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FINAL STATEMENT OF REASONS

Computers, Computer Monitors, and Signage Displays Appliance Efficiency Rulemaking

California Energy Commission
Docket Number 16-AAER-02
Notice File Number Z2016-0830-07

July 2017

INTRODUCTION

Existing law requires the Commission to reduce the inefficient consumption of energy and water by prescribing efficiency standards and other cost-effective measures for appliances that require a significant amount of energy and water to operate on a statewide basis. Such standards must be technologically feasible and attainable and must not result in any added total cost to the consumer over the designed life of the appliance.

The Appliance Efficiency Regulations (Title 20, Sections 1601-1609 of the California Code of Regulations) contain definitions, test procedures, labeling requirements, and efficiency standards for state- and federally-regulated appliances. Appliance manufacturers are required to certify to the Commission that their products meet all applicable state and federal regulations pertaining to efficiency before their products can be included in the Commission's database of approved appliances to be sold or offered for sale within California. Appliance energy efficiency is identified as a key to achieving the greenhouse gas (GHG) emission reduction goals of Assembly Bill 32 (Núñez, Chapter 488, Statutes of 2006) (AB 32), as well as the recommendations contained in the California Air Resources Board's Climate Change Scoping Plan.

PROCEDURAL HISTORY

On July 1, 2016, the Commission published a Standardized Regulatory Impact Assessment (SRIA) analyzing the potential economic effects of the proposed regulations and, on August 26, 2016, published a Revised SRIA in response to comments received. On September 9, 2016, the Notice of Proposed Action (NOPA) for this rulemaking was published, along with the Express Terms of the proposed regulations, the staff report *Final Analysis of Computers, Computer Monitors, and Signage Displays*, and an Initial Statement of Reasons (ISOR) describing the rationale for the proposal. On September 14, 2016, the Commission published an Initial Study and Proposed Negative Declaration for Amendments to the Appliance Efficiency Standards (Computers, Computer Monitors, and Signage Displays) and a Notice of Availability, concluding that the proposed regulations would result in energy savings and reductions in statewide greenhouse gas emissions, and there would be no significant adverse impacts to the environment

as a result. On October 10, 2016, the Commission held a Lead Commissioner's Meeting to hear comments on the proposed regulations. On November 1, 2016 the Commission issued a notice postponing the originally scheduled public hearing. This notice was posted on the Energy Commission's website and distributed to every person and entity on the Energy Commission's Appliances list server and to every person who had requested notice of such matters. On November 23, 2016 the Commission published a Notice of Availability of 15-Day Language, which included proposed changes to the Express Terms (Notice). On December 14, 2016, after considering all comments received, the Commission unanimously adopted the Initial Study and Negative Declaration and the proposed regulations.

At the December 14, 2016 adoption hearing, the Commission agreed to look into concerns raised by ITI regarding the automatic brightness control test procedure. After investigating the issue, the Commission determined that more comprehensive research and data collection were needed in order to develop a reliable test procedure; therefore, the Commission decided to remove this requirement from the regulations and issued a Notice of Availability of Additional 15-Day Language on April 24, 2017, which included this and a few other clarifying changes. On May 10, 2017, the Commission adopted the regulations with these final changes.

Local Mandate Determination – Government Code Sections 11346.5(a)(5); 11346.9(a)(2)

The Energy Commission has determined that these regulations will not impose a mandate on local agencies or school districts.

Consideration Of Alternative Proposals – Government Code Section 11346.9(a)(4)

The Energy Commission has determined that no alternative would be more effective in carrying out the purpose for which the regulations are proposed, would be as effective and less burdensome to affected private persons than the adopted regulations, or would be more cost effective to affected private persons and equally effective in implementing the statutory policy or other provision of law.

Staff considered all alternative proposals presented to develop the final proposed regulatory language that maximized energy efficiency and cost savings. As discussed on page 1 of the revised Standardized Regulatory Impact Assessment (SRIA), the Energy Commission used a macroeconomic model to estimate the effects of proposed and alternative regulations within the California economy. Three scenarios were modeled and evaluated (more stringent, proposed, and less stringent). The adopted express terms reflect the stringency level originally proposed, with some minor changes in response to stakeholder comment.

The more stringent alternative required greater energy savings from desktops and monitors (higher efficiency requirements for the other product categories were considered to be

technically infeasible). Based on the assumed direct costs and electricity savings estimated in the SRIA, the more stringent alternative had a considerably lower benefit-cost ratio than the proposed standard. The benefit-cost ratio for the more stringent alternative ranged from 4.3 to 4.9, whereas the benefit cost-ratio for the proposal ranged from 5.3 to 6.0. This is due primarily to a doubling in the incremental compliance costs for regulated monitors that would in turn deliver only a modest level of electricity savings. The additional savings for desktops from the higher stringency standard is also very modest, although the incremental cost for desktops is also small ($2/unit).

The macroeconomic results also suggested that the more stringent alternative delivered lower economy-wide benefits than the proposed standard, even though it still provided net direct and economy-wide benefits relative to the baseline.

The higher stringency alternative was rejected because of its significantly lower cost-effectiveness. The additional energy savings from a stricter standard would have been very modest, but the costs incurred, especially for monitor compliance, are much higher, resulting in fewer savings to consumers and a lesser economic benefit to the state.

The lower stringency alternative provided considerably lower energy savings for desktops and monitors. The incremental cost for these two product categories was also substantially lower. The benefit-cost ratio of the low stringency alternative (8.4-9.5) was substantially higher than the proposal. However, the aggregate net benefits were much smaller. The macroeconomic impacts of the less stringent proposal suggested that this regulatory option would generate considerably less aggregate economic activity than the proposed regulatory standard. The cumulative impact on jobs was a negligible increase over the analysis period.

The lower stringency alternative was rejected because the energy savings were unacceptably low given the Energy Commission's mandate to reduce the wasteful consumption of energy statewide through cost-effective and technically feasible standards. Even though the benefit-cost ratio was higher than the proposed standard, the Energy Commission's objectives of significantly reducing energy consumption would not have been met.

Discussion of Proposed Alternatives that would Lessen the Adverse Economic Impact on Small Businesses – Government Code Section 11346.9(a)(5)

The proposed regulations will not have a significant adverse economic impact on small businesses. Small businesses, like other businesses that use computers and monitors, are expected to benefit from the anticipated electricity savings resulting from the efficiency standards. Like other business enterprises, small businesses will also incur an additional cost when purchasing products covered under the standard. The net effect is expected to be an overall

savings in electricity spending. The proposal is not expected to result in savings or costs that disproportionately impact small businesses.

Nevertheless, the testing costs and costs of compliance may have a larger impact on small businesses who manufacture a small volume of computers. Therefore, the Energy Commission included an exemption in the regulations for small businesses that manufacture products covered by the proposal below a certain quantity. Entities with annual gross revenues not exceeding $2 million are considered small volume manufacturers and, under the original 45-day language, were exempted from most of the requirements of the regulations for any basic model that they manufacture in quantities of 40 units or fewer. In comments on the 45-day language, one commenter requested that small volume manufacturers be exempted from the regulations regardless of the number of units sold. In response to these comments, the Energy Commission expanded the exemption in 15-day language to 50 units of each basic model produced, and removed the cap for small-scale servers and notebooks.

It costs approximately $600 to test a computer in accordance with these regulations. Establishing an exemption for sales of 50 units or fewer ensures that the requirement to test is not cost prohibitive and that such costs do not outweigh the benefit of improved energy efficiency. The exemption for small volume manufacturers was modeled after the U.S. Department of Energy exemptions and based on: California investor-owned utilities estimates of testing costs through outreach to ENERGY STAR®-certified laboratories (roughly $600 per test); a combination of assumed overhead costs and net revenue for a small business; and the number of units that would need to be sold for the costs of testing to justify the estimated energy savings to the consumer from the proposed standards. Small volume manufacturers would still be required to comply with the no-cost power management requirements. This approach ensures an appropriate balancing of cost-effective energy efficiency gains from the regulations and costs to small businesses.

The specific benefits anticipated by the proposed regulations include achieving energy efficiency gains with regard to computers and computer monitors. Overall, these regulations help protect public health and safety and the environment by saving approximately 1,636 gigawatt-hours per year from the computer standards, calculated using the Energy Star dataset as a baseline, resulting in greenhouse gas emission reductions of 0.513 million metric tons of carbon dioxide equivalent per year and saving consumers about $262 million in electricity bills after the stock turnover. Regulating computer monitors will save about 696 gigawatt hours per year statewide, will result in greenhouse gas emission reductions of 0.218 million metric tons of carbon dioxide, and will save about $111 million after existing stock is replaced. These regulations combined will benefit businesses and consumers by reducing electricity bills by $373 million per year.

<u>Studies, Reports, and Documents Relied Upon</u> - Government Code Section 11346.9(a)(1); 11347.1

Integral stakeholder input received after 45-Day comment period, various stakeholders, November 23, 2016, was added as a document relied upon after publication of the Initial Statement of Reasons. Its addition was noticed in the Notice of Availability of 15-Day Language published on November 23, 2016, and was made available for public review during the 15-day public comment period.

<u>Incorporation by Reference</u> – Title 1, Cal. Code of Regulations, §20(c)

Ecma International Standard ECMA-383 (December 2010) was added as a document incorporated by reference after publication of 45-day language. All documents incorporated by reference were made available upon request for viewing at the Energy Commission and were also reasonably available from a specified source, as discussed below. In addition, the express terms specify how a copy of the documents may be obtained.

In total, these regulations incorporate by reference 16 documents, which range from 3 pages long up to approximately 4,017 pages, for a total of 9,532 pages for all the referenced documents combined. It would not be possible to publish the full text of these documents into the regulations given the volume of technical data and copyright issues. In addition to the sheer number and length of documents, many of them are protected by copyright, thereby impeding the ability to publish them as part of the regulations from both a practical and legal basis. Attempting to publish these documents in full in the California Code of Regulations would be cumbersome, unduly expensive, and otherwise impractical, if not legally impossible. Identifying these types of industry technical standards as documents incorporated by reference is consistent with the types of information currently incorporated by reference in Title 20 and the practice of the U.S. Department of Energy for federally-regulated products.

Pursuant to California Code of Regulations, Title 1, Section 20, all of these documents were available for review at the Commission during the rulemaking proceeding and will remain available for as long as the regulations are effective, and are also available directly from the publishing entities. All available contact information, including internet addresses, physical addresses, and phone numbers for these entities has been provided where possible. Four of the listed documents are available for download from the Commission's website for this proceeding. The other 12 documents, however, are copyrighted and copies cannot be provided directly by the Commission without violating the documents' terms of use.

In this rulemaking, the affected public consists of manufacturers of computers and computer monitors, and test laboratories that are hired by these entities to conduct the required testing. Manufacturers of computers would only need to purchase those documents that apply to

computers and manufacturers of computer monitors would similarly only have to purchase the documents related to computer monitors. Additionally, many of these companies likely already have the required documents and, if not, these documents would only need to be purchased once no matter how many models the manufacturers would be testing and certifying to the Commission's database. Therefore, the Commission has determined that the cost to obtain these documents is nominal for the entities that are subject to these regulations. Because all of the documents are available for viewing at the Commission, copies of 10 of the documents may be obtained for free, and the fee for obtaining copies of the remainder is a nominal one-time expense that can be easily absorbed by the entities being regulated, the Commission concludes that these documents are reasonably available to the affected public in conformance with California Code of Regulations, Title 1, Section 20(c). The specific details concerning the length and availability of each of the documents are discussed below.

ADOBE SYSTEMS INCORPORATED
Copies available from:
Adobe Systems Incorporated
Corporate Headquarters
345 Park Avenue
San Jose, CA 95110-2704
(408) 536-6000
http://www.adobe.com

A. *Adobe RGB (1998) Color Image Encoding Version 2005-05 (May 2005).*

This document is 20 pages, copyright protected, and is available for free from Adobe at the address listed above and https://www.adobe.com/digitalimag/pdfs/AdobeRGB1998.pdf.

ECOVA
Copies available from:
Plug Load Solutions by Ecova
www.plugloadsolutions.com
Phone: (971) 201-4180

B. *Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies Revision 6.7 (March 1, 2014)*

This document is 36 pages long and is available free online from the Energy Commission's docket as well as from Ecova at the address listed above and https://www.plugloadsolutions.com/docs/collatrl/print/Generalized_Internal_Power_Supply_Efficiency_Test_Protocol_R6.7.pdf.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE):

Copies available from:

IEEE (TechStreet)
Publications Office
10662 Los Vaqueros Circle
PO Box 3014
Los Alamitos, CA 90720-1264
http://www.techstreet.com/ieee
http://standards.ieee.org

C. IEEE 802.3az-2010. IEEE Standard for Information technology--Local and metropolitan area networks--Specific requirements--Part 3: CSMA/CD Access Method and Physical Layer Specifications Amendment 5: Media Access Control Parameters, Physical Layers, and Management Parameters for Energy-Efficient Ethernet

This document is 272 pages, copyright protected, and is available for $300 from IEEE (TechStreet) at the address listed above and http://www.techstreet.com/ieee/standards/ieee-802-3az-2010?gateway_code=ieee&vendor_id=4270&product_id=1760546.

D. IEEE 802.3-2015. IEEE Standard for Ethernet

This document is 4,017 pages in total, copyright protected, and is available for free from IEEE at the address listed above and http://standards.ieee.org/getieee802/download/802.3-2015.zip.

E. IEEE 802.11-2012. IEEE Standard for Wireless LANs

This document is 2,793 pages, copyright protected, and is available for free from IEEE at the address listed above and http://standards.ieee.org/getieee802/download/802.11-2012.pdf.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC):

Copies available from:

International Electrotechnical Commission
3, Rue de Varembé
P.O. Box 131 CH – 1211 Geneva 20
Switzerland
http://www.iec.ch
Phone: +41 22 919 02 11
Fax: +41 22 919 03 00

F. IEC 60297-3-101:2004. Mechanical structures for electronic equipment–Dimensions of mechanical structures of the 482,6 mm (19 in) series–Part 3-101: Subracks and associated plug-in units

This document is 45 pages, copyright protected, and is available for 140 Swiss Francs at the address for IEC listed above and at https://webstore.iec.ch/publication/1284.

G. IEC 61966 2-1:1999. Multimedia systems and equipment–Colour measurement and management. Part 2-1: Colour management–Default RGB colour space–sRGB

This document is 51 pages, copyright protected, and is available for 170 Swiss francs at the address for IEC listed above and at https://webstore.iec.ch/publication/6169.

H. IEC 62087: 2011. Methods of measurement for the power consumption of audio, video and related equipment

This document is 102 pages, copyright protected, and is available in CD-ROM format for 320 Swiss francs at the address for IEC listed above and at https://webstore.iec.ch/publication/6448.

I. IEC 62301:2011. Household electrical appliances – Measurement of standby power

This document is 87 pages, copyright protected, and is available for 240 Swiss francs at the address for IEC listed above and at https://webstore.iec.ch/publication/6789.

J. IEC 62623:2012. Desktop and notebook computers – Measurement of energy consumption

This document is 93 pages, copyright protected, and is available for 240 Swiss francs at the address for IEC listed above and https://webstore.iec.ch/publication/7271.

UNIFIED EXTENSIBLE FIRMWARE INTERFACE FORUM:

Copies available from:

UEFI Forum Administration
3855 SW 153rd Drive
Beaverton, OR 97003 USA
http://www.uefi.org
Phone: +1 503-619-0864
Fax: +1 503-644-6708

*K. Advanced Configuration and Power Interface Specification Revision 5.0 (
December 6, 2011)*

This document is 958 pages, copyright protected, and available for free from UEFI Forum at the address listed above and http://uefi.org/sites/default/files/resources/ACPI_5.pdf.

L. Advanced Configuration and Power Interface Specification Revision 5.0 Errata A (November 13, 2013).

This document is 956 pages, copyright protected, and available for free from UEFI Forum at the address listed above and http://uefi.org/sites/default/files/resources/ACPI_5_Errata_A.pdf

UNITED STATES DEPARTMENT OF ENERGY:

Copies available from:

US DOE
1000 Independence Ave. SW
Washington DC 20585
202-586-5000
www.energy.gov

M. International Efficiency Marking Protocol for External Power Supplies Version 3.0 (September 2013).

This document is 3 pages and is available for free online from the Energy Commission docket as well as from U.S. DOE at the address listed above and https://www.regulations.gov/contentStreamer?documentId=EERE-2008-BT-STD-0005-0218&contentType=pdf.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY – ENERGY STAR:

Copies available from:

US Environmental Protection Agency
Climate Protection Partnership
ENERGY STAR Programs Hotline & Distribution
(MS-6202J)
1200 Pennsylvania Ave NW
Washington, DC 20460
www.energystar.gov

N. ENERGY STAR Program Requirements for Computers, subparts *Eligibility Criteria Version 6.1 (Rev. March-2016)* and *Final Test Method (Rev. March-2016).*

This document is 35 pages and is available for free online from the Energy Commission docket as well as from Energy Star at the address listed above and https://www.energystar.gov/sites/default/files/Version%206.1%20Computers%20Program%20Requirements%20%28Rev.March-2016%29_0.pdf.

O. ENERGY STAR Program Requirements for Displays, subpart *Final Test Method (Rev. Sep-2015).*

This document is 26 pages and is available for free online from the Energy Commission docket as well as from Energy Star at the address listed above and https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Version%207.0%20Program%20Requirements_1.pdf.

P. Ecma International Standard ECMA-383 (December 2010)

This document is 38 pages, copyright protected, and available for free from Ecma at the address listed previously for Ecma and https://www.ecma-international.org/publications/files/ECMA-ST/ECMA-383.pdf.

Correction of typographical error

After the regulations were finalized and adopted, staff noticed a typographical error in Section 1606, Table X that has been corrected in the final text submitted with the rulemaking package. Section 1605.3(v), Table V-8, of the regulations specifies the allowance provided for a wired Ethernet or Fiber Card with a transmit rate of 10 Gb/s or greater. Table X, which specifies what information must be provided to the Energy Commission to show compliance with the standard, inadvertently referenced this as 10 GB/s. The final text has been corrected to show the accurate Gb/s reference.

UPDATE OF THE INITIAL STATEMENT OF REASONS

Government Code Section 11346.9(a)(1) requires the FSOR to include an update of the information contained in the ISOR. Other than the changes noted below, no other changes to the ISOR are necessary. Those items not addressed below are incorporated by reference.

A summary of the changes proposed in 15-Day and Additional 15-Day language is provided below. Following the summary, a detailed discussion of each individual change is provided.

1. Changing definitions of "add-in card," "digital cinema initiative (DCI)-P3," "discrete GPU," "high expandability computer," "KVM/KMM," "mobile workstation," and "very high performance monitor" to add criteria to meet the definition or make clarifications regarding what types of products qualify under these definitions.
2. Adding new definitions for "first discrete GPU" and "medical computer monitor" to clarify applicable adders and exemptions for these products in the standards.
3. Adding an alternative mode weighting for computers with "remote wake" features manufactured before July 1, 2021.
4. Adding a weighting calculation for workstations, small-scale servers, high-expandability computers, and mobile workstations for purposes of determining the annual energy consumption of these products.
5. Creating additional tiers of interface types and scores for Thunderbolt controllers in Table V-1.
6. Adding a minimum gigabyte requirement to memory interfaces receiving an expandability score in Table V-1.
7. Eliminating the modified automatic brightness control test procedure for computers with integrated displays, leaving the ENERGY STAR test procedure in place for these products.
8. Clarifying the configuration of high expandability computers, mobile gaming systems, and mobile workstations in the computer test procedure.
9. Requiring the computer power supply's median power factor to be tested in short-idle instead of long-idle.
10. Deleting an obsolete requirement for televisions and signage displays manufactured before January 1, 2011.
11. Allowing computer monitors to add together allowances for different features.
12. Requiring computer monitors to consume less than or equal to 1.2 watts in sleep and off mode combined and deleting an alternative subset of this requirement.
13. Requiring touch functionality to be enabled in computer monitors claiming touch allowances.
14. Exempting medical computer monitors from testing and efficiency standards requirements.
15. Addressing zero thin clients in power management requirements for computers.

16. Aligning effective dates for the adders for computers with integrated displays with the effective dates for computer monitors.
17. Clarifications to ensure that only one adder is claimed per component in the computer.
18. Adjusting the adder for high bandwidth system memory to add precision to ensure that only computers needing the adder will be able to claim it.
19. Adjusting the exemptions for small volume manufacturers to ensure that they remain cost-effective to consumers.
20. Changes to the data submittal requirements in Table X to match the updates in 15-day language and to add fields that are necessary for verifying compliance.
21. Other minor changes to correct grammatical or typographical errors, or to clarify text.

Section 1602. Definitions.

"Add-in card" means a removable device that can be installed in a computer peripheral component interconnect (PCI) or other slot. Add-in card does not include hard-disks, system memory, ~~or~~ removable devices that are intended to operate outside of a computer chassis, or other components that are listed in Table V-8. It also does not include cards, such as riser cards, that split~~,~~ or physically extend~~, or convert a slot type~~ a motherboard slot.

Add-in cards receive an additional power allowance called "adder" and therefore its definition has to be precise in order to clarify which components receive the "Add-in card" adder. In response to comments received, this definition was modified in the 15-day language to clarify that an individual piece of computer hardware cannot receive more than one adder.

Further modifications were made to clarify that riser cards, a type of add-in card that makes physical changes to a port, are excluded from receiving this adder because they don't consume energy. However, other types of cards that convert a slot (for example, PCIe to USB, PCIe to Ethernet slot, PCIe to SATA slots/RAID cards), which have unique power delivery requirements, receive the add-in card adder.

"Computer monitor" means an analog or digital device of diagonal screen size greater than or equal to 17 inches and less than or equal to 61 inches, that has a pixel density of greater than 5000 pixels per square inch, and that is designed primarily for the display of computer generated signals ~~not marketed for use as a television~~ for viewing by one person in a desk-based environment. A computer monitor is composed of a display screen and associated electronics.

A computer monitor does not include:

> (1) Displays with integrated or replaceable batteries designed to support primary operation without AC mains or external DC power, (e.g., electronic readers, mobile phones, ~~portable~~ tablets, battery-powered digital picture frames)~~.~~; or

(2) A television or a signage display.

Changes were made to add "diagonal screen" to clarify the measurement of the size of the monitor, to remove the word "portable" modifying tablets since a "tablet" is defined in these regulations as something portable, making the modifier unnecessary, and to add an "or" to clarify that neither type of product in the list is a computer monitor. These changes were made in 15-day language based on stakeholder comments to provide additional clarity to the definition of a "computer monitor," which is the subject of these efficiency regulations.

"Computer off mode" means an ACPI System Level S5 state.

This change was made to clarify that this definition refers to the computer's off mode and not to the monitor's off-mode. Because the definition needed to be re-alphabetized as a result of the name change, the entire phrase was double underlined in 15-day language to show that it moved, even though the only substantive change was to add "computer" before the term "off mode".

"Computer sleep mode" means a low-power mode that the computer enters automatically after a period of inactivity or by manual selection. A computer with sleep capability can quickly "wake" in response to network connections or user interface devices with a latency of less than or equal to five seconds from initiation of the wake event to the system becoming fully usable, including rendering of display. For systems where ACPI standards are applicable, computer sleep mode is ACPI System Level S3 (suspend to RAM) state. Some computers utilize an alternative sleep mode to ACPI S3.

This change was made to clarify that this definition is for the computer's sleep mode and not for the monitor's sleep mode. Because the definition needed to be re-alphabetized as a result of the name change, the entire phrase was double underlined in 15-day language to show that it moved, even though the only change was to add "computer" before the term "sleep mode".

"Digital Cinema Initiative (DCI)-P3" means a red-green-blue (RGB) color space that covers 41.7% of the CIELUV color space that features the widest color gamut of all of the emulated color spaces and that is wider than standard RGB (sRGB).

Changes were made to add specificity to the color gamut necessary for a computer monitor to meet the DCI-P3 requirement. This change was made in 15-day language in response to stakeholder comments suggesting clarifications to the definition that would reference an objective, technical requirement for color gamut rather than a subjective description.

"Discrete Graphics" or "Discrete Graphics GPU" means a graphics processing unit (GPU) with a local memory controller interface and local graphics-specific memory. Discrete GPUs are not packaged on the same die or substrate as the CPU.

Changes were made to simplify the language by harmonizing the name for discrete graphics processing unit (discrete GPU) and to remove a redundant word "graphics" in front of GPU (graphics processing unit).

Since discrete GPUs receive more energy attributions than integrated graphics, a change was made to emphasize that discrete GPU must be on a separate package from the CPU in order to prevent integrated GPUs to be qualified as a discrete GPU. This change was made in 15-day language in response to a comment received.

"First Discrete GPU" means the computer's discrete GPU that has the highest frame buffer bandwidth measured in gigabytes per second (GB/s).

Discrete GPU cards receive additional energy allowances with "first discrete GPU" receiving a higher allowance than other GPU cards. Therefore a definition was added in 15-day language to clarify the distinction between the first discrete GPU and other discrete GPUs.

"Frame buffer bandwidth" means the amount of data that is processed per second by a discrete GPU, ~~the rate at which data can be read from or stored within discrete, integrated, or hybrid graphics,~~ expressed in gigabytes per second (GB/s). It is calculated based on Ecma International Standard ECMA-383 (December 2010).

Changes were made in 15-day language to this definition for further clarification and to incorporate an international standard on the calculation method for the frame buffer bandwidth to ensure that everyone is calculating it the same way. These changes were made in response to comments received.

"Game console" means a device that is designed and marketed primarily for video game usage and that the consumer does not have the ability to add or remove system memory or a central processing unit.

This change was made in 15-day language in response to a comment that several specific console models in different configurations may be offered at the point of sale by the manufacturer, and clarification was needed to specify that the limitation of "… not have the ability to add or remove system memory or a central processing unit" applies only to attempted modifications by the consumer rather than changes made by the manufacturer or the retailer before the point of sale.

"Graphics processing unit (GPU)" means an integrated circuit~~, separate from the CPU,~~ designed to accelerate the rendering of two-dimensional or three-dimensional content to displays. A GPU may be either integrated with the CPU or discrete.

The context of the phrase "separate from the CPU" was to emphasize that GPU is not the same as the computer's CPU. However, the Energy Commission received a comment that this is

confusing because the same definition also suggests that a "GPU may be … integrated with the CPU". Removing this phrase eliminates the confusion without changing the meaning.

 "High expandability computer" means a computer with any of the following:

>   (1)   An expandability score of more than 690;
>
>   (2)   If the computer is manufactured before January 1, 2020, a power supply of 600 watts or greater and either:
>   (i) a first discrete GPU ~~discrete or integrated graphics~~ with a frame buffer bandwidth of 400 gigabytes per second (GB/s) or greater; or
>   (ii) a total of 8 gigabytes or more of system memory with a bandwidth of 432 GB/s or more and an integrated GPU.
>
>   (3)   If the computer is manufactured on or after January 1, 2020, a power supply of 600 watts or greater and either:
>   (i) a first discrete GPU ~~discrete or integrated graphics~~ with a frame buffer bandwidth of 600 gigabytes per second (GB/s) or greater; or
>   (ii) a total of 8 gigabytes or more of system memory with a bandwidth of 632 GB/s or more and an integrated GPU.

"High expandability computers" are exempt from the annual energy consumption limits of desktop computers. To prevent this category from becoming a loophole for all desktop computers, the Energy Commission made changes to the definition to ensure that only computers that meet the intended category are exempt.

All desktop computers have integrated graphics, and they share the system memory for both the graphics and other system functions. In response to comments received, to prevent unintentionally qualifying a desktop computer as high-expandability, changes were made to expand the qualification criteria for when a desktop computer with integrated graphics would qualify as a "high expandability computer". Therefore integrated graphics were removed from the criteria "i" and criteria "ii" was formed for the integrated graphics.

A minimum gigabytes capacity for high-bandwidth memory is added to the criteria to prevent unintended use of this provision for other smaller high bandwidth memories in the system such as cache memories.

The provision for the discrete GPU is modified to specify that the specifications of the first discrete GPU are used for determining the qualification if a computer has multiple discrete GPUs.

"Hybrid graphics" means a functionality that ~~allows~~ automatically places the system's first ~~D~~discrete GPU~~Graphics~~ ~~to enter~~ in a low-power state when not required in favor of an integrated GPU~~Integrated Graphics~~. This functionality allows graphics rendering by lower power and lower capability integrated GPUs while on battery or when the output graphics are not overly complex while then allowing the more power consumptive but more capable discrete GPU to provide rendering capability when the system requires it.

In response to a comment received, changes were made to clarify that switching from discrete graphics to integrated graphics in a low-power state is done automatically. Also, minor changes are made to maintain the consistency of the names for discrete and integrated GPUs.

"Integrated ~~graphics~~GPU" means a graphics solution that does not contain ~~discrete graphics~~a discrete GPU.

Minor changes were made in 15-day language to maintain the consistency of the names for discrete and integrated GPUs.

"Keyboard, video, and mouse (KVM)" or "keyboard, mouse, and monitor (KMM)" means a computer monitor that can operate with a KVM switch and is designed to be used in a server rack for use solely in a data center.

Changes were made to add a criterion for being a KVM or KMM. This change was made in 15-day language in response to stakeholder comments suggesting the added clarification. Because KVMs and KMMs are exempted from many of the requirements of the regulations, the extra criterion is necessary to ensure that the exemption is limited only to those types of monitors that were intended to be included under it.

"Limited capability operating system" means an operating system that performs basic operations and that meets all of the following criteria~~does not~~:

> (1) ~~Have~~ Does not have automatic power management features;
>
> (2) ~~Support~~ Does not support USB devices;
>
> (3) ~~Have~~ Does not have ~~Graphical User Interface (~~GUI~~)~~; ~~or~~ and
>
> (4) ~~Support~~Does not support multiple user profiles or distinguish between users.

Minor changes were made in 15-day language to clarify the intent in this language and to show that limited capability operating systems must meet all four criteria and not just one.

"Main storage" means the largest capacity non-volatile storage device present in the system.

The name for this definition changed from "primary storage" to "main storage" to prevent confusion because "primary storage" sometimes refers to the storage that the operating system is stored on, rather than the largest storage device in the computer. Because the definition needed to be realphabetized as a result of the name change, the entire phrase was double underlined in 15-day language to show that it moved.

"Medical computer monitor" means a computer monitor that meets the definition of a device contained in Section 210(h) of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. § 321(h)) and is listed and approved as such by the U.S. Food and Drug Administration.

This definition was added in 15-day language based on stakeholder comments that noted there was no definition for medical computer monitors, which are exempt from the testing and efficiency requirements of the regulations. This language matches similar exemptions for medical products found in federal appliance standards for those other products.

The changes to the original express terms also establish a status conferred situation for medical computer monitors that are determined to be medical devices by the United States Food and Drug Administration (FDA) pursuant to section 513 of the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 360c). Under our regulations, these devices are exempt from section 1605.3(v)(4) and the testing procedures contained in section 1604(v)(4), but will still be required to comply with the certification requirements in section 1606 and the marking requirements contained in section 1607. The FDA has expertise in designating devices as medical devices, and the Energy Commission has determined that it is reasonable to rely on their expertise to identify what devices should qualify for this exemption.

"Mobile gaming system" means a computer that is primarily used for gaming and that is designed specifically for portability and to be operated for extended periods both with and without a direct connection to an AC mains power source. A mobile gaming system is sold with an integrated display and a physical keyboard, and has all of the following criteria:

1) ~~Discrete video card~~First discrete GPU with frame buffer bandwidth of 128 gigabytes per second or greater;
2) System memory of 16 gigabytes or more;
3) An external power supply with a nameplate output power ~~AC adaptor size~~ of 150 watts or greater; and
4) Total battery capacity of 90 watt-hours or greater.

Minor changes were made in 15-day language per comments received for clarity, consistency, and accuracy.

"Mobile workstation" means a high-performance, single-user computer primarily used for graphics, computer-aided design (CAD), software development, financial, or scientific applications, among other computation intensive tasks, excluding game play, and that is designed

specifically for portability and to be operated for extended periods of time either with or without a direct connection to an external power source. Mobile workstations utilize an integrated display and are capable of operation on an integrated battery. A mobile workstation may use an external power supply and have an integrated keyboard and pointing device. In addition, a mobile workstation must meet all of the following criteria:

> (1) Has a mean time between failures (MTBF) of at least 13,000 hours;

> (2) Has qualified or is currently being reviewed for qualification by two or more independent software vendor (ISV) product certifications;

> (3) Has either:

>> (i) ~~a~~At least one ~~integrated or~~ discrete GPU ~~graphics processing unit~~ with frame buffer bandwidth of ~~134~~ 96 gigabytes per second or greater; or

>> (ii) A total of 4 gigabytes or more of system memory with a bandwidth of 134 gigabytes per second or greater and an integrated GPU;

> (4) Supports the inclusion of three or more internal storage devices; and

> (5) Supports at least 32 gigabytes of system memory.

Changes were made to maintain the consistency for the discrete GPU and integrated GPU names. Also, frame buffer bandwidth for discrete GPU was reduced in 15-day language per comments received during the 45-day comment period. The limits for the integrated GPU's bandwidth and discrete GPU's frame buffer bandwidth are justified per market trend analysis for mobile workstations.

~~"Off mode" means an ACPI System Level S5 state.~~

The name changed to "computer off mode" and was realphabetized. This change was made to clarify that this definition is for computer's off mode and not for monitor's off-mode.

~~"Primary storage" means the largest capacity non-volatile storage device present in the system.~~

The name for this definition changed from "primary storage" to "main storage" to prevent confusion because "primary storage" is typically referred to the storage that the operating system is stored on. Because the definition needed to be re-alphabetized as a result of the name change, the entire phrase was double struck-out in the 15-day language to show that it moved even though there were no other substantive changes to the definition.

"Short-idle mode" means a state where the computer has reached an idle condition five minutes after operating system boot, after completing an active workload, or after resuming from

computer sleep mode, and the primary computer display is on and the computer remains in the working mode ACPI G0 (S0).

This change was made to clarify that in this definition "sleep mode" refers to the computer's sleep mode and not the monitor's sleep mode.

~~"Sleep mode" means a low-power mode that the computer enters automatically after a period of inactivity or by manual selection. A computer with sleep capability can quickly "wake" in response to network connections or user interface devices with a latency of less than or equal to five seconds from initiation of the wake event to the system becoming fully usable, including rendering of display. For systems where ACPI standards are applicable, sleep mode is ACPI System Level S3 (suspend to RAM) state. Some computers utilize an alternative sleep mode to ACPI S3.~~

This change was made to clarify that in this definition "sleep mode" refers to the computer's sleep mode and not the monitor's sleep mode. Because the definition needed to be realphabetized as a result of the name change, the entire phrase was double struck-out in the 15-day language to show that it moved, even though there were no other substantive changes to the definition.

"Very high performance monitor~~s~~" means a computer monitor that meets all of the following criteria:

> (1) Has a diagonal screen size of 27 inches or greater;
>
> (2) Has a native resolution equal to or greater than either 3840x2160 pixels or 8.29 Megapixels; ~~and~~
>
> (3) Has a color space greater than 99 percent of defined Adobe RGB color or greater than 99 percent of Digital Cinema Initiative (DCI)-P3 colors~~.~~; and
>
> (4) Has a contrast ratio of at least 60:1 measured at a horizontal viewing angle of at least 85°, with or without a screen cover glass.

Minor clarifying changes were made to this definition in the 15-day language based on stakeholder feedback. In addition, the Commission added a requirement for very high performance monitors to have a high contrast ratio, based on stakeholder comments, to further distinguish these products from regular monitors. Very high performance monitors are exempt from the efficiency standards in the regulations, so it was necessary to limit that exemption to only those products that were intended to be excluded from the regulations.

"Workstation" means a computer used for graphics, computer-aided design (CAD), software development, financial, or scientific applications, among other computation intensive tasks. A workstation covered by this specification must meet the following criteria:

(1) Product as shipped does not support altering frequency or voltage beyond the computer processing unit and GPU manufacturers' operating specifications;

(2) Has system hardware that supports error-correcting code (ECC) that detects and corrects errors with dedicated circuitry on and across the CPU, interconnect, and system memory; and

(3) Meets two or more of the following criteria:

(A)   Supports one or more discrete GPU~~graphic~~ or discrete compute accelerators.

(B) Supports four or more lanes of PCI-express, other than discrete GPU ~~graphics~~, connected to accessory expansion slots or ports where each lane has a bandwidth of 8 gigabits~~ytes~~ per second (Gb~~B~~/s) or more.

(C)   Provides multi-processor support for two or more physically separate processor packages or sockets. This requirement cannot be met with support for a single multi-core processor.

(D)   Has qualified or is currently being reviewed for qualification by two or more independent software vendor (ISV) product certifications.

Changes were made to maintain consistency when referring to discrete GPU. Also, a typographical error for bandwidth's unit is corrected to gigabits per second.

Additional documents incorporated by reference include:

EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION (ECMA)

Ecma International Standard ECMA-383 (2010)	Measuring the Energy Consumption of Personal Computing Products, 3rd edition (December 2010)
Copies available from:	ECMA International Rue du Rhone 114 – CH – 1204 Geneva Tel: +41 22 849 6000 Fax: +41 22 849 6001 http://www.ecma-international.org/publications/standards/Categories_to_be_used_with_Ecma-383.htm http://www.ecma-international.org/publications/files/ECMA-ST/ECMA-383.pdf

The changes in the definition to "frame buffer bandwidth" include incorporation of an ECMA standard; thus, the standard was added in 15-day language to the documents incorporated by reference.

IEC 61966-2-1:1999	Multimedia systems and equipment–Colour measurement and management. Part 2-1: Colour management - Default RGB colour space - sRGB

Copies available from:	International Electrotechnical Commission
	3, Rue de Varembé
	P.O. Box 131 CH – 1211 Geneva 20
	Switzerland
	http://www.iec.ch
	Phone: +41 22 919 02 11
	Fax: +41 22 919 03 00

Changes were made in 15-day language to correct a typographical error by adding a hyphen in the test procedure number. This change does not have any regulatory effect.

Section 1604. Test Methods for Specific Appliances.

(V) Computers, Computer Monitors, Televisions, and Consumer Audio and Video Equipment.

(4)…

    (B) A computer monitor shall be tested as required by the test procedure ~~only~~ for each of the following:

        1. On mode power draw~~consumption~~.

        2. Computer monitor s~~S~~leep mode power draw ~~consumption~~.

        3. Computer monitor o~~O~~ff mode power draw ~~consumption~~.

    (C) Product features and functions not specifically addressed by the test method shall be turned off or disconnected. Built-in speakers shall be muted or turned down to their lowest volume setting for the on mode power ~~consumption~~draw test.

(D) Before starting the test procedure for measuring on mode power ~~consumption~~draw, any feature unrelated to the display of images (for example USB hubs, webcams, speakers, LAN connections, and SD card readers) shall be turned off.

Changes were made in 15-day language to match the definitions in Section 1602 with the test requirements in Section 1604 and to more specifically reference the type of measurement made during the computer monitor test procedure (e.g., draw instead of consumption), based on comments from stakeholders.

(5)…

(B) The total ~~power~~annual energy consumption of a computer shall be calculated using Equation 1 in Section 3 of the ENERGY STAR Program Requirements for Computers, Eligibility Criteria Version 6.1 (Rev. March-2016).

1. Computers manufactured before July 1, 2021 shall use the "conventional" mode weighting of Table 3 for a desktop computer, a mobile gaming system, a small-scale server, a high expandability computer, or a thin client, or Table 4 for a notebook computer, a mobile workstation, or a portable all-in-one computer, contained within Section 3 of the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March-2016), unless they meet either the criteria in Section 1604(v)(5)(B)(2) to use "full capability" mode weighting, or the criteria in Section 1604(v)(5)(B)(3) to use "remote wake"~~below~~.

….

3. In order to use the "remote wake" mode weighting a computer shall have the following features enabled as shipped:

i. Maintain Ethernet (IEEE 802.3-2015) or wireless (IEEE 802.11-2012) network addresses and network connection capability while in ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep mode; and

ii. Resume from ACPI System Level S3 Sleep Mode or an alternative to ACPI S3 sleep mode upon request from outside the local network.

A minor change was made to use the correct technical term for the annual energy consumption. Additional changes were made for computers manufactured before July 1, 2021, to address comments that requested to specify which mode weightings in the Energy Star's test method must be used for small-scale servers, high expandability computers, and mobile workstations when calculating annual energy consumption. The adopted computer standards incorporate Energy Star's mode weightings for various types of computers. However, Energy Star doesn't specify mode weightings for the aforementioned types of computers because in Energy Star's specifications, small-scale servers are not subject to TEC limits, and high expandability computers and mobile workstations are not defined.

Also, a change was made to allow manufacturers to use "remote wake" mode weightings for computers manufactured before July 1, 2021, if they meet specified criteria. This change was in response to a comment received during the 45-day comment period that not all operating system and hardware suppliers support the Full Capability mode requirements, necessitating an alternative mode weighting to ensure a level playing field between manufacturers.

> 4. Computers manufactured on or after July 1, 2021, shall use the "conventional" mode weighting of Table 3 for a desktop computer, a mobile gaming system, a small-scale server, a high-expandability computer, or a thin client, or Table 4 for a notebook computer, a mobile workstation, or a portable all-in-one computer, contained within Section 3 of the ENERGY STAR Program Requirements for Computers, Eligibility Criteria Version 6.1 (Rev. March-2016).

Similar to Section 1604(v)(5)(B)(1), changes were made for computers manufactured on or after July 1, 2021, to address comments that requested to specify which mode weightings in the Energy Star's test method must be used for small-scale servers, high expandability computers, and mobile workstations when calculating annual energy consumption.

> 5. Workstations shall calculate total annual energy consumption using the weighting of Table 8, contained within Section 3 of the ENERGY STAR Program Requirements for Computers, Eligibility Criteria Version 6.1 (Rev. March-2016).

Similar to Sections 1604(v)(5)(B)(1) and 1604(v)(5)(B)(4), changes were made for workstations to address comments that requested to specify which mode weightings in the Energy Star's test method must be used for workstations when calculating annual energy consumption.

> (C) The expandability score calculation shall be included in test reports and shall be calculated as follows:
>
> > 1. ~~Sum the product of~~ Identify the score for each individual interface type ~~score~~ as determined by Table V-1 and then multiply~~ied~~ by the total number of occurrences of that particular ~~such~~ interface~~s~~ type present in the system as sold or offered for sale. Finally, sum the subtotals for all interface types.
> >
> > 2. Each instance of an ~~individual~~ interface may only receive one score.
> >
> > 3. Add 100 to the score.

The language changes were made to further clarify the methodology for the expandability score calculation and the restrictions that apply. These changes are for clarification purposes only and do not change the methodology from 45-day language.

Table V-1
Interface Types and Scores for Expandability Score Calculation

Interface Type	Interface Score
USB 2.0 or less	5
USB 3.0 or 3.1 Gen 1	10
USB 3.1 Gen 2	15
USB ports or Thunderbolt 3.0 or greater that can provide 100 or more watts of power	100
USB ports or Thunderbolt 3.0 or greater that can provide ~~between~~ from 60 or more ~~and up~~ to less than 100 watts of power	60
USB ports or Thunderbolt 3.0 or greater that can provide ~~between~~ from 30 or more ~~and up~~ to less than 60 watts of power	30
Thunderbolt 3.0 or greater or USB ports that are not otherwise addressed in Table V-1 and that cannot provide 30 or more watts of power	20
Unconnected USB 2.0 motherboard header	10 per header
Unconnected USB 3.0 or 3.1 Gen 1 motherboard header	20 per header
PCI slot other than PCIe x16 (only count mechanical slots)	25
PCIe x16 or higher (only count mechanical slots)	75
Thunderbolt 2.0 or less	20
~~Thunderbolt 3.0 or greater~~	~~100~~
M.2 (except key M)	10
IDE, SATA, eSATA	15
M.2 key M, SATA express, U.2	25
Integrated liquid cooling	50
~~CPU Support for 4-channels of memory or a 256 bit or greater memory interface~~ Either: 1) CPU and motherboard support for 4 or more channels of system memory and at least 8 GB of installed and compatible system memory; or 2) At least 8 GB of system memory installed on a 256 bit or greater memory interface.	100

The language changes were made in 15-day language to remove ambiguity at the borderline values in determining the interface score for USB ports or Thunderbolt 3.0 or greater interfaces. Specifically, the words "between" and "up to" were replaced with "from" and "less than", respectively.

The interface scores listed in Table V-1 are intended to allocate a score to each interface that is proportional to its actual power consumption. Thunderbolt controllers will provide power to peripherals up to the maximum 100W and therefore could consume up to 100 Watts of power. However, not all of them provide 100 watts of power. Hence, in response to comments, the interface score allocation for Thunderbolt 3.0 or greater changed in order to reflect a similar multi-level approach taken for USB Power Delivery in 45-day language. Also, another power tier is added to cover USB ports or Thunderbolt 3.0 or greater that provide between 15 to 30 watts of power. The language for the added tier is crafted in a way to remove any overlap with other interface score allocations listed in Table V-1.

A minimum gigabyte requirement is added in 15-day language to both 256 bit or greater and four or more channels memory interfaces that receive expandability score to prevent any unintended use of this score allocation.

(D) A computer monitor used in the testing of desktop computers shall have a native resolution of at least 1920x1080 pixels and use progressive scanning. The computer operating system shall be set to operate at a minimum of 1920x1080 pixels and progressive scanning. If multiple display connections are available on the computer, choose the correct connection using the following criteria:

Changes were made in 15-day language to require that a monitor attached to a computer in testing should have a minimum resolution set for testing. This change was made to allow computers to test with a higher resolution screen if desired; a higher resolution screen would necessarily consume more energy, while the computer would necessarily need to meet the minimum efficiency standards, so this change has no effect on the estimated energy savings from the standards while allowing some flexibility in testing computers with monitors.

1. If hybrid graphics~~are~~ is available, choose the port that enables hybrid graphics.

Changes were made in 15-day language to correct a minor grammatical error.

2. If a discrete ~~graphics~~ GPU is installed, choose a connection to the ~~primary~~ first ~~discrete graphic~~ GPU, except for where it conflicts with subdivision (D)(1) of this section.

Changes were made in 15-day language to be consistent with the names and definitions changes for discrete GPU and first discrete GPU.

> 3. If no discrete ~~graphics~~ GPU is installed, choose a connection to a port integrated into the motherboard.

Changes were made in 15-day language to be consistent with the names and definitions changes for discrete GPU.

> 4. If there are multiple connector ports to choose from pursuant to ~~subdivisons~~ subdivisions (D)(1) through (D)(3) of this section, connect the display to a port using the first available from the port types listed below:
>
> > i. Display Port
> >
> > ii. HDMI
> >
> > iii. DVI
> >
> > iv. VGA
> >
> > v. Other

Changes were made in 15-day language to correct a typographical error. This change has no regulatory effect.

> (E) An integrated desktop computer, mobile gaming system, or notebook computer shall be tested using the integrated display's native resolution.

Changes were made in 15-day language to use the same term here as in the definition section for the same product (notebook computers). This change has no regulatory effect.

> (F) ~~During testing, a notebook computer, mobile gaming system, portable all-in-one, or integrated desktop shall proceed using Section 5.2(A)(1) and ignore the direction not to disable automatic brightness control as described in Section 5.2(A) of the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March 2016). If automatic brightness control is supported and is enabled by default, position a light such that 300 lux directly enters the automatic brightness control sensor. If automatic brightness control is not enabled by default or the luminous emittance of the display is less than described in the ENERGY STAR Program~~

Requirements for Computers, Final Test Method (Rev. March 2016) Section 5.2(E), then configure luminous emittance of the display per Section 5.2(E) of the ENERGY STAR Program Requirements for Computers, Final Test Method (Rev. March 2016). **High expandability computers shall be configured for the test in a manner identical to desktop computers. Mobile gaming systems and mobile workstations shall be configured for the test in a manner identical to notebook computers.**

The test procedure in the 45-day language for integrated displays with regards to automatic brightness control (ABC) was modified from the Energy Star's test procedure and was intended to measure the energy use associated with ABC. However, at the December adoption hearing for the computer standards, the Information Technology Industry Council (ITI), which is a trade association representing manufacturers of computers and computer monitors, commented that the proposed test procedure for ABC for computers with integrated displays (such as laptop computers or all-in-one desktop computers) was not accurate or repeatable, and therefore would not be a good measure of the energy consumption of these products. After reviewing the available data on ABC testing and "real world" conditions, it was concluded that more comprehensive research and data collection was needed to develop a repeatable and reliable test procedure that accurately reflected ABC's energy-saving benefits. This type of work would have extended well past January 1, 2018, the effective date of the computer standards. Therefore, the test procedure for computers with integrated displays that support ABC function was amended in additional 15-day language to align with Energy Star's 6.1 test procedure for computers with integrated displays. The amended test procedure would allow manufacturers to disable ABC for testing. This approach allows certainty for testing before the effective date of the standards as well as clarity as to whether products will meet the standards.

An additional change in additional 15-day language was made to clarify the correct test configuration for high expandability computers, mobile workstations, and mobile gaming systems. Clarifying language matches the state's new definitions with the corresponding test procedure requirements for similar products in ENERGY STAR.

(G)...

(H) The computer sleep mode power measurement shall be tested in a modified manner from the test procedure described in IEC 62623:2012. Instead of measuring power after manually entering sleep mode, the power measurement shall begin no sooner than 30 minutes and no later than 31 minutes of user inactivity on the unit under test. This measurement shall ~~follow~~ be performed after the long-idle test without altering the unit under test.

The language changes are made to clarify that the sleep mode refers to the computer's sleep mode and not the monitor's sleep mode and to reword a potentially confusing sentence.

(I) The power factor of a computer power supply and compliance with Table V-9 in Section 1605.3(v)(6) shall both be determined by the following test procedure: Generalized Test Protocol for Calculating the Energy Efficiency of Internal Ac-Dc and Dc-Dc Power Supplies Revision 6.7 (March 1, 2014). In addition the median power factor during ~~long~~short-idle measurements shall be recorded in the test report.

A change is made to specify that power factor at the power supply is measured and reported. Another change in the language is made to measure the power factor during short-idle instead of long-idle. The intent is to collect power factor at low loads, and because computers spend more time in short-idle than long-idle the effect of power factor is more significant in short-idle.

Section 1605.3. State Standards for Non-Federally-Regulated Appliances.

(v) Computers, Computer Monitors, Televisions, and Consumer Audio and Video Equipment.

(1) . . .

Table V-~~2~~3

Standards for Televisions and Signage Displays

Effective Date	Screen Size (area A in square inches)	Maximum TV and Signage Display Standby-passive Mode Power Usage (watts)	Maximum On Mode Power Usage (P in Watts)	Minimum Power Factor for (P ≥ 100W)
January 1, 2006	All	3 W	No standard	No standard
~~January 1, 2011~~	~~A < 1400~~	~~1W~~	~~P ≤ 0.20 x A + 32~~	~~0.9~~
January 1, 2013	A < 1400	1W	P ≤ 0.12 X A + 25	0.9

Changes were made in 15-day language to remove a now-obsolete provision of the regulations, as the effective date for the "tier 2" standards for televisions and signage displays has already lapsed. This change has no regulatory effect.

(4) Computer monitors. Computer monitors manufactured on or after July 1, 2019, shall comply with all of the following:

(A) The computer monitor on-mode power draw shall be less than or equal to the following equation with each of the applicable allowances applied at most once:

$$E_{on} \leq (E_{on\_max} + E_{EP} + E_{Game} + E_{OLED} + E_{Curve})$$

Where: E_{on} is the computer monitor on-mode power draw in watts as determined under Section 1604(v)(4),

E_{on_max} is the maximum on-mode power draw in watts as determined by Table V-4,

E_{EP} is the enhanced performance display allowance in watts as determined in Table V-5,

E_{Game} is the gaming monitor allowance in watts as determined in Table V-5,

E_{OLED} is the OLED monitor allowance in watts as determined in Table V-5, and

E_{Curve} is the curved monitor allowance in watts as determined in Table V-5.

~~Comply with the maximum on-mode standards in Table V-4.~~

Changes were made in 15-day language in response to stakeholder comments that certain allowances for computer monitors should be additive rather than mutually exclusive. Each allowance is for a feature or function in a specialty computer monitor that would consume additional energy above the efficiency levels established. Computer monitors may have more than one of these features or functions (for example, a gaming monitor that has an enhanced performance display), which would increase the total amount of power necessary to operate these functions. Therefore, it is necessary for manufacturers of computer monitors with multiple features to have the ability to add allowances together for those features to comply with the standards. If adding allowances were not permitted, computer monitors with multiple features may not be able to meet the efficiency standards and therefore would not be eligible for sale in California.

The equation format used here is similar to that used by ENERGY STAR Specification for Displays, version 7.0 (see Section 3.3.3), which is the framework for the Energy Commission's computer monitor efficiency standards.

(B) ~~Comply with at least one of the following requirements:~~

~~1.~~ ~~Consume less than or equal to 0.7 watt in sleep mode and less than or equal to 0.5 watt in off mode; or~~

~~2.~~ Consume less than or equal to 1.2 watts in computer monitor sleep mode and computer monitor off mode power combined.

Changes were made in 15-day language to eliminate the separate sleep mode and off mode requirements for computer monitors. The purpose of this change was to simplify the regulations,

as the separate sleep and off mode requirements are really just one way to comply with the overall 1.2 watts power limit for sleep and off mode combined.

In addition, a minor change to add "computer monitor" before sleep mode and off mode was made to align the terms here with the definitions of those terms in Section 1602.

       (D) Computer monitors with touch screen capability are allowed an additional 1 watt allowance per mode in ~~on, sleep, and off~~ modes where touch functionality is enabled.

Changes were made in 15-day language to clarify that touch functionality must be enabled in each mode for which the manufacturer claims an additional 1 watt allowance for the computer monitor. If the touch screen functionality is not enabled in the mode, there is no need for the computer monitor to consume extra power in that mode. This change ensures that only those monitors that require an extra allowance for the touch screen are provided that allowance, preventing this allowance from becoming a loophole. This change was made in response to stakeholder comments.

Table V-4

Power Consumption Standards for Computer Monitors

Resolution in megapixels (MP)	Diagonal Screen Size (d) in Inches	Maximum Computer Monitor On Mode Power Consumption in Watts
~~Resolution~~ ≤ 5.0 MP	$17" \leq d \leq 20"$	$[(6.0*r) + (0.025*A) + 3.7]$ ~~+ applicable adder in Table V-5~~
	$20" < d < 23"$	$[(4.2*r) + (0.02*A) + 2.2]$ ~~+ applicable adder in Table V-5~~
	$23" \leq d < 25"$	$[(4.2*r) + (0.04*A) - 2.4]$ ~~+ applicable adder in Table V-5~~
	$25" \leq d < 30"$	$[(4.2*r) + (0.07*A) - 10.2]$ ~~+ applicable adder in Table V-5~~
	$30" \leq d \leq 61"$	$[(6.0*r) + (0.1*A) - 14.5]$ ~~+ applicable adder in Table V-5~~
~~Resolution~~ > 5.0 MP	$17" \leq d \leq 20"$	$[25 + (0.025*A) + 3.7]$ ~~+~~

		~~applicable adder in Table V-5~~
	20"<d<23"	[25 + (0.02*A) +2.2] [a] ~~applicable adder in Table V-5~~
	23"≤d<25"	[25 + (0.04*A) – 2.4] [a] ~~applicable adder in Table V-5~~
	25"≤d<30"	[25 + (0.07*A) – 10.2] [a] ~~applicable adder in Table V-5~~
	30"≤d≤61"	[25 + (0.1*A) – 14.5] [a] ~~applicable adder in Table V-5~~

Where:

"A" is the ~~viewable~~ monitor screen area in square inches

"d" is the diagonal measurement of the display in inches

"r" is the megapixel resolution of the display.

A new heading, "Resolution in megapixels (MP)" was added to a column to match other tables in the regulations and to clarify the intent of the column. This change does not have any regulatory effect.

The multiplying factor for each on-mode power consumption level was deleted to reflect the change in 15-day language to allow manufacturers to add together allowances for computer monitors that have multiple features or functions. The rationale for allowing manufacturers to add allowances together is described in Section 1605.3(v)(4)(A).

The footnotes were modified for clarity and to align with the definitions in Section 1602.

> (E)   ~~Manufacturers shall apply no more than one applicable adder from Table V-5 to determine the maximum on-mode wattage.~~

Subdivision (v)(4)(E) was deleted in 15-day language because of the change in Section 1605.3(v)(4)(A) to allow manufacturers to add together allowances for computer monitors with multiple features or functions. The rationale for making this change to add together allowances is described above in Section 1605.3(v)(4)(A).

Table V-5

List of Potentially Applicable ~~Adders~~ Allowances

Allowance	Computer Monitor Type	Models manufactured on or after July 1, 2019, and before January 1, 2021	Models manufactured on or after January 1, 2021
E_{EP}	Enhanced Performance Display with a color gamut support of 32.9% of CIELUV or greater (99% or more of defined sRGB colors)	~~1~~.30 * E_{on_max}	~~1~~.20 * E_{on_max}
	Enhanced Performance Display with a color gamut support of 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors)	~~1~~.75 * E_{on_max}	~~1~~.60 * E_{on_max}
E_{Game}	Gaming Monitors without incremental hardware-based assistance	~~1~~.30 * E_{on_max}	~~1~~.20 * E_{on_max}
	Gaming Monitors with incremental hardware-based assistance	~~1~~.35 * E_{on_max}	~~1.35~~3 * E_{on_max}
E_{OLED}	OLED monitor	~~1~~.30 * E_{on_max}	~~1~~.20 * E_{on_max}
E_{Curve}	Curved monitor	~~1~~.30 * E_{on_max}	~~1~~.20 * E_{on_max}

Changes were made in 15-day language to align the table of potentially applicable adders with the equation in Section 1605.3(v)(4)(A) that allows manufacturers to add the allowances together. The term "adders" was changed to "allowances" for clarity. Allowances were grouped together based on whether the feature was mutually exclusive of another feature. For example, an enhanced performance display with a color gamut support of 38.4% of CIELUV or greater (Adobe RGB) should not be allowed to claim both allowances for enhanced performance displays. It should only claim the allowance for the higher color gamut, as the allowance provided represents the entire additional power needed, not the incremental power needed above the sRGB enhanced performance displays.

(~~F~~E)   EXCEPTIONS to Section 1605.3(v)(4): The following computer monitors are not required to comply with Section 1605.3(v)(4) but shall comply with the test procedures in Section 1604(v)(4), the certification requirements in Section 1606, and the marking requirements in Section 1607:

1. KVMs.

2. KMMs.

3. ~~Computer monitors that are classified for use as medical devices by the United States Food and Drug Administration.~~

~~4.~~ Very high performance monitors.

(F) EXCEPTION to Section 1605.3(v)(4): Medical computer monitors are not required to comply with Section 1605.3(v)(4) or the test procedures in Section 1604(v)(4) but shall comply with the certification requirements in Section 1606 and the marking requirements in Section 1607.

Changes were made in 15-day language in response to stakeholder comments requesting that medical monitors, which the Commission did not intend to regulate, be exempt from the testing requirements as well as the efficiency standards for computers. The exceptions to Section 1605.3(v)94) were modified in 15-day language to exempt medical computer monitors from both testing and compliance with the efficiency standards, but to clarify that manufacturers should still certify these monitors to the Commission and mark them with manufacturer name, date, and model number. Maintaining the certification and marking requirements will help the Commission to monitor these products and ensure that the exception does not become a loophole in the regulations. Sections were renumbered to the deletion of subsection (E) regarding allowances.

 (5)…

(B) Be shipped with power management settings that do both of the following:

1. Transition the computer into either the computer sleep mode or computer off mode measured in Section 1604(v)(5) within 30 minutes of user inactivity. If the transition is to a computer sleep mode, that sleep mode shall either:

This change to the language is made to clarify that the sleep and off modes here refer to computers and not monitors.

(C) If the model is shipped at the purchaser's request with either a limited capability operating system or without an operating system, or if the model is not capable of having an operating system, the model is not required to comply with Section 1605.3(v)(5)(B).

Section 1605.3(v)(5)(C) provides an exemption to the power management and sleep mode power limits for computers that are sold without an operating system or with a limited capability

operating system per purchaser's request. In response to the comments received, a change in the language is made to add another option in order to qualify computers, such as "Zero thin clients", which are not capable of having an operating system, for this exemption.

Table V-6
Alternative Computer Sleep Mode Power Limits

Computer Type	Maximum Power Consumption (watts)
Workstations, Mobile Workstations, High Expandability Computers, Small-Scale Servers	$10 + 0.03 * C$ where C is the system memory capacity in gigabytes minus 32 gigabytes. If C is less than zero, use zero for the value of C.
Desktop Computers, Thin Clients, Mobile Gaming Systems	$5 + 0.03 * C$ where C is the system memory capacity in gigabytes minus 32 gigabytes. If C is less than zero, use zero for the value of C.
Notebook Computers, Portable All-In-Ones	$2.5 + 0.03 * C$ where C is the system memory capacity in gigabytes minus 16 gigabytes. If C is less than zero, use zero for the value of C. If a discrete ~~graphics~~ GPU is present in the system, the maximum power consumption limit shall be increased by an additional 2 watts.

The title of this table is changed to clarify that the sleep mode here is referring to the computer's sleep mode and not the monitor's. Also, a change is made for consistency when referring to discrete GPU.

Table V-8
List of Potentially Applicable Adders

Function	Desktop Computer, Mobile Gaming System, and Thin Client Adder (kWh/yr)	Notebook Computers and Portable All-In-One Adder (kWh/yr)
System Memory	$4 + 0.15 * C$ where C is the capacity in GB.	$4 + 0.15 * C$ where C is the capacity in GB.
Energy-Efficient Ethernet	0.9 per computer	0.9 per computer
Storage device other than ~~primary~~ main storage device	3.5-inch Drive: 26 2.5-inch Drive: 4.5 Solid-State Drive (SSD): 0.5 Solid-State Hybrid Drive (SSHD): 1.0 Other: 26 per storage device	2.6 per storage device
Integrated Display	For d≤20:	$8.76*0.3*(1+EP)*$

Where: "d" is the diagonal measurement of the display in inches "r" is the megapixel resolution of the display "A" is the viewable screen area in square inches EP=0 for displays that are not enhanced performance displays	$(8.76*0.35*(1+EP)*[(4.2*r)+5.7])*0.8$ For 20<d<23: $(8.76*0.35*(1+EP)*[(4.2*r)+(0.02*A)+2.2])*0.8$ For 23≤d<25: $(8.76*0.35*(1+EP)*[(4.2*r)+(0.04*A)-2.4])*0.8$ For 25≤d: $(8.76*0.35*(1+EP)*[(4.2*r)+(0.07*A)-10.2])*0.8$ r=6 for r~~R~~esolutions greater than 6 megapixels~~shall use 6 for r~~. Before July 1, 2021 ~~On or after July 1, 2019~~: EP=0.3 for displays with a color gamut support of 32.9% of CIELUV or greater (99% or more of defined sRGB colors); and EP=0.75 for displays with a color gamut support of 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors). On or after July ~~January~~ 1, 2021: EP=0.2 for displays with a color gamut support of 32.9% of CIELUV or greater (99% or more of defined sRGB colors); and EP=0.6 for displays with a color gamut support of 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors).	$[(0.43*r)+(0.0263*A)]$ r=6 for r~~R~~esolutions greater than 6 megapixels~~shall use 6 for r~~. EP=0.4 for displays with a color gamut support of 38.4% of CIELUV or greater (99% or more of defined Adobe RGB colors).
First Discrete ~~Graphics~~ GPU (on	$58.6*\tanh(0.0038*B-$	$29.3*\tanh(0.0038*B-$

or after January 1, 2019 and before July 1, 2021) Where "B" is frame buffer bandwidth measured in GB/s	0.137)+26.8	0.137)+13.4
First Discrete ~~Graphics~~ GPU (on or after July 1, 2021) Where "B" is frame buffer bandwidth measured in GB/s	$29.4*\tanh(0.008*B-0.03)+11+(0.011*B)$	$14.7*\tanh(0.008*B-0.03)+5.5+(0.0055*B)$
Additional Discrete ~~Graphics~~ GPU	11 per ~~unit~~GPU	5.5 per ~~unit~~GPU
Add-in Cards This adder does not apply if either of the following criteria is met: 1) An adder is claimed for a device connected through this add-in card; or 2) An interface score from Table V-1 applies to a slot or interface provided by this add-in card.	10 per card	5 per card
Video Surveillance Card	25 per card	12.5 per card
Wired Ethernet or Fiber Card with a transmit rate of 10 Gb/s or greater	25 per card	12.5 per card
High bandwidth system memory, where "S" is system memory bandwidth measured in GB/s. This adder does not apply to a computer that meets any of the following criteria: 1) Expandability score includes a credit for 4-channel memory. 2) System memory bandwidth is less than ~~134~~ 146 GB/s. 3) ~~Majority of system memory capacity (in gigabytes) has a bandwidth less than 134 GB/s~~ Less than 4 GB of the system memory has a bandwidth of 146 GB/s or more and either: a) Has an integrated display with a resolution of 9 megapixels or less; or	$22.78*\tanh[0.006*(S-70)+0.15]-12.33$	$9.11*\tanh[0.006*(S-70)+0.15]-4.45$

b) Does not have an integrated display. 4) Uses an adder for a first discrete ~~graphics~~ GPU.		

The language was changed for consistency when referring to main storage devices and discrete GPUs, and rewording to clarify the intent for the resolution and per unit.

In addition, in response to the comments received, the effective dates for the first and second tiers for integrated displays were changed to align with computer monitors because the adders apply in a similar fashion for both integrated and not-integrated displays.

The Energy Commission received comments on the 45-day language that adders for the add-in card can be applied to some of the interfaces that already receive either an expandability score or other adders such as discrete GPUs, allowing "double-counting" of the points for the same component. In response to this comment, changes were made in 15-day language to prevent double dipping for add-in cards.

Moreover, one of the criteria for the high bandwidth system memory adder was changed from requiring the majority of the system memory to be high bandwidth to requiring a minimum 4 GB of it to be high bandwidth. This will ensure that the objective of granting an adder only to computers that have a substantial amount of high-bandwidth system memory is met without restricting other types of the memory in the computer.

(6) Small-scale servers, high expandability computers, mobile workstations, and workstations. Small-scale servers, high expandability computers, mobile workstations, and workstations manufactured on or after January 1, 2018, shall:

(A) Be powered by ~~a~~ an internal power supply that meets or exceeds the standards in Table V-9, or an external power supply that meets the level VI of efficiency described in the International Efficiency Marking Protocol for External Power Supplies Version 3.0 (Sept. 2013);

(B) Incorporate Energy-Efficient Ethernet functionality;

(C) Transition connected displays into sleep mode within 15 minutes of user inactivity; and

(D) Transition the computer into either the computer sleep mode or computer off mode measured in Section 1604(v)(5) within 30 minutes of user inactivity. If the transition is to a computer sleep mode, that sleep mode shall either:

1. Be a computer sleep mode as described in ACPI as S3; or

2. Consume power less than or equal to the values shown in Table V-6.

The language was changed to clarify that only internal power supply is required to meet or exceed the standards in Table V-9, as separate requirements apply to federally regulated external power supplies, and to specify that sleep and off modes are intended for computers, not monitors.

Table V-9

Internal Power Supply Requirements ~~for Small-scale Servers, High-expandability Computers, Mobile Workstations, and Workstations~~

115V power supplies				
10% load	20% load	50% load	100% load	Power Factor Correction
-	87%	90%	87%	0.9 at 50% load
230V power supplies				
10% load	20% load	50% load	100% load	Power Factor Correction
-	88%	92%	88%	0.9 at 50% load

The language in Table V-9's title was changed to specify that the requirements only apply to the internal power supplies, as separate requirements apply to external power supplies. Moreover, the title was changed to remove redundant language because the computers that have internal power supplies subject to this requirement are specified in 1605.3(v)(6).

(7) Small volume manufacturers.

(A) Computers manufactured on or after January 1, 2019, by a small volume manufacturer ~~in quantities of 40 or fewer units of a basic model~~ shall:

(1) C~~e~~omply with the power management settings identified in Sections 1605.3(v)(5)(B)(2)~~,~~ and 1605.3(v)(6)(C)~~,and 1605.3(v)(6)(D), and are exempt from all other requirements for computers.~~;

(2) Be shipped with power management settings that transition the computer into either computer sleep mode or computer off mode within 30 minutes of user inactivity; and

(3) Be exempt from all other requirements for computers unless the small volume manufacturer meets the criteria in Section 1605.3(v)(7)(C).

(B) Small-scale servers and rack-mounted workstations are not required to comply with Section 1605.3(v)(7)(A)(2).

(C) If a small volume manufacturer produces desktop or workstation computers in quantities of more than 40 50 units of a basic model, the manufacturer shall certify those units as meeting the requirements in Sections 1603, 1604(v)(5), 1605.3(v)(5) or 1605.3(v)(6), 1606, and 1607.

Although the adopted standards are cost effective, a minimum number of units of a basic model have to be sold for the cost of testing to be balanced with the consumer bill savings from the saved energy. This number was calculated to be about 40 units of desktop or workstation computers. A change to the language was made in response to comments received from small business owners with regards to the limit for the number of basic units in order for the exemption to apply. With a more conservative calculation, the limit was increase from 40 to 50 basic models. Additionally, this limit was removed for notebooks and small-scale servers because the energy savings are significantly lower for these systems compared to desktops and workstations, making it more difficult to balance the cost of testing.

A provision was added to exempt small-scale servers and rack-mounted workstations from complying with power management settings since there is a similar provision for these computers for all manufacturers.

Section 1606. Filing by Manufacturers; Listing of Appliances in Database.

Table X Continued - Data Submittal Requirements			
…			
	Appliance	Required Information	Permissible Answers
V	Computer Monitors	~~Technology~~Backlight Type	~~C~~CCFL, LED, OLED, Quantum Dots

		~~Monitor Type~~	~~Computer Monitor, EPD sRGB, EPD Adobe RGB, OLED, Gaming Monitor w/ Incremental Hardware, Gaming Monitor w/o Incremental hardware, "Keyboard, Video, Mouse," "Keyboard, Mouse, Monitor," Very High Performance~~
		EPD sRGB	True, False
		EPD Adobe RGB	True, False
		OLED	True, False
		Gaming Monitor w/ Incremental Hardware	True, False
		Gaming Monitor w/o Incremental Hardware	True, False
		KVM	True, False
		KMM	True, False
		Very High Performance	True, False
		Curved Monitor	True, False
		Viewable Screen area (square inches)	
		Screen size (diagonal inches)	
		Automatic Brightness Control	True~~,~~ False
		Automatic Brightness Control Enabled when Shipped	True~~,~~ False
		Screen Luminance (Candelas Per Square Meter)	
		Native Resolution (megapixels)	

Power ~~Consumed~~Draw in ~~Computer Monitor~~ On Mode (watts)		
Power ~~Consumed~~Draw in Computer Monitor Sleep Mode (watts)		
Power ~~Consumed~~Draw in Computer Monitor Off Mode (watts)		
Touch Screen Capability	True~~,~~ False	
Touch Screen Enabled in On Mode	True, False	
Touch Screen Enabled in Computer Monitor Sleep Mode	True, False	
Touch Screen Enabled in Computer Monitor Off Mode	True, False	
Color Gamut	$\geq$32.9% of CIELUV ~~or greater,~~ (99% or more of defined sRGB colors), $\geq$38.4% of CIELUV ~~or greater~~ (99% or more of defined Adobe RGB colors), ~~Less than~~ $\leq$32.9% of CIELUV	

Changes were made in 15-day language to the reporting requirements in Table X to clarify the type of information that was requested (e.g., changing "Technology Type" to "Backlight Type"), to align the reporting requirements with changes made in 15-day language in the regulations (e.g., changing "Power Consumed" to Power Draw"), and separating out the types of computer monitors and features that could receive allowances to make it possible to determine in the Commission's Modernized Appliance Efficiency Database System what efficiency standard (including allowances) the certified model should be meeting. These latter changes are necessary as a result of the modifications to Section 1605.3(v)(4)(A) that permit manufacturers to add allowances together for computer monitors with multiple features, which is explained above.

In Additional 15-day language, the Commission corrected a typographical error by deleting a "C" in the term "CCFL," (referring to cold cathode fluorescent lamps).

	Appliance	Required Information	Permissible Answers
V	Medical Computer Monitor	* Manufacturer's Name	
		* Brand Name	
		* Model Number	

Changes were made in 15-day language to require medical computer monitors to submit a limited amount of information instead of having to undergo testing and reporting of all of the data relevant for other computer monitors. This change was made to align with the change to the EXCEPTIONS in Section 1605.3(v)(4), as described above.

Table X Continued - Data Submittal Requirements

		Appliance	Required Information	Permissible Answers
V		Computers	Computer Type	Desktop, Notebook, Small-Scale Server, Workstation, Thin Client, Portable All-In-One, Mobile Gaming System, Mobile Workstation, High Expandability Computer**, Rack-mounted Workstation**
			Operating System Type	None, Limited Capability Operating System, Other
			Operating System (Provide the operating system used during testing to calculate energy consumption.)	
			Core Speed (gigahertz)	
			Number of CPU Cores	
			CPU support for 4 or more channels of memory or a 256 bit or greater memory interface	True, False
			Number of 3.5" hard-disk drives and Others (other than ~~primary~~ main storage)	
			Number of 2.5" hard-disk drives (other than ~~primary~~ main storage)	
			Number of solid-state drives (other than ~~primary~~ main storage)	
			Number of hybrid solid-state drives (other than ~~primary~~ main storage)	
			Nameplate output power of the external power supply ~~AC Adapter~~	

		~~Size~~ (watts) (notebook computers and mobile gaming systems only)	
		Total Battery Capacity (watt-hours) (notebook computers, portable all-in-one, and mobile gaming systems only)	
		Discrete ~~graphics processing unit(s)~~ GPU(s) present in system	True~~/~~, False
		First Discrete GPU ~~Graphics~~ Frame Buffer Bandwidth (rounded to nearest gigabyte per second)	
		Total Number of Discrete GPUs ~~Graphics Processing Units~~	
		Integrated Display	True~~/~~, False
		Color Gamut (if computer has integrated display)	≥32.9% of CIELUV ~~or greater,~~ (99% or more of defined sRGB colors), ≥38.4% of CIELUV ~~or greater~~ (99% or more of defined Adobe RGB colors), ~~Less than~~ ≤32.9% of CIELUV
		Diagonal screen size (inches) (if computer has integrated display)	
		Viewable screen area (square inches) (if computer has integrated display)	
		Resolution (megapixels) (if computer has integrated display)	
		Enhanced Performance (if computer has integrated display)	True~~/~~, False
		Length of time of user inactivity before computer entering sleep (minutes). Do not report a number if the model does not enter sleep.	
		Length of time of user inactivity before placing display into sleep (minutes). Do not report a number if the model does not enter sleep.	
		Energy Efficient Ethernet Capability	True~~/~~, False
		Total Number of Add-in Cards	
		Video Surveillance Card	True~~/~~, False
		Wired Ethernet or Fiber Card with a transmit rate of 10 GB/s or greater	True~~/~~, False
		Total System Memory (gigabytes)	
		Highest system ~~System~~ memory bandwidth (gigabytes/second)	
		System memory with bandwidth	

		higher than 632 GB/s (gigabytes)	
		System memory with bandwidth higher than 432 GB/s (gigabytes)	
		System memory with bandwidth higher than 146 GB/s (gigabytes)	
		System memory with bandwidth higher than 134 GB/s (gigabytes)	
		~~Sleep~~ Computer sleep mode type	ACPI S3, Other
		Computer ~~O~~off mode power (watts)	
		~~Sleep~~Computer sleep mode power (watts)	
		Long-idle power (watts)	
		Short-idle power (watts)	
		Expandability Score	
		Meets full capability mode weighting criteria	True~~/~~, False
		Meets remote wake mode weighting criteria	True, False
		Total Annual Energy Consumption (kilowatt hours per year)	
		Power Supply Meets Table V-9 or Level VI	True~~/~~, False
		Small Volume Manufacturer	True~~/~~, False
		Motherboard model number	
		Power supply type	Internal, External
		Internal power supply size (watts)	
		Power factor at full load of the computer's power supply that is not a federally regulated external power supply	
		Median power factor during short-idle of the computer's power supply that is not a federally regulated external power supply	
		Power supply model number	

The 15-day language changes simplify the information requested, update references based on changes in Section 1602 (such as references to discrete GPU), add clarifications or specifications, and add missing data fields that are necessary to collect to verify compliance with the applicable efficiency requirements.

APPENDIX A

SUMMARY OF COMMENTS RECEIVED AND THE ENERGY COMMISSION'S RESPONSES

TABLE OF CONTENTS

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