "Effective Date" means January 1, 2015, except that as applied to a Signatory that signs the Voluntary Agreement after that date, it shall mean the date on which that party signs the Voluntary Agreement.

3. "End User" means a subscriber to Internet access services provided by a Service Provider who uses SNE provided by the Service Provider as part of the subscription.

4. "Energy Advocates" are the organizations that participate in this Voluntary Agreement as Energy Advocates.

5. "Federal" includes any part of the government of the United States and any department, agency, or instrument thereof.

6. "Independent Administrator" means the party designated by the Steering Committee that is tasked with, and responsible for, the collection and processing of information supplied directly or indirectly by Signatories, and with determining a Signatory's satisfaction of its commitments under the Voluntary Agreement.

7. "Member" means a member of the Steering Committee.

8. "Purchase" means, with respect to a Service Provider, to accept delivery of SNE for commercial deployment to residential customers in the United States.

9. "Ready State" shall have the meaning established in the Test Method.

10. "Reporting Period" means the period within which the required information is to be submitted by a Signatory (which is generally a calendar year).

11. "Sell," "Sale" and "Sold" refers to sale by a Vendor of SNE through retail channels for consumer purchase and use in residential broadband Internet access services in the United States.

12. "Service Provider" means an entity that provides broadband Internet access services to residential subscribers with whom it has an ongoing contractual relationship through a managed distribution network provided by that entity.

13. "Set-Top Box Voluntary Agreement" refers to the Voluntary Agreement for Ongoing Improvement to the Energy Efficiency of Set-Top Boxes, Amended and Restated March 18, 2021.

14. "Signatory" and "Signatories" mean those companies or organizations that sign this Voluntary Agreement as Service Providers, Vendors or Energy Advocates.

15. "Small Network Equipment" means the following types of devices Purchased and placed into service by a Service Provider or Sold by a Vendor for the first time on or after the Effective Date for use by a consumer for residential access to broadband Internet access services in the United States as the primary intended function. SNE excludes enterprise equipment, Service Provider network equipment, and Set-Top Boxes and Multi-Service Gateway Set-Top Boxes with video as one of the primary functions (services) (as defined by the Set-Top Box Voluntary Agreement).

a. "Broadband Modem." A simple network device that enables high speed data service with a WAN (Wide Area Network) interface to a service provider wired or optical network, and typically a single LAN (Local Area Network) interface for the customer premise network. The Broadband Modem category does not include devices with integrated router or IEEE 802.11 (Wi-Fi) wireless access point functionality.

b. "Integrated Access Device" ("IAD"). A network device that enables high speed data service with a WAN interface to a service provider wired or optical network and one or more of the following functions on the LAN interface: multiport routing, IEEE 802.11 (Wi-Fi) wireless access point functionality, and/or VoIP.

c. "Local Network Equipment" ("LNE"). The following local network devices that do not have a direct interface to a Service Provider wired or optical network:

   i. Wireless Access Point: A device that typically includes one or more Ethernet interfaces, and that provides IEEE 802.11 (Wi-Fi) wireless network connectivity to multiple clients as its primary function.

   ii. Router: A network device that forwards packets from one network interface to another based on network layer information (typically IP destination address). Devices fitting this definition may provide both wired and wireless network connectivity.

   iii. Switch: A network device that filters and forwards frames based on the Ethernet destination MAC address of each frame as its primary function.

   iv. Network Extender: A device that bridges or extends a local area network beyond its physical limitations using one or more transmission media such as twisted pair, coax, Wi-Fi, or powerline.

16. "State" includes the governments of the District of Columbia and any State, territory, and insular possession of the United States and their political subdivisions; and any agency or instrument thereof.

17. "Steering Committee" means the coordinating and governing body of this Voluntary Agreement.

18. "Test Method" means the test procedure as defined in ANSI/CTA-2049-B, Determination of Small Network Equipment Average Energy Consumption, published by the Consumer Technology Association, or such successor standard as is approved by the Steering Committee.

19. "Vendor" means an equipment manufacturer or other company that Sells SNE through retail channels for consumer purchase and use with residential broadband Internet access services in the United States; and a company that is responsible for designing, developing and/or manufacturing SNE for Purchase and deployment in the United States by a Service Provider.

ANNEX 2 – PROGRAM REQUIREMENTS

1. Introduction

This document defines maximum base and additional feature energy allowances and allowance rules for Small Network Equipment used to determine satisfaction of the procurement and sales commitments of the Voluntary Agreement.

2. Definitions

2.1 Small Network Equipment, Broadband Modem, Integrated Access Device, Wireless Access Point, Router, Switch, and Local Network Equipment shall have the meanings set forth in Annex 1.

2.2 ADSL2plus: an International Telecommunication Union standard for asymmetric digital subscriber line (ADSL) broadband Internet access as defined by ITU G.992.5.

2.3 VDSL2: an International Telecommunication Union standard for very high speed digital subscriber line (VDSL) broadband Internet access as defined by ITU G.993.2.

2.4 G.fast: an International Telecommunication Union standard for DSL broadband Internet access as defined by ITU G.9700 and G.9701. References to G.fast herein and the associated allowances are only for single twisted pair implementations using a +4 dBm, 106 MHz profile, or coax implementations using a +2 dBm, 106 MHz or 212 MHz profile.

2.5 DOCSIS 3.0: DOCSIS® 3.0 interface as defined by CableLabs Data Over Cable Service Interface Specifications 3.0.

2.6 Advanced LNE: Local Network Equipment (LNE) that incorporates multi-port routing, wireless access point, and/or VoIP functionality.

2.7 MoCA Home: home networking specification as defined by the Multimedia Over Coax Alliance (including versions MoCA Home 1.1, and 2.0, and 2.5).

2.8 SFP - small form-factor pluggable: a compact, hot-pluggable transceiver used to interface a device to a fiber optic or copper networking cable.

2.9 WAN – Wide Area Network: the interface(s) to the service provider network.

2.10 LAN – Local Area Network: the interface(s) to the consumer networking devices within the premise.

2.11 MIMO - Multiple-Input and Multiple-Output: the use of multiple antennas at both the transmitter and receiver in a bidirectional wireless communication device to improve communication.

2.12 HPNA: HomePNA Alliance, formerly the Home Phoneline Networking Alliance.

2.13 FXS (Foreign Exchange Station): device interface, such as RJ-11, to connect directly to a standard telephone, fax machine, or similar device and supply ring, voltage, and dial tone.

2.14 DECT: Digital Enhanced Cordless Telecommunications is the ETSI standard for short-range cordless communications over unlicensed frequency used for voice, data and networking applications with a range up to 500 meters.

2.15 USB: Universal Serial Bus.

2.16 SATA – Serial ATA: interface for connecting devices to external storage devices, such as a hard disk drive (HDD).

2.17 Bluetooth: a wireless technology standard for exchanging data over short distances.

2.18 Zigbee: a specification for a suite of high-level communication protocols used to create personal area networks built from small, low-power digital radios.

2.19 Z-wave: a wireless communications protocol designed for home automation.

2.20 PCIe (Peripheral Component Interconnect Express): a high speed serial computer expansion bus standard.

2.21 DOCSIS 3.1: DOCSIS® 3.1 interface as defined by CableLabs Data Over Cable Service Interface Specifications 3.1. References to DOCSIS 3.1 herein and the associated allowances do not include support for symmetrical full duplex (FDX) DOCSIS 3.1 as initially defined in Annex F of the CableLabs Specification CM-SP-PHYv3.1-I12-17026 or later versions.

2.22 G.hn: a home networking specification as defined by ITU-T G.9960 for data transmission over telephone wiring, coaxial cables, power lines, and Plastic Optical Fiber (POF).

2.23 10G EPON: Ethernet Passive Optical Networking WAN interface supporting 10 Gbps symmetrical Internet access service as defined by IEEE 802.3av.

2.24 GigE: Gigabit Ethernet.

2.25 XGS PON: 10-Gigabit-capable symmetric passive optical network as defined by ITU-T G.9807.1.

3. Ready State

The testing and power allowances are based on the device operating in the Ready State as defined in ANSI/CTA-2049-B. This is defined as powered on and ready to pass traffic, but no user-generated traffic is initiated during the test. ANSI/CTA-2049-B also defines a Ready Interface as an interface that is configured and active and capable of passing traffic.

4. Efficiency Criteria

4.1 Significant Digits and Rounding – all measured and calculated power values shall be rounded as follows:

4.1.1 To the nearest 0.01 W for power values of 10 W or less

4.1.2 To the nearest 0.1 W for power measurements of greater than 10 W and less than 100 W

4.1.3 To the nearest 1 W for power measurements of greater than 100 W

4.2 Ready State power as measured per the Test Method shall be less than or equal to the maximum requirement for allowed power in the Ready State as calculated per equation 1.

Equation 1 – Maximum Ready State power calculation for small network equipment

$$P_{READY_STATE_MAX} = P_{Base} + \sum_{i=1}^{n} P_{ADD_i}$$

where

- P_{Base} = Base power allowance (W) from Table 1
- P_{ADD_i} = The power allowance (W) as specified in Tables 2, 3 and 4 for each feature present in the device, for a total of *n* such allowances.

Table 1 – Base Power Allowances

Base Allowance: IAD Devices (by WAN interface)	Tier 3 (watts)	Tier 4 (watts)	Notes
ADSL2plus	3.7	3.7	
VDSL2 (8, 12a, 17a, but not 30a)	4.5	4.5	
VDSL2 (all above profiles including 30a)	6.0	6.0	
VDSL2 (all above profiles including 35b)	6.0	6.0	
DOCSIS 3.0 basic configuration (4x4)	4.5	4.5	
DOCSIS 3.1 (no FDX)	14.0	11.0	
MoCA Home 1.1/2.0/2.5	3.7	3.7	
1 Gigabit Ethernet (1GigE)	3.7	3.7	
2.5 Gigabit Ethernet (2.5GigE)	4.5	4.5	
5 Gigabit Ethernet (5GigE)	5.0	5.0	
10 Gigabit Ethernet (10GigE)	5.5	5.5	
SFP (1000BaseLX/SX)	4.0	4.0	
GPON	5.0	5.0	
10G EPON	13.0	7.0	
On-board fiber WAN (without SFP)	5.0	N/A	Removed for Tier 4 (covered by other allowances)
XGS PON	13.0	7.0	
Base Allowance: Broadband Modems (by WAN Interface)	**Tier 3 (watts)**	**Tier 4 (watts)**	**Notes**
ADSL2plus	2.2	2.2	
VDSL2 (8, 12a, 17a, but not 30a)	3.0	3.0	
VDSL2 (all above profiles including 30a)	4.5	4.5	
DOCSIS 3.0 basic configuration (4x4)	3.0	3.0	
DOCSIS 3.1 (no FDX)	11.0	9.5	

G.fast	4.2	4.2	Reverse power feed (if available) should be disabled when testing
10G EPON	10.0	5.5	
Base Allowance: LNE	**Tier 3 (watts)**	**Tier 4 (watts)**	**Notes**
LNE other than Advanced LNE	1.5	1.5	
Advanced LNE	3.2	3.2	

Table 2 – Additional WAN Power Allowances

Allowances for Additional Backup WAN Interface	**Tier 3 (watts)**	**Tier 4 (watts)**	**Notes**
1 Gigabit Ethernet (1GigE) WAN	0.4	N/A	
SFP Not Present	0.7	N/A	
SFP Present (1000BaseLX/SX or GPON)	2.0	N/A	
VDSL2 (8, 12a, 17a, but not 30a)	0.7	N/A	
Allowances for Simultaneous WAN Interface	**Tier 3 (watts)**	**Tier 4 (watts)**	
VDSL2 (8, 12a, 17a, but not 30a)	3.2	3.2	For VDSL bonding
VDSL2 (profile 30a)	4.7	4.7	For VDSL bonding
DOCSIS 3.0 additional power allowance for each additional 4 downstream channels above 4	1.0	1.0	e.g. a 16x4 cable modem has 12 downstream channels above 4, take 1.0x3=3.0W allowance for Tier 3. Not applicable to a DOCSIS 3.1 broadband modem or IAD.

Table 3 – Additional LAN Power Allowances

Allowances for LAN interfaces and Additional Functionality	**Tier 3 (watts)**	**Tier 4 (watts)**	**Notes**
Fast Ethernet port	0.2	0.2	For each port whether or not connected during test
1GigE port	0.2	0.2	For each port whether or not connected during test
2.5GigE port connected (active link)	2.5	2.1	Applies to integrated copper LAN ports
2.5GigE port not connected	0.8	0.8	Applies to integrated copper LAN ports
5GigE port connected (active link)	2.5	2.1	Applies to integrated copper LAN ports
5GigE port not connected	0.8	0.8	Applies to integrated copper LAN ports
10GigE port connected (active link)	3.5	3.0	Applies to integrated copper LAN ports and SFP+ Ports with SFP+ inserted and connected to 10GB endpoint
10GigE port not connected	1.5	1.5	Applies to integrated copper LAN ports
SFP Cage (SFP Module Not Present)	N/A	0.7	
SFP+ Cage (SFP Module Not Present)	N/A	1.6	

Allowances for LAN interfaces and Additional Functionality	Tier 3 (watts)	Tier 4 (watts)	Notes
Wi-Fi 2.4 GHz radio with a conducted output power of less than 200 mW per chain up to 2x2	1.0	1.0	For each radio
Additional allowance per RF chain above 2x2 MIMO at 2.4 GHz with a conducted output power of less than 200 mW per chain	0.1	0.1	
Wi-Fi 5 GHz radio up to 80 MHz channel bandwidth with a conducted output power of less than 200 mW per chain up to 2x2	1.6	1.6	For each radio
Additional allowance per RF chain above 2x2 MIMO at 5 GHz up to 80 MHz channel bandwidth with a conducted output power of less than 200 mW per chain	0.1	0.1	
Wi-Fi 5 GHz radio at 160 MHz channel bandwidth with a conducted output power of less than 200 mW per chain up to 2x2	2.0	2.0	For each radio. Must be tested with a test client capable of operating at 160 MHz channel bandwidth
Additional allowance per RF chain above 2x2 MIMO at 5 GHz at 160 MHz channel bandwidth with a conducted output power of less than 200 mW per chain	0.1	0.1	Must be tested with a test client capable of operating at 160 MHz channel bandwidth
Wi-Fi 6 GHz radio up to 80 MHz channel bandwidth with a conducted output power of less than 200 mW per chain up to 2x2	1.6	1.6	For each radio
Additional allowance per RF chain above 2x2 MIMO at 6 GHz up to 80 MHz channel bandwidth with a conducted output power of less than 200 mW per chain	0.1	0.1	
Wi-Fi 6 GHz radio at 160 MHz channel bandwidth with a conducted output power of less than 200 mW per chain up to 2x2	2.0	2.0	For each radio. Must be tested with a test client capabale of operating at 160 MHz channel bandwidth
Additional allowance per RF chain above 2x2 MIMO at 6 GHz at 160 MHz channel bandwidth with a conducted output power of less than 200 mW per chain	0.1	0.1	Must be tested with a test client capable of operating at 160 MHz channel bandwidth
Wi-Fi 6 GHz radio at 320 MHz channel bandwidth with a conducted output power of less than 200 mW per chain up to 2x2	N/A	2.4	
Additional allowance per RF chain above 2x2 MIMO at 6 GHz at 320 MHz channel bandwidth with a conducted output power of less than 200 mW per chain	N/A	0.1	
Wi-Fi 2.4 GHz radio with a conducted output power of greater than or equal to 200 mW per chain up to 2x2	1.1	1.1	For each radio

Allowances for LAN interfaces and Additional Functionality	Tier 3 (watts)	Tier 4 (watts)	Notes
Additional allowance per RF chain above 2x2 MIMO at 2.4 GHz with a conducted output power of greater than or equal to 200 mW per chain	0.2	0.2	
Wi-Fi 5 GHz radio up to 80 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain up to 2x2	2.1	2.1	For each radio
Additional allowance per RF chain above 2x2 MIMO at 5 GHz up to 80 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain	0.3	0.3	
Wi-Fi 5 GHz radio at 160 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain up to 2x2	2.6	2.6	For each radio. Must be tested with a test client capable of operating at 160 MHz channel bandwidth
Additional allowance per RF chain above 2x2 MIMO at 5 GHz at 160 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain	0.3	0.3	Must be tested with a test client capable of operating at 160 MHz channel bandwidth
Wi-Fi 6 GHz radio up to 80 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain up to 2x2	2.1	2.1	For each radio
Additional allowance per RF chain above 2x2 MIMO at 6 GHz up to 80 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain	0.3	0.3	
Wi-Fi 6 GHz radio at 160 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain up to 2x2	2.6	2.6	For each radio. Must be tested with a test client capable of operating at 160 MHz channel bandwidth
Additional allowance per RF chain above 2x2 MIMO at 6 GHz at 160 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain	0.3	0.3	Must be tested with a test client capable of operating at 160 MHz channel bandwidth
Wi-Fi 6 GHz radio at 320 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain up to 2x2	N/A	3.1	For each radio. Must be tested with a test client capable of operating at 320 MHz channel bandwidth

Allowances for LAN interfaces and Additional Functionality	Tier 3 (watts)	Tier 4 (watts)	Notes
Additional allowance per RF chain above 2x2 MIMO at 6 GHz at 320 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain	N/A	0.4	
Wi-Fi IEEE 802.11n at 2.4GHz supporting 256-QAM	0.3	0.3	Take this allowance in addition to 802.11n if supporting 256-QAM at 2.4GHz
HPNA	1.5	1.5	
G.hn	2.0	2.0	
MoCA Home Base Allowance 1.1/2.0, 2.1, or 2.5	2.2	2.2	
MoCA Additional Bonded Channels (maximum 4)	N/A	0.2	May also be added to MoCA IAD base allowance
FXS	0.3	0.3	For each port (up to four)
DECT	0.5	0.5	
USB 2.0 - no load connected	0.1	0.1	
USB 3.0 - no load connected	0.2	0.1	
SATA - no load connected	0.3	N/A	
Backup battery	0.4	0.1	If battery is present during test
Bluetooth	0.5	0.1	
Z-wave	0.2	0.1	
802.15.4 for ZigBee, Thread, etc.	0.2	0.1	Per active radio, up to 2
PCIe Interface Gen 1 and 2 Base (includes first lane)	0.2	0.2	For connected PCIe interfaces only
PCIe Gen 1 and 2 Additional Lane	0.1	0.1	
PCIe Gen 3 Base (includes first lane)	0.3	0.2	For connected PCIe interfaces only
PCIe Gen 3 Additional Lane	0.25	0.1	
PCIe Gen 4 Base (includes first lane)	N/A	0.3	For connected PCIe interfaces only
PCIe Gen 4 Additional Lane	N/A	0.2	
Application Processor 5-10K DMIPS	1.0	1.0	
Application Processor > 10K DMIPS (for every additional 5K DMIPS)	0.5	0.5	
Speaker (rated at <= 10 W rms power per speaker) (maximum 2 speakers)	0.3	0.1	Allowance is per speaker (up to 2). No speaker output in the Ready State but enabled
Voice control	0.5	0.2	No active input for test in the Ready State, but enabled and sensing

5. Usage rules for establishing the maximum allowable values:

5.1 One and only one base allowance (P_{Base}) shall be used from either the IAD group, the broadband modem group, or the LNE group in Table 1.

5.2 For an IAD or a broadband modem, the WAN interface is included in the base allowance. For an LNE device all interfaces should be taken as additional allowances from Table 3: LAN Power Allowances, even if a WAN interface is explicitly defined (because LNE does not have a WAN that connects directly to the service provider network, as is the definition of WAN in this document).

5.3 For VDSL channel bonding, take an allowance from Table 2 (Allowances for Simultaneous WAN Interface).

5.4 For DOCSIS 3.0 channel bonding above 4x4, take an allowance for every four downstream channels greater than 4. For example, a 16x4 cable modem will take an additional 1.0x3=3.0W allowance for Tier 3.

5.5 Tier 3 and Tier 4 Wi-Fi allowances are based upon physical radio attributes (e.g. , center frequency and channel bandwidth). For example, the same Tier 3 allowance applies to a 5GHz radio whether it is operating with the 802.11ac protocol or the 802.11ax protocol. See the Sample Calculations in the next section for more details. A future protocol that supports a new feature and that causes a device to exceed the prescribed allowances may be eligible for consideration for a new feature allowance pursuant to Annex 3.

5.6 A device that supports more than two Wi-Fi RF chains (or spatial streams) per radio (i.e. a 2x2) can take one allowance for each RF chain greater than two for each radio. See the Sample Calculations in the next section for more details on how to take the additional RF chain allowances.

5.7 A device can take either the low-power Wi-Fi allowances or the high-power Wi-Fi allowances, but not both, to characterize a specific radio in a device. In a device with more than one concurrent radio, it is possible to have one or more radios in the low-power category and one or more radios in the high-power category.

5.8 A device that includes 802.11n supporting 256-QAM at 2.4GHz can take the "Wi-Fi IEEE 802.11n at 2.4GHz supporting 256-QAM" allowance in addition to other applicable Wi-Fi allowances.

5.9 The DOCSIS 3.1 allowances for the broadband modem or IAD are defined for DOCSIS 3.1 devices that support 2 OFDM channels at 192 MHz and 4096 QAM and up to 32 SC-QAM channels at 256 QAM simultaneously in the downstream. A device that supports more than two OFDM channels will need to be evaluated under the new features process. A DOCSIS 3.1 broadband modem or IAD cannot take any additional DOCSIS 3.0 Simultaneous WAN Interface allowances.

5.10 A device with a combination of 1GigE LAN ports, 2.5GigE LAN ports, 5GigE LAN ports, and/or 10GigE LAN ports should be tested with half the ports connected for each category of port (if any port quantity is an odd number, round the result up), such as:

- Total number of 1GigE ports / 2 rounded up

- Total number of 2.5GigE ports / 2 rounded up
- Total number of 5GigE ports / 2 rounded up
- Total number of 10GigE ports / 2 rounded up

Examples:

1. A device with four 1GigE ports and two 2.5GigE ports would be tested with two of the 1GigE ports connected and one of the 2.5GigE ports connected.

2. A device with only one 1GigE port and one 2.5GigE port would be tested with both the 1GigE and the 2.5GigE ports connected.

3. A device with two 1GigE ports, one 5GigE port, and one 10GigE port would be tested with one of the 1GigE ports and both the 5GigE and the 10GigE ports connected.

Each connected port must be connected to an end point that supports the same speed (e.g., a 10GigE port must be connected to a 10GigE end point).

The allowances for 2.5 GigE, 5 GigE, and 10 GigE ports differ depending on whether the port is connected during the test. The allowance for all 1GigE ports is the same.

5.11 An LNE device that doesn't have a designated WAN port should be tested with the highest data rate Ethernet port connected as the WAN port, and the remaining ports will be considered LAN ports and connected per 6.10. For example, an LNE device with two 10GigE ports and two 2.5GigE ports will have one 10GigE port connected as the WAN port, the remaining 10GigE port considered a LAN port and it is connected for test. One of the two 2.5GigE ports are also connected for test.

5.12 A device that supports Power over Ethernet (PoE) on the Ethernet LAN ports is also be considered a separate category for testing in accordance with ANSI/CTA-2049-B.

The following examples illustrate testing a device with PoE ports:

1. A device with three 1GigE ports (one of which supports PoE) and one 2.5GigE port would be tested with one non-PoE 1GigE port, one PoE 1GigE port, and one 2.5GigE port connected.

2. A device with eight 1GigE ports (four of which support PoE) would be tested with two 1GigE PoE ports connected and two 1GigE non-PoE ports connected.

The test client connected to a PoE port must not draw power from the unit under test. The allowances defined for the Ethernet LAN interfaces (Fast Ethernet, 1GigE, 2.5GigE, 5GigE, and 10GigE) are the same whether or not the port supports PoE.

5.13 The Application Processor (AP) allowance may be taken for devices with an application processor that is rated at > 5K DMIPS. If the processor is >10K DMIPS, the additional allowance may also be taken for every 5K DMIPS above 10K DMIPS. For example, a 10K DMIPS-rated processor would only take the initial AP allowance. A 12K DMIPS-rated processor would take the initial AP allowance (1.0 watt) and the additional AP allowance (0.5 watt) for a total of 1.5 watts. A 20K DMIPS-rated processor would take

the initial AP allowance (1.0 watt) and two times the additional AP allowance (2 x 0.5=1.0 watt) for a total of 2 watts.

5.14 To be eligible to take the speaker allowance, the speaker(s) must be enabled during the power consumption test, but no speaker output should occur during the test in the Ready State. The allowance can be taken once per speaker up to 2. Devices with more than two speakers or any speaker with an output of more than 10 watts is deemed to have primary function of audio output and is therefore not SNE.

5.15 To be eligible to take the voice control allowance, the voice control feature must be enabled during test, but the test environment and process should not include any activity (audible or manual such as a button press) that could activate the voice control.

6. Sample Calculations

6.1 **Product 1:** Integrated Access Device (IAD) with a DOCSIS 3.1 Cable WAN connection and the following LAN connections: Three 1GigE LAN ports, one 2.5GigE LAN port, dual-band Wi-Fi 6 wireless router with a 2.4 GHz 4x4 radio and 5 GHz 4x4 radio operating at 160 MHz channels. Also includes Bluetooth, two connected PCIe interfaces to the Wi-Fi chips and has an application processor operating at 7K DMIPs.

Feature	Tier 3 Allowance (watts)	Tier 4 Allowance (watts)
DOCSIS 3.1 Base Allowance	14	11
1GigE LAN ports (one connected during test)	0.6 (3 x 0.2)	0.6 (3 x 0.2)
2.5GigE LAN port active (connected during test)	2.5	2.1
Wi-Fi 2.4 GHz radio with a conducted output power of more than 200 mW per chain (up to 2x2)	1.1	1.1
Additional allowance per RF chain above 2x2 MIMO at 2.4 GHz with a conducted output power of greater than or equal to 200 mW per chain	0.4 (2 x 0.2)	0.4 (2 x 0.2)
Wi-Fi 5 GHz radio at 160 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain up to 2x2	2.6	2.6
Additional allowance per RF chain above 2x2 MIMO at 5 GHz at 160 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain	0.6 (2 x 0.3)	0.6 (2 x 0.3)
PCIe Interface Gen 1 & 2 Base (includes first lane)	0.4 (2 x 0.2)	0.4 (2 x 0.2)
Application Processor 5K-10K DMIPS	1.0	1.0

Bluetooth	0.5	0.1
Total	**23.7**	**19.9**

6.2 **Product 2:** Advanced Local Network Equipment (LNE) Tri-band Wi-Fi 6E router with two 10GigE ports, two 2.5GigE ports, a 2.4 GHz 3x3 radio, a 5 GHz 4x4 radio, and a 6 GHz 4x4 radio operating at less than 200 mW per chain. Also includes Bluetooth, an 802.15.4 radio for Zigbee, three connected PCIe interfaces to the Wi-Fi chips and has an application processor operating at 10K DMIPs.

Feature	Tier 3 Allowance (watts)	Tier 4 Allowance (watts)
Advanced LNE Base Allowance	3.2	3.2
10GigE WAN port Active (connected during test)	3.5	3.0
10GigE LAN port Active (connected during test)	3.5	3.0
2.5GigE LAN port active (connected during test)	2.5	2.1
2.5GigE LAN port (not connected during test)	0.8	0.8
Wi-Fi 2.4 GHz radio with a conducted output power of more than 200 mW per chain (up to 2x2)	1.1	1.1
Additional allowance per RF chain above 2x2 MIMO at 2.4 GHz with a conducted output power of greater than or equal to 200 mW per chain	0.2 (1 x 0.2)	0.2 (1 x 0.2)
Wi-Fi 5 GHz radio at 160 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain up to 2x2	2.6	2.6
Additional allowance per RF chain above 2x2 MIMO at 5 GHz at 160 MHz channel bandwidth with a conducted output power of greater than or equal to 200 mW per chain	0.6 (2 x 0.3)	0.6 (2 x 0.3)
Wi-Fi 6 GHz radio at 160 MHz channel bandwidth with a conducted output power of less than or equal to 200 mW per chain up to 2x2	2.0	2.0
Additional allowance per RF chain above 2x2 MIMO at 5 GHz at 160 MHz channel bandwidth with a conducted output	0.2 (2 x 0.1)	0.2 (2 x 0.1)

power of less than or equal to 200 mW per chain		
Bluetooth	0.5	0.1
802.15.4 for Zigbee, Thread, etc.	0.2	0.1
PCIe Interface Gen 1 & 2 Base (includes first lane)	0.6 (3 x 0.2)	0.6 (3 x 0.2)
Application Processor 5K-10K DMIPS	1.0	1.0
Total	**22.5**	**20.6**

ANNEX 3 – NEW FEATURES PROCESS

1. The New Features Process is intended to encourage innovation and competition by Service Provider and Vendor Signatories and also to encourage energy efficiency by design.

2. This process is intended to provide a path for Signatories to innovate and add new features, including features with no assigned allowances and features that are in the early stages of design, without being treated as in violation of Voluntary Agreement energy allowances or commitments.

3. This new features process is intended to assure that most SNE remains under the procurement commitments of the Voluntary Agreement, with sufficient transparency for appropriate allowances to be established for new features.

4. If a Service Provider Signatory deploys or a Vendor Signatory Sells SNE that includes a new feature with no allowance, and the presence of the feature causes the SNE to exceed the prescribed allowances, the Signatory will set and report an appropriate initial allowance for the power consumption of that feature when it reports the device under the Voluntary Agreement.

5. If the SNE includes a feature that does not have an allowance in the current applicable Tier (e.g. Tier 3) but is defined in the next Tier (e.g. Tier 4), the Signatory may use that allowance as a new feature allowance in lieu of invoking the new features process.

6. The initial allowance will be reported within nine months of the initial deployment or Sale of such SNE if the Signatory expects that its percentage of Procurement or Sale of such SNE will be sufficient to be reported in its next annual report.

7. The initial allowance will represent the Signatory's best estimate of the amount of energy consumed by the new feature in that particular unit. All new features, associated initial allowances, and justifications for such allowances will be submitted to the Independent Administrator together with other required testing data. The Independent Administrator shall inform the Steering Committee of the Signatory's created allowance for the new feature, except as otherwise provided in Section 7 of this Annex.

8. If the new feature is confidential and the Signatory seeks an allowance, the Signatory shall confidentially report the initial allowance, the basis for the allowance, and a written justification for its confidentiality to the Independent Administrator. The new feature may remain confidential until the feature is marketed or otherwise made public. The Signatory shall inform the Independent Administrator within thirty days of marketing or otherwise making public a previously confidential new feature. In no case may a new feature remain confidential for purposes of this agreement for longer than eighteen months from initial deployment. Once a new feature is reported as public information or the eighteen month period has elapsed, the Independent Administrator shall inform the Steering Committee of the Signatory created allowance for the new feature. Annual reports should include the total energy use of SNE that includes confidential new features, but need not identify the new feature.

9. When the information is reported to the Steering Committee, the Steering Committee shall propose appropriate allowances and effective dates when the allowances would go into effect under the processes of Voluntary Agreement. Initial allowances set by the Steering Committee will reflect the Steering Committee's best estimates of the energy consumption required for systems incorporating the new feature to meet the Voluntary Agreement levels. Initial allowances shall be

set within six months of submission, and become effective at such time as is prescribed by the Steering Committee.

10. If a Signatory includes in its report to the Independent Administrator a SNE that it has Purchased but has not yet deployed that includes a new feature with no allowance, and the presence of the feature causes the SNE to exceed the prescribed allowances, the Signatory may report a provisional Signatory created allowance until an initial allowance is submitted after deployment.

11. Allowance setting would be designed to not prejudice a variety of implementations. If a new feature is specific to one particular industry group (cable, satellite, and telephone) and its energy consumption when applied to other industry groups is undetermined, it may be adopted for application solely to that particular industry group. The process for adopting a level for that feature will apply to other industry groups when one of its Signatory members submits an allowance for that feature to the Independent Administrator.

12. Allowances established by the Steering Committee for a new feature would be publicly reported as are other such allowances under the Voluntary Agreement.

13. The Steering Committee may adopt appropriate modifications to the Test Method and/or additional rules governing the applicability of new feature allowances.

ANNEX 4, PART A – SERVICE PROVIDER SIGNATORIES

The undersigned Signatories agree to the Voluntary Agreement as Service Providers.

Altice USA, Inc. (including former Cablevision Systems Corp.)

Signature: /s/ Michael Olsen
Name: Michael Olsen
Title: SVP Legal, Altice USA, Inc.
Date: January 1, 2019

Signature: /s/ Robert Clyne, Sr.
Name: Robert Clyne, Sr.
Title: SVP-Video Engineering, Cablevision Systems Corp.
Date: April 17, 2015

AT&T Services, Inc.

Signature: /s/ Thomas Keathley
Name: Thomas Keathley
Title: Senior Vice President, Wireless Network Architecture and Design
Date: April 17, 2015

Charter Communications, Inc.

Signature: /s/ Jay Rolls
Name: Jay Rolls
Title: Senior VP & Chief Technology Officer
Date: March 17, 2015

Comcast Cable Communications, LLC

Signature: /s/ Mark Hess
Name: Mark Hess
Title: Senior Vice President
Date: March 12, 2015

Cox Communications, Inc.

Signature: /s/ Kevin T. Hart
Name: Kevin T. Hart
Title: Executive Vice President & Chief Technology Officer
Date: March 20, 2015

Frontier Communications Corporation

Signature: /s/ Steve Gable
Name: Steve Gable
Title: Executive Vice President and Chief Technology Officer
Date: October 11, 2017

Verizon Communications, Inc.

Signature:	/s/ James J. Gowen
Name:	James J. Gowen
Title:	Vice President Supply Chain Operations and Chief Sustainability Officer
Date:	April 3, 2015

ANNEX 4, Part B – VENDOR SIGNATORIES

The undersigned Signatories agree to the Voluntary Agreement as Vendors.

Actiontec Electronics, Inc.

Signature: /s/ Brian Paul
Name: Brian Paul
Title: CFO
Date: February 24, 2015

ASUSTeK Computer Inc.

Signature: /s/ Tenlong Deng
Name: Tenlong Deng
Title: Corporate Vice President
Date: February 5, 2020

eero, LLC

Signature: /s/ Nicholas S. Weaver
Name: Nicholas S. Weaver
Title: CEO
Date: June 9, 2022

Google LLC

Signature: /s/ Ajay Kamath
Name: Ajay Kamath
Title: Senior Director of Product Integrity Engineering
Date: June 10, 2022

Linksys USA Inc. f/k/a Belkin International, Inc.

Signature: /s/ Eu Chong Son
Name: Eu Chong Son
Title: Vice President of Engineering
Date: December 3, 2019

Netgear, Inc.

Signature: /s/ Andrew Kim
Name: Andrew Kim
Title: SVR Corporate Development and General Counsel
Date: April 29, 2015

Plume Design Inc.

Signature: /s/ Liem H.D. Vo
Name: Liem H.D. Vo
Title: Head of Hardware Engineering

Date: June 08, 2020

Sagemcom Broadband SAS

Signature: /s/ Ahmed Selmani
Name: Ahmed Salmani
Title: CEO, Broadband Solutions
Date: March 22, 2022

Technicolor Connected Home USA LLC d/b/a Vantiva (which acquired home networking division of CommScope, Inc. of North Carolina f/k/a ARRIS Group, Inc.)

Signature: /s/ Luis Martinez-Amago
Name: Luis Martinez-Amago
Title: President
Date: February 25, 2016

Signature: /s/ Jim Brennan
Name: Jim Brennan
Title: SVP, Supply Chain (ARRIS)
Date: February 18, 2015

Signature: /s/ William Pleasant
Name: William Pleasant
Title: VP and Deputy General Counsel (CommScope)
Date: June 10, 2019

TP-Link Corporation Limited

Signature: /s/ Derrick Wang
Name: Derrick Wang
Title: Director of Product Management

Date: August 1, 2022

Ubee Interactive, Inc.

Signature: /s/ Maria Popo
Name: Maria Popo
Title: President
Date: March 20, 2015

ANNEX 4, PART C – ENERGY ADVOCATE SIGNATORIES

The undersigned Signatory agrees to the Voluntary Agreement as an Energy Advocate.

Pacific Gas and Electric Company

Signature: /s/ David Poster
Name: David Poster
Title: Director, Energy Efficiency
Date: August 18, 2022