

CATEGORY 4 - COMPUTERS

Note 1: Computers, related equipment and “software” performing telecommunications or “local area network” functions must also be evaluated against the performance characteristics of Category 5, Part 1 (Telecommunications).

Note 2: Control units that directly interconnect the buses or channels of central processing units, ‘main storage’ or disk controllers are not regarded as telecommunications equipment described in Category 5, Part 1 (Telecommunications).

N.B.: For the control status of “software” “specially designed” for packet switching, see ECCN 5D001. (Telecommunications).

Technical Note: ‘Main storage’ is the primary storage for data or instructions for rapid access by a central processing unit. It consists of the internal storage of a “digital computer” and any hierarchical extension thereto, such as cache storage or non-sequentially accessed extended storage.

Note 3: Commodities and “software” in ECCNs 4A005 and 4D004 that are also controlled in ECCNs 5A002.a, 5A004.a, 5A004.b, 5D002.c.1, or 5D002.c.3, remain controlled in Category 5 – Part 2 by those entries. Category 5 – Part 2 does not apply to elements of source code that implement functionality controlled by these Category 4 ECCNs, or to any item subject to the EAR where Encryption Item (EI) functionality is absent, removed or otherwise non-existent.

Note 4: Items in ECCNs 4A005, 4D001.a (for 4A005 or 4D004), 4D004, and “technology” specified in ECCN 4E001.a (for 4A005, 4D001.a (for 4A005 or 4D004) or 4D004) and 4E001.c that are also controlled for Surreptitious Listening (SL) reasons under another ECCN, will continue to be classified under the SL ECCN.

A. “END ITEMS,” “EQUIPMENT,” “ACCESSORIES,” “ATTACHMENTS,” “PARTS,” “COMPONENTS,” AND “SYSTEMS”

4A001 Electronic computers and related equipment, having any of the following (see List of Items Controlled), and “electronic assemblies” and “specially designed” “components” therefor.

License Requirements

Reason for Control: NS, MT, AT, NP

Control(s)	Country Chart (See Supp. No. 1 to part 738)
NS applies to entire entry	NS Column 2
MT applies to items in 4A001.a when the parameters in 4A101 are met or exceeded	MT Column 1
AT applies to entire entry	AT Column 1
NP applies, unless a License Exception is available. See §742.3(b) of the EAR for information on applicable licensing review policies.	N/A

Reporting Requirements

See § 743.1 of the EAR for reporting requirements for exports under License Exceptions, and Validated End-User authorizations.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

LVS: \$5000 for 4A001.a; N/A for MT.
 GBS: N/A

Special Conditions for STA

STA: License Exception STA may not be used to ship any commodity in 4A001.a.2 to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: See also [4A101](#) and [4A994](#). Equipment designed or rated for transient ionizing radiation is “subject to the ITAR” (see 22 CFR parts 120 through 130).
Related Definitions: For the purposes of integrated circuits in 4A001.a.2, $5 \times 10^3 \text{ Gy(Si)} = 5 \times 10^5 \text{ Rads (Si)}$; $5 \times 10^6 \text{ Gy (Si)/s} = 5 \times 10^8 \text{ Rads (Si)/s}$.

Items:

a. “Specially designed” to have any of the following:

a.1. Rated for operation at an ambient temperature below 228 K (-45°C) or above 358 K (85°C); or

Note: 4A001.a.1 does not apply to computers “specially designed” for civil automobile, railway train or “civil aircraft” applications.

a.2. Radiation hardened to exceed any of the following specifications:

a.2.a. A total dose of $5 \times 10^3 \text{ Gy (Si)}$;

a.2.b. A dose rate upset of $5 \times 10^6 \text{ Gy (Si)/s}$; or

a.2.c. Single Event Upset of $1 \times 10^{-8} \text{ Error/bit/day}$;

Note: 4A001.a.2 does not apply to computers “specially designed” for “civil aircraft” applications.

b. [Reserved]

4A003 “Digital computers”, “electronic assemblies”, and related equipment therefor, as follows (see List of Items Controlled) and “specially designed” “components” therefor.

License Requirements

Reason for Control: NS, CC, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
NS applies to 4A003.b and .c	NS Column 1
NS applies to 4A003.e and .g	NS Column 2
CC applies to “digital computers” for computerized finger-print equipment	CC Column 1
AT applies to entire entry (refer to 4A994 for controls on “digital computers” with a $APP > 0.0128$ but $\leq 29 \text{ WT}$)	AT Column 1

Note: For all destinations, except those countries in Country Group E:1 or E:2 of Supplement No. 1 to part 740 of the EAR, no license is required (NLR) for computers with an “Adjusted Peak Performance” (“APP”) not exceeding 29 Weighted TeraFLOPS (WT) and for “electronic assemblies” described in 4A003.c that are not capable of exceeding an “Adjusted Peak Performance” (“APP”) exceeding 29 Weighted TeraFLOPS (WT) in aggregation, except certain transfers as set forth in § 746.3 (Iraq).

Reporting Requirements

Special Post Shipment Verification reporting and recordkeeping requirements for exports of computers to destinations in Computer Tier 3 may be found in §743.2 of the EAR.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

LVS: \$5000; N/A for 4A003.b and .c.
GBS: Yes, for 4A003.g and “specially designed” “parts” and “components” therefor, exported separately or as part of a system.
APP: Yes, for computers controlled by 4A003.b, and “electronic assemblies” controlled by 4A003.c, to the exclusion of other technical parameters. See §740.7 of the EAR.

“specially designed” for other equipment with functions limited to those required for the other equipment is determined by the control status of the other equipment even if it exceeds the “principal element” criterion.

N.B. 2: *For the control status of “digital computers” or related equipment for telecommunications equipment, see Category 5, Part 1 (Telecommunications).*

List of Items Controlled

Related Controls: See also [4A994](#) and [4A980](#)

Related Definitions: N/A

Items:

Note 1: *4A003 includes the following:*

- ‘Vector processors’ (as defined in Note 7 of the “Technical Note on “Adjusted Peak Performance” (“APP”));

- Array processors;

- Digital signal processors;

- Logic processors;

- Equipment designed for “image enhancement.”

Note 2: *The control status of the “digital computers” and related equipment described in 4A003 is determined by the control status of other equipment or systems provided:*

a. *The “digital computers” or related equipment are essential for the operation of the other equipment or systems;*

b. *The “digital computers” or related equipment are not a “principal element” of the other equipment or systems; and*

N.B. 1: *The control status of “signal processing” or “image enhancement” equipment*

c. *The “technology” for the “digital computers” and related equipment is determined by 4E.*

a. [Reserved]

b. “Digital computers” having an “Adjusted Peak Performance” (“APP”) exceeding 29 Weighted TeraFLOPS (WT);

c. “Electronic assemblies” “specially designed” or modified to be capable of enhancing performance by aggregation of processors so that the “APP” of the aggregation exceeds the limit in 4A003.b.;

Note 1: *4A003.c applies only to “electronic assemblies” and programmable interconnections not exceeding the limit in 4A003.b when shipped as unintegrated “electronic assemblies.”*

Note 2: *4A003.c does not control “electronic assemblies” “specially designed” for a product or family of products whose maximum configuration does not exceed the limit of 4A003.b.*

d. to f. [Reserved]

N.B.: *For “electronic assemblies,” modules or equipment, performing analog-to-digital conversions, see 3A002.h.*

g. Equipment “specially designed” for aggregating the performance of “digital computers” by providing external

interconnections which allow communications at unidirectional data rates exceeding 2.0 Gbyte/s per link.

Note: 4A003.g does not control internal interconnection equipment (e.g., backplanes, buses) passive interconnection equipment, “network access controllers” or “communication channel controllers”.

4A004 Computers as follows (see List of Items Controlled) and “specially designed” related equipment, “electronic assemblies” and “components” therefor.

License Requirements

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

LVS: \$5000

GBS: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

- a. ‘Systolic array computers’;
- b. ‘Neural computers’;
- c. ‘Optical computers’.

Technical Notes:

1. ‘Systolic array computers’ are computers where the flow and modification of the data is dynamically controllable at the logic gate level by the user.

2. ‘Neural computers’ are computational devices designed or modified to mimic the behaviour of a neuron or a collection of neurons, i.e., computational devices which are distinguished by their hardware capability to modulate the weights and numbers of the interconnections of a multiplicity of computational components based on previous data.

3. ‘Optical computers’ are computers designed or modified to use light to represent data and whose computational logic elements are based on directly coupled optical devices.

4A005 “Systems,” “equipment,” and “components” therefor, “specially designed” or modified for the generation, command and control, or delivery of “intrusion software”.

License Requirements

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry	NS Column 1
AT applies to entire entry	AT Column 1

Reporting Requirements

See § 743.1 of the EAR for reporting requirements for exports under License Exceptions, and Validated End-User authorizations.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

LVS: N/A
GBS: N/A
APP: N/A
ACE: Yes, except to Country Group E:1 or E:2. See §740.22 of the EAR for eligibility criteria.

GBS: N/A

Special Conditions for STA

STA: License Exception STA may not be used to ship items specified by ECCN 4A005.

List of Items Controlled

Related Controls: N/A
Related Definitions: N/A
Items:

List of Items Controlled

Related Controls: Defense articles described in USML Category XI(b), and software directly related to a defense article, are “subject to the ITAR”; see § 120.10(a)(4).
Related Definitions: N/A
Items:

- a. Rated for continuous operation at temperatures from below 228 K (-45° C) to above 328 K (+55°C); or
- b. Designed as ruggedized or ‘radiation hardened’.

Note: ‘Radiation hardened’ means that the “part,” “component” or equipment is designed or rated to withstand radiation levels which meet or exceed a total irradiation dose of 5×10^5 rads (Si).

The list of items controlled is contained in the ECCN heading.

4A102 “Hybrid computers” “specially designed” for modelling, simulation or design integration of “missiles” or their subsystems. (These items are “subject to the ITAR” See 22 CFR parts 120 through 130.)

4A101 Analog computers, “digital computers” or digital differential analyzers, other than those controlled by 4A001 designed or modified for use in “missiles”, having any of the following (see List of Items Controlled).

4A611 Computers, and “parts,” “components,” “accessories,” and “attachments” “specially designed” therefor, “specially designed” for a military application that are not enumerated in any USML category are controlled by ECCN 3A611.

License Requirements

Reason for Control: MT, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
MT applies to entire entry	MT Column 1
AT applies to entire entry	AT Column 1

4A980 Computers for fingerprint equipment, n.e.s.

License Requirements

Reason for Control: CC, AT

List Based License Exceptions (See Part 740 for a description of all license exceptions)

LVS: N/A

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>

CC applies to entire entry	CC Column 1
AT applies to entire entry	AT Column 1

Related Controls: N/A
Related Definitions: N/A
Items:

List Based License Exceptions (See Part 740 for a description of all license exceptions)

LVS: N/A
GBS: N/A

List of Items Controlled

Related Controls: N/A
Related Definitions: N/A
Items:

The list of items controlled is contained in the ECCN heading.

Note: 4A980 does not control equipment limited to one finger and designed for user authentication or access control.

4A994 Computers, “electronic assemblies” and related equipment, not controlled by 4A001 or 4A003, and “specially designed” “parts” and “components” therefor (see List of Items Controlled).

License Requirements

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

LVS: N/A
GBS: N/A

List of Items Controlled

Note 1: The control status of the “digital computers” and related equipment described in 4A994 is determined by the control status of other equipment or systems provided:

a. The “digital computers” or related equipment are essential for the operation of the other equipment or systems;

b. The “digital computers” or related equipment are not a “principal element” of the other equipment or systems; and

N.B. 1: The control status of “signal processing” or “image enhancement” equipment “specially designed” for other equipment with functions limited to those required for the other equipment is determined by the control status of the other equipment even if it exceeds the “principal element” criterion.

N.B. 2: For the control status of “digital computers” or related equipment for telecommunications equipment, see Category 5, Part 1 (Telecommunications).

c. The “technology” for the “digital computers” and related equipment is determined by 4E.

a. Electronic computers and related equipment, and “electronic assemblies” and “specially designed” “parts” and “components” therefor, rated for operation at an ambient temperature above 343 K (70°C);

b. “Digital computers”, including equipment of “signal processing” or image enhancement”, having an “Adjusted Peak Performance” (“APP”) equal to or greater than 0.0128 Weighted TeraFLOPS (WT);

c. “Electronic assemblies” that are “specially

designed” or modified to enhance performance by aggregation of processors, as follows:

c.1. Designed to be capable of aggregation in configurations of 16 or more processors;

c.2. [Reserved];

Note 1: 4A994.c applies only to “electronic assemblies” and programmable interconnections with a “APP” not exceeding the limits in 4A994.b, when shipped as unintegrated “electronic assemblies”. It does not apply to “electronic assemblies” inherently limited by nature of their design for use as related equipment controlled by 4A994.k.

Note 2: 4A994.c does not control any “electronic assembly” “specially designed” for a product or family of products whose maximum configuration does not exceed the limits of 4A994.b.

d. [Reserved];

e. [Reserved];

f. Equipment for “signal processing” or “image enhancement” having an “Adjusted Peak Performance” (“APP”) equal to or greater than 0.0128 Weighted TeraFLOPS WT;

g. [Reserved];

h. [Reserved];

i. Equipment containing “terminal interface equipment” exceeding the limits in 5A991;

j. Equipment “specially designed” to provide external interconnection of “digital computers” or associated equipment that allows communications at data rates exceeding 80 Mbyte/s.

Note: 4A994.j does not control internal interconnection equipment (e.g., backplanes,

buses) passive interconnection equipment, “network access controllers” or “communication channel controllers”.

k. “Hybrid computers” and “electronic assemblies” and “specially designed” “parts” and “components” therefor containing analog-to-digital converters having all of the following characteristics:

k.1. 32 channels or more; and

k.2. A resolution of 14 bit (plus sign bit) or more with a conversion rate of 200,000 conversions/s or more.

B. TEST, INSPECTION AND “PRODUCTION EQUIPMENT”

[Reserved]

C. “MATERIALS”

[Reserved]

D. “SOFTWARE”

Note: The control status of “software” for equipment described in other Categories is dealt with in the appropriate Category.

4D001 “Software” as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, CC, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry	NS Column 1

CC applies to “software” for computerized finger-print equipment controlled by 4A003 for CC reasons	CC Column 1
AT applies to entire entry	AT Column 1

Reporting Requirements

See § 743.1 of the EAR for reporting requirements for exports under License Exceptions, and Validated End-User authorizations.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: Yes, except for “software” for the “development” or “production” of the following:

(1) Commodities with an “Adjusted Peak Performance” (“APP”) exceeding 29 WT; or

(2) Commodities controlled by 4A005 or “software” controlled by 4D004.

APP: Yes to specific countries (see §740.7 of the EAR for eligibility criteria)

ACE: Yes for 4D001.a (for the “development”, “production” or “use” of equipment or “software” specified in ECCN 4A005 or 4D004), except to Country Group E:1 or E:2. See §740.22 of the EAR for eligibility criteria.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit “software” “specially designed” or modified for the “development” or “production” of equipment specified by ECCN 4A001.a.2 or

for the “development” or “production” of “digital computers” having an ‘Adjusted Peak Performance’ (‘APP’) exceeding 29 Weighted TeraFLOPS (WT) to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR); and may not be used to ship or transmit “software” specified in 4D001.a “specially designed” for the “development” or “production” of equipment specified by ECCN 4A005 to any of the destinations listed in Country Group A:5 or A:6.

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

a. “Software” “specially designed” or modified for the “development” or “production”, of equipment or “software” controlled by 4A001, 4A003, 4A004, 4A005 or 4D (except 4D980, 4D993 or 4D994).

b. “Software”, other than that controlled by 4D001.a, “specially designed” or modified for the “development” or “production” of equipment as follows:

b.1. “Digital computers” having an “Adjusted Peak Performance” (“APP”) exceeding 15 Weighted TeraFLOPS (WT);

b.2. “Electronic assemblies” “specially designed” or modified for enhancing performance by aggregation of processors so that the “APP” of the aggregation exceeds the limit in 4D001.b.1.

4D004 “Software” “specially designed” or modified for the generation, command and control, or delivery of “intrusion software.”

License Requirements

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry	NS Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

APP: N/A

ACE: Yes, except to Country Group E:1 or E:2. See §740.22 of the EAR for eligibility criteria.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit “software” specified by ECCN 4D004.

List of Items Controlled

Related Controls: Software described in USML Category XI(b), and software directly related to a defense article, is “subject to the ITAR”; see § 120.10(a)(4).

Related Definitions: N/A

Items:

The list of items controlled is contained in the ECCN heading.

Note: 4D004 does not apply to “software” specially designed and limited to provide “software” updates or upgrades meeting all the following:

a. The update or upgrade operates only with the authorization of the owner or administrator of the system receiving it; and

b. After the update or upgrade, the “software” updated or upgraded is not any of the following:

1. “Software” specified by 4D004; or
2. “Intrusion software.”

4D980 “Software” “specially designed” for the “development,” “production” or “use” of commodities controlled by 4A980.

License Requirements

Reason for Control: CC, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
CC applies to entire entry	CC Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

The list of items controlled is contained in the ECCN heading.

4D993 “Program” proof and validation “software,” “software” allowing the automatic generation of “source codes,” and operating system “software” that are “specially designed” for “real-time processing” equipment (see List of Items Controlled).

License Requirements

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: “Global interrupt latency time” is the time taken by the computer system to recognize an interrupt due to the event, service the interrupt and perform a context switch to an alternate memory-resident task waiting on the interrupt.

Items:

- a. “Program” proof and validation “software” using mathematical and analytical techniques and designed or modified for “programs” having more than 500,000 “source code” instructions;
- b. “Software” allowing the automatic generation of “source codes” from data acquired on line from external sensors described in the Commerce Control List; *or*
- c. Operating system “software” “specially designed” for “real-time processing” equipment that guarantees a “global interrupt latency time” of less than 20 microseconds.

4D994 “Software” other than that controlled in 4D001 “specially designed” or modified for the “development”, “production”, or “use” of equipment controlled by 4A101, 4A994.

License Requirements

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

The list of items controlled is contained in the ECCN heading.

E. “TECHNOLOGY”

4E001 “Technology” as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, MT, CC, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry	NS Column 1.
MT applies to “technology” for items controlled by 4A001.a and 4A101 for MT reasons	MT Column 1.
CC applies to “software” for computerized finger-print equipment controlled by 4A003 for CC reasons	CC Column 1.
AT applies to entire entry	AT Column 1.

Reporting Requirements

See § 743.1 of the EAR for reporting requirements for exports under License Exceptions, and Validated End-User authorizations.

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: Yes, except for the following:

(1) “Technology” for the “development” or “production” of commodities with an “Adjusted Peak Performance” (“APP”) exceeding 29 WT or for the “development” or “production” of commodities controlled by 4A005 or “software” controlled by 4D004; or

(2) “Technology” for the “development” of “intrusion software”.

APP: Yes to specific countries (see §740.7 of the EAR for eligibility criteria).

ACE: Yes for 4E001.a (for the “development”, “production” or “use” of equipment or “software” specified in ECCN 4A005 or 4D004) and for 4E001.c, except to Country Group E:1 or E:2. See §740.22 of the EAR for eligibility criteria.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit “technology” according to the General Technology Note for the “development” or “production” of any of the following equipment or “software”: a. Equipment specified

by ECCN 4A001.a.2; b. “Digital computers” having an ‘Adjusted Peak Performance’ (‘APP’) exceeding 29 Weighted TeraFLOPS (WT); or c. “software” specified in the License Exception STA paragraph found in the License Exception section of ECCN 4D001 to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR); and may not be used to ship or transmit “software” specified in 4E001.a (for the “development”, “production” or “use” of equipment or “software” specified in ECCN 4A005 or 4D004) and 4E001.c to any of the destinations listed in Country Group A:5 or A:6.

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

a. “Technology” according to the General Technology Note, for the “development”, “production”, or “use” of equipment or “software” controlled by 4A (except 4A980 or 4A994) or 4D (except 4D980, 4D993, 4D994).

b. “Technology” according to the General Technology Note, other than that controlled by 4E001.a, for the “development” or “production” of equipment as follows:

b.1. “Digital computers” having an “Adjusted Peak Performance” (“APP”) exceeding 15 Weighted TeraFLOPS (WT);

b.2. “Electronic assemblies” “specially designed” or modified for enhancing performance by aggregation of processors so that the “APP” of the aggregation exceeds the limit in 4E001.b.1.

c. “Technology” for the “development” of “intrusion software.”

Note 1: 4E001.a and 4E001.c do not apply to “vulnerability disclosure” or “cyber incident response”.

Note 2: Note 1 does not diminish national authorities’ rights to ascertain compliance with 4E001.a and 4E001.c.

4E980 “Technology” for the “development,” “production” or “use” of commodities controlled by 4A980.

License Requirements

Reason for Control: CC, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
CC applies to entire entry	CC Column 1
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

*Related Controls: N/A
Related Definitions: N/A
Items:*

The list of items controlled is contained in the ECCN heading.

4E992 “Technology” other than that controlled in 4E001 for the “development,” “production,” or “use” of equipment controlled by 4A994, or “software” controlled

by 4D993 or 4D994.

License Requirements

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

*Related Controls: N/A
Related Definitions: N/A
Items:*

The list of items controlled is contained in the ECCN heading.

4E993 “Technology” for the “development” or “production” of equipment designed for “multi-data-stream processing.”

License Requirements

Reason for Control: AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
AT applies to entire entry	AT Column 1

List Based License Exceptions (See Part 740 for a description of all license exceptions)

TSR: N/A

List of Items Controlled

Related Controls: N/A
 Related Definitions: N/A
 Items:

The list of items controlled is contained in the ECCN heading.

EAR99 Items subject to the EAR that are *not* elsewhere specified in this CCL Category or in any other category in the CCL are designated by the number **EAR99**.

TECHNICAL NOTE ON “ADJUSTED PEAK PERFORMANCE” (“APP”)

“APP” is an adjusted peak rate at which “digital computers” perform 64-bit or larger floating point additions and multiplications.

Abbreviations used in this Technical Note

n number of processors in the “digital computer”
I processor number (i,...n)
t_i processor cycle time ($t_i = 1/F_i$)
F_i processor frequency
R_i peak floating point calculating rate
W_i architecture adjustment factor

“APP” is expressed in Weighted TeraFLOPS (WT), in units of 10^{12} adjusted floating point operations per second.

Outline of “APP” calculation method

1. For each processor *i*, determine the peak number of 64-bit or larger floating-point operations, FPO_i , performed per cycle for each processor in the “digital computer”.

Note: In determining FPO , include only 64-bit or larger floating point additions or multiplications. All floating point operations

must be expressed in operations per processor cycle; operations requiring multiple cycles may be expressed in fractional results per cycle. For processors not capable of performing calculations on floating-point operands of 64-bits or more the effective calculating rate *R* is zero.

2. Calculate the floating point rate *R* for each processor

$$R_i = FPO_i/t_i.$$

3. Calculate “APP” as

$$“APP” = W_1 \times R_1 + W_2 \times R_2 + \dots + W_n \times R_n.$$

4. For ‘vector processors,’ $W_i = 0.9$. For non-‘vector processors,’ $W_i = 0.3$.

Note 1: For processors that perform compound operations in a cycle, such as an addition and multiplication, each operation is counted.

Note 2: For a pipelined processor the effective calculating rate *R* is the faster of the pipelined rate, once the pipeline is full, or the non-pipelined rate.

Note 3: The calculating rate *R* of each contributing processor is to be calculated at its maximum value theoretically possible before the “APP” of the combination is derived. Simultaneous operations are assumed to exist when the computer manufacturer claims concurrent, parallel, or simultaneous operation or execution in a manual or brochure for the computer.

Note 4: Do not include processors that are limited to input/output and peripheral functions (e.g., disk drive, communication and video display) when calculating “APP”.

Note 5: “APP” values are not to be calculated for processor combinations(inter)connected by “Local Area

Networks”, Wide Area Networks, I/O shared connections/devices, I/O controllers and any communication interconnection implemented by “software”.

***Note 6:** “APP” values must be calculated for processor combinations containing processors “specially designed” to enhance performance by aggregation, operating simultaneously and sharing memory*

Technical Notes

1. Aggregate all processors and accelerators operating simultaneously and located on the same die.

2. Processor combinations share memory when any processor is capable of accessing any memory location in the system through the hardware transmission of cache lines or memory words, without the involvement of any software mechanism, which may be achieved using “electronic assemblies” specified in 4A003.c.

***Note 7:** A ‘vector processor’ is defined as a processor with built-in instructions that perform multiple calculations on floating-point vectors (one-dimensional arrays of 64-bit or larger numbers) simultaneously, having at least 2 vector functional units and at least 8 vector registers of at least 64 elements each.*