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PERSONAL COMPUTERS, PERIPHERAL DEVICES, AND SUBASSEMBLIES

I. INTRODUCTION

A personal computer is an electronic computer that is marketed for use in the home, notwithstanding business applications.¹ It generally consists of an enclosure, central processing unit (CPU), motherboard, power supply, computer peripherals, and subassemblies. Desktop, notebook, laptop, and tablet computers are examples of personal computers. A personal computer is classified as a Class B digital device. As specified in Section 15.101(a), Class B personal computers and Class B personal-computer peripherals require an FCC equipment authorization, using either certification² or Supplier’s Declaration of Conformity (SDoC).³ This publication provides guidance on authorization of personal computers.

The following terms and concepts are used in this guidance document.

- Personal computers (or synonymously personal computer systems) and personal computer peripherals as used in this document denote Class B personal computers and peripherals as specified in Section 15.101(a), and as defined in Sections 15.3(s) *Personal computer*, 15.3(k) *Digital device*, and 15.3(r) *Peripheral device*.
- The term “authorization” refers to an FCC equipment authorization under Part 2 Subpart J and Section 15.101, using either certification or Supplier’s Declaration of Conformity (SDoC).
- The term “component” specifically refers to the elements of a personal computer system: enclosure, CPU, motherboard, power supply, computer peripherals, and subassemblies.
- The term motherboard, as used in this document includes boards with soldered CPUs or boards with sockets for CPUs, with processors either included or sold separately.
- Computers, computer systems, and peripherals that are marketed for use only in commercial, industrial, or business environments qualify as Class A digital devices.⁴ Computers that qualify as Class A equipment are outside of the scope of this publication.⁵ Further to Section 15.31(k), the final configuration of any Class A equipment assembled with Class A and Class B components (or similarly using all Class A components) is required to be tested and demonstrate compliance with the limits for a Class A device.⁶

¹ See 47 CFR § 15.3(s).

² See 47 CFR § 2.907 et seq.

³ See 47 CFR § 2.906 et seq.

⁴ See 47 CFR § 15.3(h).

⁵ Other basic information about requirements and concepts for Class A and Class B digital devices is available in OET Bulletin 62; see (<https://www.fcc.gov/general/oet-bulletins-line>).

⁶ See 47 CFR § 15.31(k).

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II. AUTHORIZED PERSONAL COMPUTER SYSTEMS

Personal computers are authorized and permitted to be imported and marketed using one of the following methods.⁷

- a) Complete personal computer systems comprised of an enclosure (case), motherboard, power supply, CPU, peripherals, and subassemblies shall be tested together and authorized as an end product.⁸
- b) A personal computer system may be assembled from authorized components (motherboard, power supply, computer peripherals,⁹ and subassemblies) by system integrators.¹⁰ Such a system does not require final testing, is authorized under the procedure set forth in Section 15.102(b), and is labeled in accordance with Sections 2.1074 and 15.19. The user instructions must be provided as required in Sections 15.21 and 15.105, and compliance information must be included as required by Section 2.1077(b).
- c) A refurbished personal computer system is one that is restored to its original operational characteristics using original manufactured parts, or replaced with a CPU board, power supply, or computer peripheral that is authorized, and the end product remains comparable to the original specifications. In this case, no testing or re-certification is required. The same basic semiconductor lineup, filtering, clock circuits, etc., shall continue to be employed as in the original end product.
- d) If the equipment is being improved beyond its original operational characteristics, it is necessary to have the entire personal computer (or the components) tested and authorized by the party making the modifications.¹¹
- e) Wireless communications functions can be connected to or integrated within the motherboard of a personal computer; this is considered to be a composite system consisting of a digital device (personal computer) and a wireless transmitter. Wireless transmitters (e.g., Part 15 intentional radiator) used on a motherboard are subject to certification.¹² Also, it is permitted to use a separate wireless transmitter that has been certified as a

⁷ Items a) through c) of this paragraph are based on the requirements in 47 CFR § 15.101(c).

⁸ See 47 CFR § 2.1. *End product* – A completed electronic device that has received all requisite FCC approvals and is suitable for marketing.

⁹ See 47 CFR § 15.101(d). Components that can be individually authorized for subsequent assembly into Class B personal computers are: motherboard/mainboard, power supply/PSU, peripheral, optical drive, graphics card/GPU, sound card, keyboard, mouse, external drive, and thumb drive. Other assemblies that are fully enclosed in a computer case (such as RAM, internal Storage – either HDD or SSD storage drives) are considered subassemblies, and do not need to be authorized prior to being assembled into a Class B personal computer system; see also 47 CFR § 15.101(e).

¹⁰ Integrators includes someone who assembles a computer system.

¹¹ Modifications such as overclocking will void the authorization of the processor/motherboard. In this case, it is necessary to have the component tested and authorized to permit use in assembled personal computers. End users modifying a component are subject to the general requirements of Sections 15.1 and 15.5. General conditions of operation require the end user to stop operating the personal computer if it is causing harmful interference.

¹² In this case, either SDoC or certification can be used for the personal computer/motherboard/peripheral, while certification is required for the transmitter. A single FCC ID can be used if both the transmitter portion and the computer/motherboard/peripheral portion are authorized using certification.

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modular transmitter.¹³ Composite-system considerations and rules apply for personal computer systems containing wireless communications functions, including the following:¹⁴

- 1) Where the individual devices used in the end product are subject to different technical requirements, each such device must comply with its specific requirements. In no event may the measured emissions of the composite-system exceed the highest level permitted for an individual component.
- 2) Testing for compliance with the different requirements shall be performed with all of the devices in the end product functioning.

III. AUTHORIZED PERSONAL-COMPUTER PERIPHERALS

Personal computer peripheral devices¹⁵ are user-replaceable subsystems that feed data into and/or receive data from the CPU of a personal computer, where the operating system recognizes the peripheral as an associated local device. Personal computer peripherals can be externally connected devices for transferring data by wire or cable to/from a personal computer's digital input/output interface connectors (*e.g.*, USB, HDMI, DVI, eSATA, IEEE 1394, etc.). Peripherals can also be devices installed inside the computer housing that are connected to the computer's expansion bus and provide an external digital connection to other computer peripherals or equipment.

Examples of personal computer peripheral devices include: keyboard, USB mouse, pen tablet, joystick, MIDI keyboard, scanner, digital camera, video camera, monitor, projector, TV screen, printer, plotter, external hard drives, media card readers, digital camcorders, digital mixers, MIDI equipment, special turbo cards, and enhancement boards. Enhanced turbo boards, and any circuit board designed for interchangeable mounting, internally or externally, that increases the operating or processing speed, are also personal computer peripheral devices.

Personal-computer peripherals authorized separately can be imported and marketed directly to end users, or used by sellers to assemble a personal computer system, refurbished personal computer systems, or used by end users.

Wireless products that communicate via wireless connections to personal computers are considered personal computer peripherals if the device physically plugs into the computer. The transmitter included in the peripheral is subject to the applicable technical requirements and is usually required to be certified. For example, this applies to various types of wireless keyboard,¹⁶ wireless mouse, and USB dongle transmitters.

¹³ The required certification for a wireless function on a motherboard or peripheral may be achieved by using a certified modular transmitter; see KDB Publication 996369 on modular transmitters.

¹⁴ See 47 CFR §§ 2.947(f) and 15.31(k).

¹⁵ See also definition 47 CFR § 15.3(r) *Peripheral device*.

¹⁶ These wireless peripheral systems (keyboard, mouse, etc.) are made up of two parts: The first part, Device-1, is the keyboard, mouse, etc., and the second part, Device-2, is the peripheral that is either plugged into the personal computer by the user or is built into the computer itself (motherboard). When Device-2 is plugged in by the user, it is considered a peripheral, and if it also contains a transmitter it is composite-system equipment requiring authorization as described in Clause 3. When the transmitter is built into the motherboard, it is also composite-system equipment requiring additional certification as described in e) of Clause 2. Note also that Device-1 is composite-system equipment but is not considered a computer peripheral, the key difference being the test procedures (see ANSI C63.4-2014) requiring typical system configurations for personal computers and peripherals.

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IV. AUTHORIZED PERSONAL COMPUTER MOTHERBOARDS AND POWER SUPPLIES

Personal computer motherboards and power supplies can be authorized separately¹⁷ and sold under the following circumstances:

- installed in personal computers systems assembled from authorized components (see b) in Clause 2),
- used in refurbished personal computer systems, or
- as authorized motherboards and power supplies to end users.

Sellers of such authorized motherboards or power supplies shall provide end users with the compliance information in accordance with Section 2.1077(a) for individual motherboards and power supplies, and per Section 2.1077(b) for assembled computer systems. Wireless functions can be integrated onto the motherboard, which requires additional certification as part of the motherboard approval.

Manufacturers or responsible parties (importer, integrators, or assemblers) marketing separately authorized parts must document, for the party marketing an assembled personal or notebook computer, the complete installation procedures that must be followed to ensure compliance. The marketing individual, or the seller, of an assembled personal or notebook computer must ensure:

- a) Each device used in the system, including the notebook enclosure combination, has been authorized under the SDoC or certification procedure;
- b) the original label and identification on each piece of equipment remains unchanged;
- c) each responsible party's instructions to ensure compliance (including, if necessary, the use of shielded cables or other accessories or modifications) are followed when the system is assembled;
- d) the final notebook computer is authorized under SDoC in accordance with Section 15.101(c)(4); and
- e) has the required user instructions and device labels (Section 2.1077(b))¹⁸.

V. UNAUTHORIZED MOTHERBOARDS, POWER SUPPLIES, PERIPHERALS, AND SUBASSEMBLIES

Unauthorized motherboards, power supplies, and peripheral devices can be imported and marketed to manufacturers, assemblers, or system integrators, who are responsible to obtain the appropriate equipment authorization prior to marketing these items within personal computer systems, individually or to end users. The party marketing and selling unauthorized motherboards, power supplies, or peripheral devices must obtain a statement in writing from the party purchasing the unauthorized motherboards, power supplies, and peripheral devices that they will obtain the appropriate equipment authorization.¹⁹

Personal computer subassemblies include socketed CPUs, circuit boards, and other components that are installed inside the housing of a personal computer and that do not provide a digital interface for external connections.²⁰ Subassemblies do not require an equipment authorization. Examples of subassemblies include: CPU chip-carrier or CPU integrated-circuit package, internal memory expansion boards, internal drives, and internal disk drive controller boards. Unauthorized subassemblies may be sold to manufacturers (for incorporation into an end

¹⁷ See also 47 CFR § 15.102.

¹⁸ See 47 CFR §§ 2.1077, 15.101 and 15.212.

¹⁹ See 47 CFR § 15.101 (d) (1)

²⁰ See 47 CFR § 15.101(e).

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product), system integrators or assemblers (for use in personal computer systems assembled from authorized components), and to the general public. While many types of subassemblies are not directly subject to FCC technical standards or equipment authorization requirements,²¹ a personal computer containing subassemblies must still comply with FCC technical requirements. Manufacturers of subassemblies should design their products so that the digital devices into which they are installed will comply with the technical standards.

VI. LABELING AND INFORMATION TO USERS

Personal computers are required to be labeled in accordance with Section 2.1074 and the compliance information to users as required by Section 2.1077 (if authorized under SDoC) or Section 2.925 (if certified), and Section 15.19.²²

In addition, for devices approved under Part 15, the user's manual or instruction manual for an intentional radiator or unintentional radiator shall caution the user about changes or modifications to the device.²³ Also, for Class A and Class B digital devices or peripherals, information to the user is required to include an appropriate statement as specified in Section 15.105.²⁴ See also KDB Publication 784748 on labeling guidance.

CHANGE NOTICE

04/05/2018: 657217 D01 Personal Computer v02 replaces 657217 D01 Notebook CPU Brds and Pwr Suply v01. Changes have been made to combine guidance on personal computers into a single publication and reflect changes in the rules in accordance with FCC 17-93 (docket no. 15-170). Former KDB Publications 548301 and 715856 are expired but with the contents adapted herein.

12/20/2019: 657217 D01 Personal Computer v03 replaces 657217 D01 Personal Computer v02. Changes have been made to re-define CPUs sold separately as subassemblies (previously defined in v02 as authorized components).

²¹ Equipment authorization generally is not required for many types of subassemblies, parts, or components of radio frequency devices unless they constitute an essentially completed device or end product which requires only the addition of cabinets, knobs, speakers, or similar minor attachments before marketing or use. Exceptions include computer circuit boards that are peripheral devices (as defined in Section 15.3(r)) and all devices that, by themselves, are subject to FCC marketing rules.

²² See 47 CFR §§ 2.925, 2.1074 and 15.19. Also, see KDB Publication 784748 for other labeling guidance.

²³ See 47 CFR § 15.21.

²⁴ See 47 CFR § 15.105. Specific types of digital devices are exempted from the technical standards under the provisions of Section 15.103 and are not required to include this information to the user.

APPENDIX A

TEST PROCEDURES FOR NOTEBOOK COMPUTERS ASSEMBLED USING SEPARATELY AUTHORIZED MOTHERBOARD, ENCLOSURES, POWER SUPPLIES, AND OTHER DEVICES

A.1 INTRODUCTION

Approvals for computer system components in accordance with Sections 15.101(c)(2) or 15.101(c)(3), and when the resulting product is not separately tested, require that the individual devices be separately authorized under the Supplier's Declaration of Conformity (SDoC) or certification process, and be separately tested under the procedures of Section 15.31 and ANSI C63.4-2014. The guidelines in this appendix provide clarification specifically for notebook computer motherboards, enclosures, outboard power supplies, or other devices.

Unlike a desktop computer enclosure, a notebook computer enclosure is treated like a peripheral device, because it contains active circuitry typically integrated with a video display unit, keyboard, and touchpad components.

Separately authorizing all the individual system components allows a party to market and sell a complete notebook computer assembled in accordance with Sections 15.101(c)(2) or 15.101(c)(3) without further testing under the provisions of Section 15.102(b).

For a motherboard sold without a CPU, a CPU applicable for that motherboard that maximizes emissions shall be used to demonstrate compliance. Motherboards sold with integral or attached CPU are tested together and are referred to as "CPU boards" in this appendix.

A.2 NOTEBOOK COMPUTER NOMENCLATURE

A notebook computer enclosure is composed of four basic parts, called shells. These shells are labeled A, B, C, and D. The A shell covers the back of the video display, and it forms the top of the assembly when the notebook computer is closed. The B shell is the part through which the video display is viewed, and it forms the second half of the enclosure for the display. The C shell forms the top of the lower portion of the notebook computer. The keyboard, touch pad, and other on-enclosure components penetrate the C shell. The D shell forms the bottom of the computer. Figure A.1 shows a typical notebook computer.

A.3 POWER SUPPLIES

Power supplies for notebook computers are typically external to the computer and approved under SDoC using appropriate test procedures as outlined in Section 15.31 for a computer peripheral device.

Testing shall be in accordance with the procedures specified in Section 15.31 and ANSI C63.4-2014 and must demonstrate compliance with all of the standards contained in Part 15. Because a notebook computer power supply is typically an external part, it will not be installed in the enclosure, but rather in its typical fashion. A representative notebook computer will be used as the load for the power supply in these tests. When configured with a typical notebook computer, the power supply shall meet the Class B limits for AC power line conducted emissions in Section 15.107(a) and for radiated emissions in Section 15.109(a).

A.4 NOTEBOOK COMPUTER MOTHERBOARD

Two tests are potentially required for Section 15.32 purposes: one test with the cover off (called "open-case"), and if the limits in Section 15.109(a) are not met, a test with the cover in place (called closed-case). Whereas with a desktop computer the cover can be removed without displacing other parts of the system, including internal

cables, this is not the case for a typical notebook computer. Although testing is possible for several types of notebooks by hinging open the C shell of the enclosure, this results in abnormal placement of the keyboard and touchpad. If the top side of the C shell is designed with shielding effects features (*e.g.*, metal, conductive-filled plastic, and conductive coating), a special C shell shall be used for the sole purpose of evaluating the emissions from the CPU board. These special shells shall be made of plastic with no conductive properties that would enable them to provide shielding for emissions from components contained within them. The A and B shells would be of normal structure, because the A and B shells house the display and associated circuitry. The bottom side of the D shell will be the enclosure common plane to accommodate the CPU board. At least two of the four vertical sides of the enclosure should be designed without shielding effects for the open-case test. The requirement for the top side of the C shell is extended to these unshielded vertical sides.

For notebook computers, the four vertical sides are not always part of the D shell; some or all may be part of the C shell. Figure A.2 and Figure A.3 show an example of the top side of the C shell for both cases of with and without shielding. Both the conductive coating on the enclosure and conductive plates (or similar) shall be removed for the open-case test. Any mounting or interface function provided by the shielding parts will be accomplished via other means. The preferred way to accomplish the removal of shielding from any area is to remove shielding material if present; special unshielded parts should be fabricated only if the latter option is not possible.

The notebook computer keyboard, which is part of the complete setup of the notebook computer, is normally manufactured with a conductive plate at the base of the keyboard (illustrated in Figure A.4). The conductive plate is intended for thermal heat dissipation, as well as housing the circuitry for the keyboard. For open-case testing, the conductive base shall be replaced with non-conductive material, to remove the effect of shielding when it is installed on top of the notebook computer system above the CPU board in the typical setup. Removing the conductive base could potentially cause keyboard related EMI issues, due to the removal of the common reference plane for the keyboard circuitry (if needed). Emissions greater than 6 dB over the limit that can be identified and documented to originate from the keyboard, may be disregarded. This requirement is extended to other components which are designed as parts of the top side of the C shell, including touchpad, fingerprint reader, etc.

Radiated emissions testing will therefore be performed in two separate housings. The open-case test, where emissions are allowed to exceed the limits in Section 15.109(a) by up to 6 dB, will be performed in a special enclosure where the shielding effects of at least two vertical sides and the top side of the C shell, including the components like keyboard, touchpad, and fingerprint reader are removed, as mentioned above.

All other aspects of this test will be as normally required under Part 15 and ANSI C63.4-2014. The cover-on closed-case test, where emissions may not exceed the limits in Section 15.109(a), will be performed in a normal, representative enclosure.

A.5 ENCLOSURE COMBINATION

A.5.1 General

For personal computer systems tested per Appendix B of this publication, an approval process is neither described or required for the enclosure itself in which the computer system is integrated. For such systems, the enclosure is little more than sheet metal to hold the system components together. However, for a notebook computer the enclosure serves one additional key function. In a desktop system, the video display unit is typically a separate, external, peripheral device. In a notebook computer, the video display unit is typically an integral part of the enclosure, installed inside the A/B shell part of the enclosure. The keyboard, touchpad, and other possible components in the enclosure are typically unique to a specific enclosure for typical modern notebook computers. This combination should be treated as a peripheral device and authorized as such under Section 15.31. The

following is for qualification of an enclosure, display, keyboard, touchpad, and other possible components in the enclosure combination.

A.5.2 Equipment-Under-Test (EUT) configuration

The unique enclosure/display/keyboard/touchpad/fingerprint reader, etc., combination to be tested shall be installed as part of a complete notebook computer. All necessary additional components (*e.g.*, hard drive, memory, and motherboard) and external devices (*e.g.*, power supply, external peripheral devices connected to I/O ports) shall be connected to create a complete system. Any change in the configuration of the enclosure or video display (including support electronics) is subject to the permissive change requirements in Section 2.1043.

A.5.3 Test procedure

The notebook computer system, configured per A.5.2, shall meet the Class B limits for AC power-line conducted emissions in Section 15.107(a) and for radiated emissions in Section 15.109(a). Testing shall be performed using the methods provided in ANSI C63.4-2014.

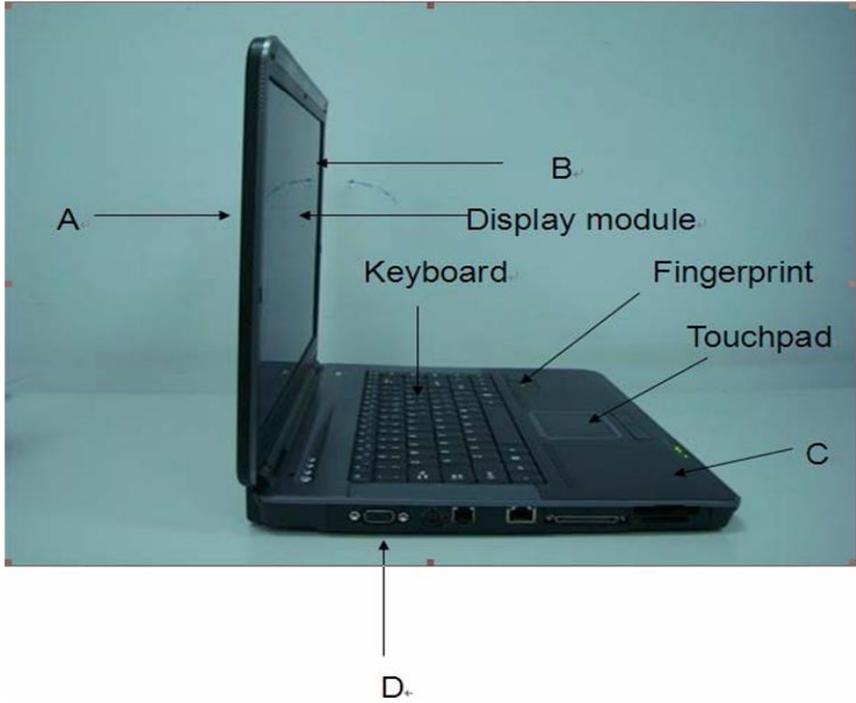


Figure A.1 – Typical notebook computer

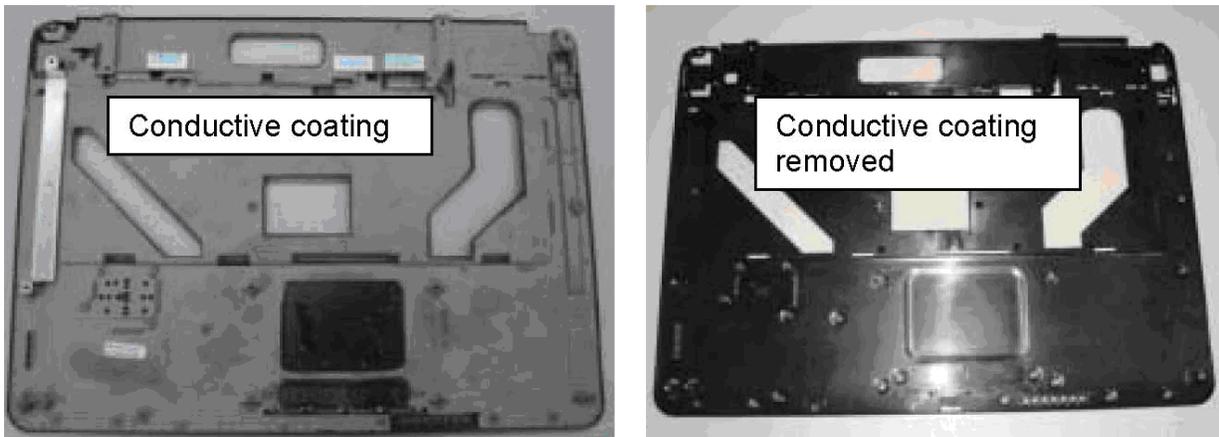


Figure A.2 – C shell (with and without conductive coating on the top side)



Figure A.3 – Installation of a C shell (with and without conductive coating on the top side) on complete system

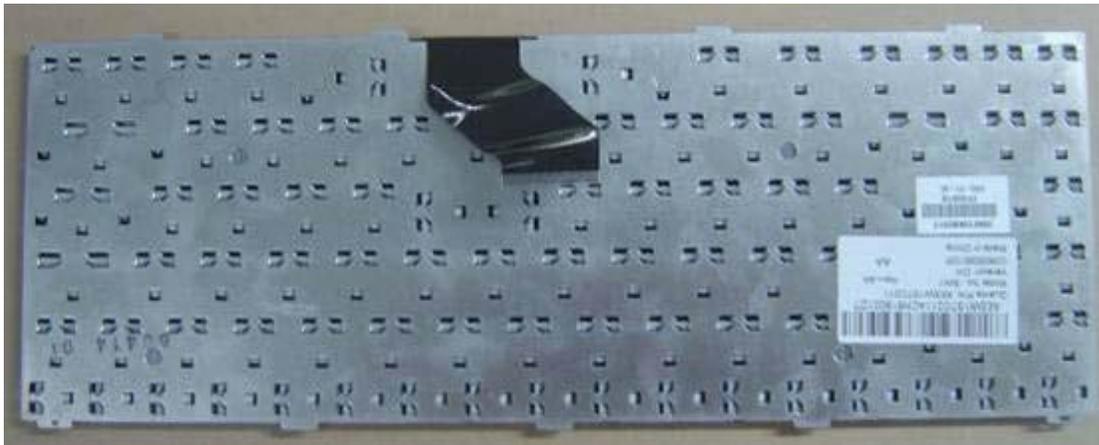


Figure A.4 – Conductive plate at the base of the keyboard

APPENDIX B

TEST PROCEDURES FOR CPU BOARDS AND COMPUTER POWER SUPPLIES

B.1 Introduction

Further to Section 15.32, power supplies and CPU boards used with personal computers, for which separate authorizations are required to be obtained, shall be tested as follows.

- Testing of motherboards with CPU sockets shall be performed using socketed CPU that maximize emissions for the set of socketed CPUs marketed as compatible. Manufactures can use reasonable engineering judgment and investigative testing methods to determine one test case for compliance documentation and retention of records.
- Motherboards sold with integral or attached CPU are tested together; both types are referred to as “CPU boards” in this appendix.

B.2 Test Procedures

a) CPU boards shall be tested as follows.

- 1) Testing for radiated emissions shall be performed with the CPU board installed in a typical enclosure, but with the enclosure’s cover removed so that the internal circuitry is exposed at the top and on at least two sides (this is called the open-case test condition). Additional components, including a power supply, peripheral devices, and subassemblies, shall be added, as needed, to produce a complete personal computer system. If the oscillator and the microprocessor circuits are contained on separate circuit boards, both boards, typical of the combination that would normally be employed, must be used in the test. Testing shall be in accordance with the procedures specified in Section 15.31 and ANSI C63.4-2014.
 - i) Under these test conditions, the system under test shall not exceed the radiated emission limits specified in Section 15.109 by more than 6 dB. Emissions greater than 6 dB that can be identified and documented to originate from a component(s) other than the CPU board being tested, may be disregarded. If compliance under this step a) 1) i) is not demonstrated, the alternative test procedure of step a) 2) shall be used.
 - ii) Unless the test specified in step a) 1) demonstrates compliance with the limits in Section 15.109, a second test shall be performed using the same configuration described in step a) 1) but with the cover installed on the enclosure. Testing shall be in accordance with the procedures specified in Section 15.31 and ANSI C63.4-2014. Under these test conditions, the system under test shall not exceed the radiated emission limits specified in Section 15.109.
- 2) In lieu of the procedure in step a) 1) (open-case), CPU boards may be tested to demonstrate compliance with the limits in Section 15.109 using a specified enclosure with the cover installed (called closed-case test condition). Testing for radiated emissions shall be performed with the CPU board installed in a typical system configuration. Additional components, including a power supply, peripheral devices, and subassemblies, shall be added, as needed, to result in a complete personal computer system. If the oscillator and the microprocessor circuits are contained on separate circuit boards, both boards, typical of the combination that would normally be employed, must be used in the test. Testing shall be in accordance with the procedures specified Section 15.31 and ANSI C63.4-2014. Under this procedure, CPU boards that comply with the limits in Section 15.109 must be marketed together with the specific enclosure used for the test.

- 3) The test demonstrating compliance with the AC power line conducted limits specified in Section 15.107 shall be performed in accordance with the procedures specified in Section 15.31 and ANSI C63.4-2014, using an enclosure, peripherals, power supply, and subassemblies that are typical of the type with which the CPU board under test would normally be employed.
- b) The power supply shall be tested installed in an enclosure that is typical of the type within which it would normally be installed. Additional components, including peripheral devices, a CPU board, and subassemblies, shall be added, as needed, to produce a complete personal computer system. Testing shall be in accordance with the procedures specified in Section 15.31 and ANSI C63.4-2014, and must demonstrate compliance with all of the standards contained in Part 15.
- c) Other general test configuration guidance includes the following:²⁵
 - 1) If the device under test provides for the connection of external accessories, including external electrical input signals, the device shall be tested with the accessories attached. The device under test shall be fully exercised with these external accessories. The emission measurements shall be performed with the device and accessories configured in a manner that tends to produce maximized emissions within the range of variations that can be expected under normal operating conditions. In the case of multiple accessory external ports, an external accessory shall be connected to one of each type of port. Only one test using peripherals or external accessories that are representative of the devices that will be employed with the equipment under test is required; all possible equipment combinations do not need to be tested. The accessories or peripherals connected to the device being tested shall be unmodified, commercially-available equipment.
 - 2) If the equipment under test consists of a central control unit (*e.g.*, host device) and an external or internal accessory(ies) (peripheral) and the responsible party manufactures or assembles the central control unit and at least one of the accessory devices that can be used with that control unit, then – testing of the control unit and/or the accessory(ies) must be performed using the devices manufactured or assembled by that party, in addition to any other needed devices which the party does not manufacture or assemble. If the responsible party does not manufacture or assemble the central control unit and at least one of the accessory devices that can be used with that control unit, or the party can demonstrate that the central control unit or accessory(ies) normally would be marketed or used with equipment from a different entity, then – testing of the central control unit and/or the accessory(ies) must be performed using the specific combination of equipment which is intended to be marketed or used together. Only one test using peripherals or accessories that are representative of the devices that will be employed with the equipment under test is required; all possible equipment combinations are not required to be tested. The accessories or peripherals connected to the device being tested shall be unmodified, commercially-available equipment.

²⁵ See 47 CFR §§ 15.31(i) and 15.31(j).