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December 2003 Wassenaar Arrangement Plenary Agreement Implementation: Categories 1, 2, 3, 4, 5, 6, and 7 of the Commerce Control List, and Reporting Requirements; and Interpretation Regarding NUMA Technology; Final Rule

DEPARTMENT OF COMMERCE

Bureau of Industry and Security

15 CFR Parts 770 and 774

[Docket No. 040414115–4115–01]

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December 2003 Wassenaar Arrangement Plenary Agreement Implementation: Categories 1, 2, 3, 4, 5, 6, and 7 of the Commerce Control List, and Reporting Requirements; and Interpretation Regarding NUMA Technology

AGENCY: Bureau of Industry and Security, Commerce.

ACTION: Final rule.

SUMMARY: The Bureau of Industry and Security (BIS) maintains the Commerce Control List (CCL), which identifies items subject to Department of Commerce export controls. This final rule revises certain entries controlled for national security reasons in Categories 1, 2, 3, 4, 5 Part I (telecommunications), 5 Part II (information security), 6, and 7 to conform with changes in the List of Dual-Use Goods and Technologies maintained and agreed to by governments participating in the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies (Wassenaar Arrangement). The Wassenaar Arrangement focuses on implementation of effective export controls on strategic items with the objective of improving regional and international security and stability.

The purpose of this final rule is to make the necessary changes to the Commerce Control List to implement revisions to the Wassenaar List that were agreed upon in the December 2003 meeting. In addition, this rule adds a paragraph to Interpretation 12 ''Computers'' to provide guidance as to how to calculate the Composite Theoretical Performance (CTP) for computer systems with ''non-uniform memory access'' (NUMA) architecture, and to define NUMA.

DATES: *Effective Date:* This rule is effective April 29, 2004.

FOR FURTHER INFORMATION CONTACT: For questions of a general nature contact Sharron Cook, Office of Exporter Services, Bureau of Industry and Security, U.S. Department of Commerce at (202) 482–2440 or e-mail: *scook@bis.doc.gov.*

For questions of a technical nature contact:

Category 1: Bob Teer 202–482–4749

Category 2: George Loh 202–482–3570

Category 3: Dave Ports 202–482–9164 or Brian Baker 202–482–9135

Category 4 and 5 part 1: Joe Young 202–482–4197

Category 5 part 2: Norm La Croix 202–482–4439

Category 6: Chris Costanzo (night vision) 202–482–0718 or Wayne Hovis (lasers) 202–482–1837

Categories 7 and 8: Dan Squire 202–482–3710

Categories 8 and 9: Gene Christensen 202–482–2984

SUPPLEMENTARY INFORMATION:

Background

In July 1996, the United States and thirty-two other countries gave final approval to the establishment of a new multilateral export control arrangement, called the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies (Wassenaar Arrangement). The Wassenaar Arrangement contributes to regional and international security and stability by promoting transparency and greater responsibility in transfers of conventional arms and dual-use goods and technologies, thus preventing destabilizing accumulations of such items. Participating states have committed to exchange information on exports of dual-use goods and technologies to non-participating states for the purposes of enhancing transparency and assisting in developing common understandings of the risks associated with the transfers of these items.

This rule revises a number of national security controlled entries on the Commerce Control List (CCL) to conform with December 2003 revisions to the Wassenaar List of Dual-Use Goods and Technologies. This rule also revises language to provide a complete or more accurate description of controls. A detailed description of the revisions to the CCL is provided below.

Specifically, this rule makes the following amendments to the Commerce Control List:

Category 1—Materials, Chemicals, ''Microorganisms,'' and Toxins

- ECCN 1A005 is amended by:

(a) Revising note 2 in the Related Controls paragraph and moving it to a Note in the Items paragraph in the List of Items Controlled section;

(b) Moving note 3 in the Related Controls paragraph to a Note in the Items paragraph in the List of Items Controlled section; and

(c) Adding a new note 2 in the Related Controls paragraph of the List of Items Controlled section to point to a related control in ECCN 1C010 concerning the ''fibrous or filamentary materials'' used in the manufacture of body armor.

Category 2—Materials Processing

- ECCN 2B001 is amended by:

(a) Revising the heading to add ''specially designed components'' (inserting ''and specially designed components'' in the 2B001 heading before the words ''as follows'' simply makes the heading consistent with the inclusion of ''and specially designed components therefor'' in 2B001.f and does not impose a new license requirement for specially designed components for the other 2B001 sub-items); and

(b) Adding a new note 3 to the beginning of the Items paragraph in the List of Items Controlled section that reads, ''A machine tool having at least two of the three turning, milling or grinding capabilities (*e.g.*, a turning machine with milling capability), must be evaluated against each applicable entry 2B001.a., b. or c.''

- ECCN 2B002 is added to the CCL to control exports and reexports of ''Numerically controlled machine tools using a magnetorheological finishing (MRF) process'' for national security (NS) and anti-terrorism (AT) reasons.
- ECCN 2B006 is amended by revising the note for 2B006.b.2 to provide that ''laser light'' is an example of ''collimated light''.
- ECCN 2B206 is amended by adding a paragraph 2B206.c that will duplicate text from 2B006.b.2, without, however, the ''laser light'' example of ''collimated light'' in the note, because the ''laser light'' example has not been adopted by the Nuclear Supplier's Group.
- ECCN 2D002 is amended by adding a second note to the Items paragraph of the List of Items Controlled section to read, ''2D002 does not control 'software' for items controlled by 2B002. *See* 2D001 for control of 'software' for items controlled by 2B002.''
- Category 2E—Materials Processing ''Notes to Table on Deposition Techniques'' is amended by adding to the end of note 17, ''or molds, for casting or molding of plastics, manufactured from alloys containing less than 5% beryllium.''

Category 3—Electronics

- ECCN 3A001 is amended by:

(a) Revising the parameter ''31 GHz'' to read ''31.8 GHz'' in paragraph (b) of Notes 1 and 2 for 3A001.b.1, and 3A001.b.1.a.1;

(b) Revising 3A001.b.2 (including subparagraphs) to control microwave monolithic integrated circuits with newly revised parameters;

(c) Revising Note 1 for 3A001.b.2;

(d) Adding two new notes for 3A001.b.2;

(e) Revising 3A001.b.3 to add parameters and a Note;

(f) Revising 3A001.b.4 to add parameters, a *nota bene* (N.B.), and two Notes; and

(g) Removing and reserving 3A001.b.6 ''certain 'microwave assemblies' '', and reference to such commodity in the Related Controls paragraph of the List of Items Controlled section of 3A001.

• ECCN 3A002 is amended by:

(a) Revising the parameter for frequency synthesized signal generators in 3A002.d.1;

(b) Adding a new parameter in 3A002.d.2;

(c) Redesignating paragraphs 2 and 3 as paragraphs 3 and 4; and

(d) Adding a Technical Note for 3A002.d.1 regarding ''pulse duration''.

• ECCN 3A003 is added to control certain ''spray cooling thermal management systems'' and ''specially designed components therefor''.

• ECCN 3B001 is amended by:

(a) Removing the term ''Stored program controlled'' from 3B001.a, .b, .c, .d, .e, and .f.

(b) Revising the parameters in 3B001.a.1 for equipment designed for epitaxial growth;

(c) Revising the parameters in 3B001.b.4 for equipment designed for ion implantation;

(d) Revising the parameters in 3B001.d.1 for plasma enhanced CVD equipment with cassette-to-cassette operation and load-locks;

(e) Revising the parameters in 3B001.d.2 for plasma enhanced CVD equipment specially designed for automatic loading multi-chamber central wafer handling systems controlled in 3B001.e; and

(f) Adding a Note to 3B001.h for ''Multi-layer masks with a phase shift layer''.

• ECCN 3B002 is amended by:

(a) Revising the frequency parameter from ''31 GHz'' to read ''31.8 GHz'' in 3B002.a;

(b) Revising the parameter for test equipment for testing integrated circuits capable of performing functional (truth table) testing at a pattern rate of more than ''333 MHz'' to read ''667 MHz'' in 3B002.b;

Note: For commodities no longer controlled under ECCN 3B002, there is a license requirement under ECCN 3B992 for exports and reexports to AT Column 1 countries of the Commerce Country Chart.

• ECCN 3D002 is amended by revising the Heading and adding paragraphs to the List of Items Controlled to remove ''use'' software for 3B001.g and .h (masks, reticles, and multi-layer masks) from this entry.

Note: For commodities no longer controlled under ECCN 3D002, there is a license requirement under ECCN 3D991 for exports and reexports to AT Column 1 countries of the Commerce Country Chart.

• ECCN 3D003 is amended by revising the Heading to include the items to be controlled by this ECCN, removing the note in Related Controls, removing Note 2 in the Related Definitions paragraph, adding a new Note 2 to define ''Physics-based,'' and deleting all paragraphs under Items paragraph of the List of Items Controlled section.

• ECCN 3D004 is added to control ''software'' specially designed for the ''development'' of the equipment controlled by the newly added ECCN 3A003 ''spray cooling thermal management systems and specially designed components therefor''.

• ECCN 3D991 is amended by revising the Heading to add ''software'' specially designed for the ''use'' of equipment controlled by 3B001.g and .h (masks, reticles, and multi-layer masks).

• ECCN 3E001 is amended by revising Note 1 and adding Note 2 to read ''3E001 does not control 'technology' for the 'production' of equipment or components controlled by 3A003.''

• ECCN 3E002 is amended by revising the Note in the List of Items Controlled to remove reference to certain microwave transistors.

• ECCN 3E003 is amended by adding a Note for 3E003.b concerning high electron mobility transistors (HEMT); and revising the frequency from ''31 GHz'' to ''31.8 GHz'' in Note 1 of the Related Controls paragraph, as well as in paragraph 3E003.g ''Electronic vacuum tubes''.

Category 4—Computers

• ECCN 4A002 is deleted from the CCL.

Note: For commodities no longer controlled under ECCN 4A002, there is a license requirement under ECCN 4A994 for exports and reexports to AT Column 1 countries of the Commerce Country Chart. The software and technology for the ''development'', ''production'', and ''use'' of this commodity will move from 4D001 to 4D994, and 4E001 to 4E992, respectively.

• ECCN 4A994 is amended by revising the Heading and adding paragraph 4A994.k to control commodities that were previously controlled by ECCN 4A002. In addition, this rule adds an explanatory note contained in the List of Items Controlled section of ECCN 4A003 to ECCN 4A994, to clarify that the control status of the listed items is determined the same way for both ECCNs.

• Composite Theoretical Performance (CTP) Calculation formula is amended to add a *nota bene* (N.B.) just below the heading to reference a new paragraph (3) to paragraph 770.2(1) Interpretation 12: ''Computers'', which now provides guidance as to how to calculate the Composite Theoretical Performance (CTP) for computer systems with ''Non-Uniform Memory Access'' (NUMA) architecture, and defines NUMA.

Category 5—Part I—Telecommunications

• ECCN 5B001 is amended by:

(a) Removing the term ''stored program controlled'' from 5B001.b;

(b) Removing the phrase ''including 'Asynchronous Transfer Mode' ('ATM')'' from 5B001.b.1;

(c) Revising the ''total digital transfer rate'' parameter from ''1.5 Gbit/s'' to ''15 Gbit/s'' in 5B001.b.1; and

(d) Adding a Technical Note after 5B001.b.1 to define ''total digital transfer rate''.

Note: For commodities no longer controlled under ECCN 5B001, there is a license requirement under ECCN 5B991 for exports and reexports to AT Column 1 countries of the Commerce Country Chart.

• ECCN 5D001 is amended by:

(a) Removing the term ''stored program controlled'' from 5D001.d;

(b) Removing the phrase ''including 'Asynchronous Transfer Mode' ('ATM')'' from 5D001.d.1;

(c) Revising the ''total digital transfer rate'' parameter from ''1.5 Gbit/s'' to ''15 Gbit/s'' in 5D001.d.1; and

(d) Adding a Technical Note after 5D001.d.1 to define ''total digital transfer rate''.

Note: For commodities no longer controlled under ECCN 5D001, there is a license requirement under ECCN 5D991 for exports and reexports to AT Column 1 countries of the Commerce Country Chart.

• ECCN 5E001 is amended by:

(a) Removing the term ''stored program controlled'' from 5E001.c;

(b) Removing the phrase ''including 'Asynchronous Transfer Mode' ('ATM')'' from 5E001.c.1;

(c) Revising the ''total digital transfer rate'' parameter from ''1.5 Gbit/s'' to ''15 Gbit/s'' in 5E001.c.1;

(d) Adding a Technical Note after 5E001.c.1 to define ''total digital transfer rate''; and

(e) Revising the frequency parameter from ''31 GHz'' to ''31.8 GHz'' in 5E001.c.4.b.

Note: For commodities no longer controlled under ECCN 5E001, there is a license requirement under ECCN 5E991 for

exports and reexports to AT Column 1 countries of the Commerce Country Chart.

Category 5—Part II—Information Security

• ECCN 5A002 is amended by removing and reserving 5A002.a.7, which read ''Designed or modified to provide certified or certifiable 'multilevel security' or user isolation at a level exceeding Class B2 of the Trusted Computer System Evaluation Criteria (TCSEC) or equivalent;''

Category 6—Sensors

• ECCN 6A001 is amended by:

(a) Revising the parameter for towed acoustic hydrophone arrays by adding the phrase '' 'or able to be modified' to have hydrophone group spacing of less than 12.5 m;'' to the existing parameter in 6A001.a.2.b.1; and

(b) Revising the reference in the Technical Note from ''6A001.a.2.b.2'' to read ''6A001.a.2.b''.

• ECCN 6A003 is amended by:

(a) Revising the parameter in 6A001.b.1 for video cameras incorporating solid state sensors by adding three new parameters to control these video cameras when they have optical mirrors controlled by 6A004.a, optical control equipment controlled by 6A004.d, or the capability for annotating internally generated camera tracking data; and

(b) Adding Technical Note 2 to explain camera tracking data.

• ECCN 6A005 is amended by:

(a) Repositioning the two Notes under 6A005.b.4 to under 6A005.b. Note 1 explains 6A005.b includes semiconductor ''lasers'' having optical output connectors (*e.g.*, fiber optic pigtails); and Note 2 explains that the control status of semiconductor ''lasers'' specially designed for other equipment is determined by the control status of the other equipment;

(b) Revising the wavelength ranges and CW output variations for individual multiple-transverse mode semiconductor ''lasers'' in 6A005.b.2 (including all subparagraphs);

(c) Revising the wavelength ranges and CW output variations for individual semiconductor ''laser'' arrays in 6A005.b.3 (including all subparagraphs);

(d) Adding a control paragraph 6A005.b.4 for array stacks of semiconductor ''lasers'' containing at least one array that is controlled under 6A005.b.3; and

(e) Adding Technical Notes 2 and 3 to 6A005.b.4 to explain ''array'' and ''array stack''.

• ECCN 6A006 is amended by adding to 6A006.a a new parameter ''or triaxial fluxgate'' for magnetometers.

• ECCN 6E003 is amended by adding a new parameter ''non-triaxial'' in 6E003.f for fluxgate magnetometers and fluxgate magnetometer systems.

Category 7—Navigation and Avionics

• Removing *nota bene* (N.B.) number 2 ''For inertial navigation equipment for ships or submersibles, see Item 9.e on the Wassenaar Munitions List.'' from Category 7.

• ECCN 7A003 is amended by:

(a) Revising the phrase ''Inertial Navigation Systems (INS)'' to read ''Inertial Systems'' in the Heading;

(b) Revising the phrase ''Inertial navigation systems'' to read ''Inertial Navigation Systems (INS)'', and adding ''vessels (surface or underwater)'' to 7A003.a;

(c) Adding a new paragraph 7A003.c to control ''Inertial Equipment for Azimuth, Heading, or North Pointing.'' Specific parameters for this equipment are also added in 7A003.c.1 and c.2; and

(d) Adding Note 3 to read, ''7A003.c.1 does not control theodolite systems incorporating inertial equipment specially designed for civil surveying purposes.''

All items removed from national security (NS) controls as a result of changes to the Wassenaar List of Dual-Use Goods and Technologies will continue to be controlled for antiterrorism (AT) reasons.

In addition, this rule adds a paragraph (3) to paragraph 770.2(1) Interpretation 12: ''Computers'' to provide guidance as to how to calculate the Composite Theoretical Performance (CTP) for computer systems with ''Non-Uniform Memory Access'' (NUMA) architecture, and to define NUMA. In the CTP formula found in Supplement No. 1 to part 774, Category 4, there are two ways to calculate the CTP values of computers with multiple processors: the shared memory and non-shared memory methods. The use of either one of these two methods was well understood back in the early 1990's when computers were either symmetric multi-processor (SMP) systems or massively parallel systems. With the advancement of high-performance and relatively inexpensive microprocessors, NUMA has emerged as a popular computer architecture. All major manufacturers offer a product line based on NUMA. Because NUMA has established itself as a dominant technology, it became necessary to clarify how the CTP values of NUMA machines should be calculated. About two years ago, the Information Systems Technical Advisory Committee (ISTAC) examined the CTP calculation for NUMA machines. A consensus was reached in the Committee to apply the non-shared method in calculating CTP values for NUMA machines. By publishing this interpretation, we harmonize across the computer industry how the CTP values of NUMA machines should be determined.

Although the Export Administration Act expired on August 20, 2001, Executive Order 13222 of August 17, 2001 (66 FR 44025, August 22, 2001), as extended by the Notice of August 7, 2003, (68 FR 47833, 2003 WL 21877490), continues the Regulations in effect under the International Emergency Economic Powers Act

Saving Clause

Shipments of items removed from eligibility for export or reexport without a license, under a particular License Exception authorization or the designator NLR, as a result of this regulatory action, may continue to be exported or reexported under that License Exception authorization or designator until June 1, 2004. In addition, this rule revises the numbering and structure of certain entries on the Commerce Control List. For items under such entries and for July 28, 2004, BIS will accept license applications for items described either by the entries in effect immediately before April 29, 2004, or the entries described in this rule.

Rulemaking Requirements

1. This final rule has been determined to be not significant for purposes of E.O. 12866.

2. Notwithstanding any other provision of law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with a collection of information, subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*) (PRA), unless that collection of information displays a currently valid Office of Management and Budget (OMB) Control Number. This rule involves a collection of information subject to the PRA. This collection has been approved by OMB under control number 0694–0088, ''Multi-Purpose Application,'' which carries a burden hour estimate of 58 minutes for a manual or electronic submission. Send comments regarding these burden estimates or any other aspect of these collections of information, including suggestions for reducing the burden, to OMB Desk Officer, New Executive Office Building, Washington, DC 20503; and to the Office of Administration, Bureau of Industry and Security,

Department of Commerce, 14th and Pennsylvania Avenue, NW., Room 6883, Washington, DC 20230.

3. This rule does not contain policies with Federalism implications as that term is defined under E.O. 13132.

4. The provisions of the Administrative Procedure Act (5 U.S.C. 553) requiring notice of proposed rulemaking, the opportunity for public participation, and a delay in effective date, are inapplicable because this regulation involves a military and foreign affairs function of the United States (5 U.S.C. 553(a)(1)). Further, no other law requires that a notice of proposed rulemaking and an opportunity for public comment be given for this final rule. Because a notice of proposed rulemaking and an opportunity for public comment are not required to be given for this rule under the Administrative Procedure Act or by any other law, the analytical requirements of the Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) are not applicable. Therefore, this regulation is issued in final form. Although there is no formal comment period, public comments on this regulation are welcome on a continuing basis. Comments should be submitted to Sharron Cook, Office of Exporter Services, Bureau of Industry and Security, Department of Commerce, P.O. Box 273, Washington, DC 20044.

List of Subjects

15 CFR Part 770

Exports, Foreign trade.

15 CFR Part 774

Exports, Foreign Trade, Reporting and recordkeeping requirements.

■ Accordingly, parts 770 and 774 of the Export Administration Regulations (15 CFR parts 730–799) are amended as follows:

PART 770—[AMENDED]

■ 1. The authority citation for part 770 is revised to read as follows:

Authority: 50 U.S.C. app. 2401 *et seq.*; 50 U.S.C. 1701 *et seq.*; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; Notice of August 7, 2003, 68 FR 47833, 3 CFR, 2003 Comp., p. 328.

■ 2. Section 770.2 is amended by adding paragraph (l)(3) and Note to paragraph (l)(3), to read as follows:

§ 770.2 Item Interpretations.

* * * * *

(l) Interpretation 12: Computers.* * *

(3) Computer systems with ''non-uniform memory access'' (NUMA) architecture should use the non-shared memory method in determining the CTP value for the system. In determining the aggregate performance of Computing Elements (CEs) for NUMA systems, exporters should follow the instructions for groups of CEs not sharing memory, interconnected by one or more data channels.

Note to paragraph (l)(3): Non-Uniform Memory Access (NUMA): A multiprocessing architecture in which memory is separated into local and distant banks. NUMA is characterized by memory on the same processor board as the processor (local memory) is accessed faster than memory on other processor boards (distant memory).

PART 774—[AMENDED]

■ 3. The authority citation for part 774 is revised to read as follows:

Authority: 50 U.S.C. app. 2401 *et seq.*; 50 U.S.C. 1701 *et seq.*; 10 U.S.C. 7420; 10 U.S.C. 7430(e); 18 U.S.C. 2510 *et seq.*; 22 U.S.C. 287c, 22 U.S.C. 3201 *et seq.*, 22 U.S.C. 6004; 30 U.S.C. 185(s), 185(u); 42 U.S.C. 2139a; 42 U.S.C. 6212; 43 U.S.C. 1354; 46 U.S.C. app. 466c; 50 U.S.C. app. 5; Sec. 901–911, Pub. L. 106–387; Sec. 221, Pub. L. 107–56; E.O. 13026, 61 FR 58767, 3 CFR, 1996 Comp., p. 228; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; Notice of August 7, 2003, 68 FR 47833, 3 CFR, 2003 Comp., p. 328.

Supplement No. 1 to Part 774 [Amended]

■ 4. In Supplement No. 1 to part 774 (the Commerce Control List), Category 1—Materials, Chemicals, Microorganisms, and Toxins, Export Control Classification Number (ECCN) 1A005 is amended by revising the ''related controls'' and ''items'' paragraphs in the List of Items Controlled section, to read as follows:

1A005 Body armor, and specially designed components therefor, not manufactured to military standards or specifications, nor to their equivalents in performance.

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: (1) Bulletproof and bullet resistant vests (body armor) NIJ levels III and IV, are subject to the export licensing authority of the U.S. Department of State, Office of Defense Trade Controls. (*See* 22 CFR part 121.) (2) For ''fibrous or filamentary materials'' used in the manufacture of body armor, see ECCN 1C010.

Related Definitions: * * *

Items:

Note to ECCN 1A005: 1. This entry does not control body armor or protective garments when accompanying their user for the user's own personal protection.

2. This entry does not control body armor designed to provide frontal protection only from both fragment and blast from non-military explosive devices.

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

■ 5. In Supplement No. 1 to part 774 (the Commerce Control List), Category 2—Materials Processing, Export Control Classification Number (ECCN) 2B001 is amended by revising the Heading and revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

2B001 Machine tools and any combination thereof, for removing (or cutting) metals, ceramics or ''composites'', which, according to the manufacturer's technical specifications, can be equipped with electronic devices for ''numerical control''; and specially designed components (see List of Items Controlled).

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items:

Note 1: 2B001 does not control special purpose machine tools limited to the manufacture of gears. For such machines, see 2B003.

Note 2: 2B001 does not control special purpose machine tools limited to the manufacture of any of the following parts:

a. Crank shafts or cam shafts;

b. Tools or cutters;

c. Extruder worms;

d. Engraved or faceted jewellery parts.

Note 3: A machine tool having at least two of the three turning, milling or grinding capabilities (*e.g.*, a turning machine with milling capability), must be evaluated against each applicable entry 2.B001.a., b. or c.

a. Machine tools for turning, having all of the following characteristics:

a.1. Positioning accuracy with ''all compensations available'' of less (better) than 6 μm along any linear axis; *and*

a.2. Two or more axes which can be coordinated simultaneously for ''contouring control'';

Note: 2B001.a does not control turning machines specially designed for the production of contact lenses.

b. Machine tools for milling, having any of the following characteristics:

b.1. Having all of the following:

b.1.a. Positioning accuracy with ''all compensations available'' of less (better) than 6 μm along any linear axis; *and*

b.1.b. Three linear axes plus one rotary axis which can be coordinated simultaneously for ''contouring control'';

b.2. Five or more axes which can be coordinated simultaneously for ''contouring control'';

b.3. A positioning accuracy for jig boring machines, with ''all compensations available'', of less (better) than 4 μm along any linear axis; or

b.4. Fly cutting machines, having all of the following characteristics:

b.4.a. Spindle ''run-out'' and ''camming'' less (better) than 0.0004 mm TIR; *and*

b.4.b. Angular deviation of slide movement (yaw, pitch and roll) less (better) than 2 seconds of arc, TIR, over 300 mm of travel.

c. Machine tools for grinding, having any of the following characteristics:

c.1. Having all of the following:

c.1.a. Positioning accuracy with ''all compensations available'' of less (better) than 4 µm along any linear axis; *and*

c.1.b. Three or more axes which can be coordinated simultaneously for ''contouring control''; *or*

c.2. Five or more axes which can be coordinated simultaneously for ''contouring control'';

Notes: 2B001.c does not control grinding machines, as follows:

1. Cylindrical external, internal, and external-internal grinding machines having all the following characteristics:

a. Limited to cylindrical grinding; *and*

b. Limited to a maximum workpiece capacity of 150 mm outside diameter or length.

2. Machines designed specifically as jig grinders having any of the following characteristics:

a. The c-axis is used to maintain the grinding wheel normal to the work surface; *or*

b. The a-axis is configured to grind barrel cams.

3. Surface grinders.

d. Electrical discharge machines (EDM) of the non-wire type which have two or more rotary axes which can be coordinated simultaneously for ''contouring control'';

e. Machine tools for removing metals, ceramics or ''composites'' having all of the following characteristics:

e.1. Removing material by means of any of the following:

e.1.a. Water or other liquid jets, including those employing abrasive additives;

e.1.b. Electron beam; *or*

e.1.c. ''Laser'' beam; *and*

e.2. Having two or more rotary axes which:

e.2.a. Can be coordinated simultaneously for ''contouring control''; *and*

e.2.b. Have a positioning accuracy of less (better) than 0.003°;

f. Deep-hole-drilling machines and turning machines modified for deep-hole-drilling, having a maximum depth-of-bore capability exceeding 5,000 mm and specially designed components therefor.

■ 6. In Supplement No. 1 to part 774 (the Commerce Control List), Category 2—Materials Processing, Export Control Classification Number (ECCN) 2B002 is added after 2B001 and before 2B003, to read as follows:

2B002 Numerically controlled machine tools using a magnetorheological finishing (MRF) process

License Requirements

Reason for Control: NS, AT

Control(s)	Country chart
NS applies to entire entry	NS Column 2
AT applies to entire entry	AT Column 1

License Exceptions

LVS: N/A
GBS: N/A
CIV: N/A

List of Items Controlled

Unit: Equipment in number.

Related Controls: See also 2B001.

Related Definitions: For the purposes of 2B002, ''MRF'' is a material removal process using an abrasive magnetic fluid whose viscosity is controlled by a magnetic field.

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

■ 7. In Supplement No. 1 to part 774 (the Commerce Control List), Category 2—Materials Processing, Export Control Classification Number (ECCN) 2B006 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

2B006 Dimensional inspection or measuring systems and equipment, as follows (see List of Items Controlled)

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items:

a. Computer controlled, ''numerically controlled'' or ''stored program controlled'' co-ordinate measuring machines (CMM), having a three dimensional length (volumetric) maximum permissible error of indication (MPE_E) at any point within the operating range of the machine (*i.e.*, within the length of axes) equal to or less (better) than (1.7 + L/1,000) µm (L is the measured length in mm) tested according to ISO 10360–2 (2001);

b. Linear and angular displacement measuring instruments, as follows:

b.1. Linear displacement measuring instruments having any of the following:

Technical Note: For the purpose of 2B006.b.1 ''linear displacement'' means the change of distance between the measuring probe and the measured object.

b.1.a. Non-contact type measuring systems with a ''resolution'' equal to or less (better) than 0.2 µm within a measuring range up to 0.2 mm;

b.1.b. Linear voltage differential transformer systems having all of the following characteristics:

b.1.b.1. ''Linearity'' equal to or less (better) than 0.1% within a measuring range up to 5 mm; *and*

b.1.b.2. Drift equal to or less (better) than 0.1% per day at a standard ambient test room temperature ± 1 K; *or*

b.1.c. Measuring systems having all of the following:

b.1.c.1. Containing a ''laser''; *and*

b.1.c.2. Maintaining, for at least 12 hours, over a temperature range of ± 1 K around a standard temperature and at a standard pressure, all of the following:

b.1.c.2.a. A ''resolution'' over their full scale of 0.1 µm or less (better); *and*

b.1.c.2.b. A ''measurement uncertainty'' equal to or less (better) than (0.2 + L/2,000) µm (L is the measured length in mm);

Note: 2B006.b.1 does not control measuring interferometer systems, without closed or open loop feedback, containing a ''laser'' to measure slide movement errors of machine-tools, dimensional inspection machines or similar equipment.

b.2. Angular displacement measuring instruments having an ''angular position deviation'' equal to or less (better) than 0.00025°;

Note: 2B006.b.2 does not control optical instruments, such as autocollimators, using collimated light (*e.g.*, laser light) to detect angular displacement of a mirror.

c. Equipment for measuring surface irregularities, by measuring optical scatter as a function of angle, with a sensitivity of 0.5 nm or less (better).

■ 8. In Supplement No. 1 to part 774 (the Commerce Control List), Category 2—Materials Processing, Export Control Classification Number (ECCN) 2B206 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

2B206 Dimensional inspection machines, instruments or systems, other than those described in 2B006, as follows (see List of Items Controlled)

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

ECCN Controls: * * *

Items:

a. Computer controlled or numerically controlled dimensional inspection machines having both of the following characteristics:

a.1. Two or more axes; *and*

a.2. A one-dimensional length ''measurement uncertainty'' equal to or less (better) than (1.25 + L/1000) µm tested with a probe of an ''accuracy'' of less (better) than 0.2 µm (L is the measured length in millimeters) (Ref.: VDI/VDE 2617 Parts 1 and 2);

b. Systems for simultaneously linear-angular inspection of hemishells, having both of the following characteristics:

b.1. ''Measurement uncertainty'' along any linear axis equal to or less (better) than 3.5 µm per 5 mm; *and*

b.2. ''Angular position deviation'' equal to or less than 0.02°.

Technical Notes:

(1) The probe used in determining the measurement uncertainty of a dimensional inspection system shall be described in VDI/VDE 2617 parts 2, 3 and 4.

(2) All parameters of measurement values in this entry represent plus/minus, *i.e.*, not total band.

c. Angular displacement measuring instruments having an ''angular position deviation'' equal to or less (better) than 0.00025°;

Note: 2B206.c does not control optical instruments, such as autocollimators, using

collimated light to detect angular displacement of a mirror.

■ 9. In Supplement No. 1 to part 774 (the Commerce Control List), Category 2—Materials Processing, Export Control Classification Number (ECCN) 2D002 is amended by revising the Heading and revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

2D002 ''Software'' for electronic devices, even when residing in an electronic device or system, enabling such devices or systems to function as a ''numerical control'' unit, capable of coordinating simultaneously more than 4 axes for ''contouring control''.

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items:

Note 1: 2D002 does not control ''software'' specially designed or modified for the operation of machine tools not controlled by Category 2.

Note 2: 2D002 does not control ''software'' for items controlled by 2B002. See 2D001 for control of ''software'' for items controlled by 2B002.

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

■ 10. In Supplement No. 1 to part 774 (the Commerce Control List), Category 2—Materials Processing, ''**Notes to Table on Deposition Techniques**'' is amended by revising note 17, to read as follows:

Notes to Table on Deposition Techniques:

* * * * *

17. ''Technology'' specially designed to deposit diamond-like carbon on any of the following is not controlled: magnetic disk drives and heads, equipment for the manufacture of disposables valves for faucets, acoustic diaphragms for speakers, engine parts for automobiles, cutting tools, punching-pressing dies, office automation equipment, microphones or medical devices or molds, for casting or molding of plastics, manufactured from alloys containing less than 5% beryllium.

* * * * *

■ 11. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3A001 is amended by revising the ''related controls'' and ''items'' paragraphs in the List of Items Controlled section, to read as follows:

3A001 Electronic components, as follows (see List of Items Controlled).

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: (1) All other ''space qualified'' and radiation hardened photovoltaic arrays defined in 3A001.e.1.c and spacecraft/satellite concentrators and batteries are under the export licensing authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121). *See also* 3A101, 3A201, and 3A991.

Related Definitions: * * *

Items:

a. General purpose integrated circuits, as follows:

Note 1: The control status of wafers (finished or unfinished), in which the function has been determined, is to be evaluated against the parameters of 3A001.a.

Note 2: Integrated circuits include the following types:

''Monolithic integrated circuits'';

''Hybrid integrated circuits'';

''Multichip integrated circuits'';

''Film type integrated circuits'', including silicon-on-sapphire integrated circuits;

''Optical integrated circuits''.

a.1. Integrated circuits, designed or rated as radiation hardened to withstand any of the following:

a.1.a. A total dose of 5×10^3 Gy (Si), or higher;

a.1.b. A dose rate upset of 5×10^6 Gy (Si)/s, or higher; *or*

a.1.c. A fluence (integrated flux) of neutrons (1 MeV equivalent) of 5×10^{13} n/cm^2 or higher on silicon, or its equivalent for other materials;

Note: 3A001.a.1.c does not apply to Metal Insulator Semiconductors (MIS).

a.2. ''Microprocessor microcircuits'', ''microcomputer microcircuits'', microcontroller microcircuits, storage integrated circuits manufactured from a compound semiconductor, analog-to-digital converters, digital-to-analog converters, electro-optical or ''optical integrated circuits'' designed for ''signal processing'', field programmable logic devices, neural network integrated circuits, custom integrated circuits for which either the function is unknown or the control status of the equipment in which the integrated circuit will be used in unknown, Fast Fourier Transform (FFT) processors, electrical erasable programmable read-only memories (EEPROMs), flash memories or static random-access memories (SRAMs), having any of the following:

a.2.a. Rated for operation at an ambient temperature above 398 K (125°C);

a.2.b. Rated for operation at an ambient temperature below 218 K (−55°C); *or*

a.2.c. Rated for operation over the entire ambient temperature range from 218 K (−55°C) to 398 K (125° C);

Note: 3A001.a.2 does not apply to integrated circuits for civil automobile or railway train applications.

a.3. ''Microprocessor microcircuits'', ''micro-computer microcircuits'' and microcontroller microcircuits, having any of the following characteristics:

Note: 3A001.a.3 includes digital signal processors, digital array processors and digital coprocessors.

a.3.a. [RESERVED]

a.3.b. Manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz; *or*

a.3.c. More than one data or instruction bus or serial communication port that provides a direct external interconnection between parallel ''microprocessor microcircuits'' with a transfer rate exceeding 150 Mbyte/s;

a.4. Storage integrated circuits manufactured from a compound semiconductor;

a.5. Analog-to-digital and digital-to-analog converter integrated circuits, as follows:

a.5.a. Analog-to-digital converters having any of the following:

a.5.a.1. A resolution of 8 bit or more, but less than 12 bit, with a total conversion time of less than 5 ns;

a.5.a.2. A resolution of 12 bit with a total conversion time of less than 20 ns;

a.5.a.3. A resolution of more than 12 bit but equal to or less than 14 bit with a total conversion time of less than 200 ns; or

a.5.a.4. A resolution of more than 14 bit with a total conversion time of less than 1 µs;

a.5.b. Digital-to-analog converters with a resolution of 12 bit or more, and a ''settling time'' of less than 10 ns;

Technical Note:

1. A resolution of n bit corresponds to a quantization of 2^n levels.

2. Total conversion time is the inverse of the sample rate.

a.6. Electro-optical and ''optical integrated circuits'' designed for ''signal processing'' having all of the following:

a.6.a. One or more than one internal ''laser'' diode;

a.6.b. One or more than one internal light detecting element; *and*

a.6.c. Optical waveguides;

a.7. Field programmable logic devices having any of the following:

a.7.a. An equivalent usable gate count of more than 30,000 (2 input gates);

a.7.b. A typical ''basic gate propagation delay time'' of less than 0.1 ns; *or*

a.7.c. A toggle frequency exceeding 133 MHz;

Note: 3A001.a.7 includes: Simple Programmable Logic Devices (SPLDs), Complex Programmable Logic Devices (CPLDs), Field Programmable Gate Arrays (FPGAs), Field Programmable Logic Arrays (FPLAs), and Field Programmable Interconnects (FPICs).

N.B.: Field programmable logic devices are also known as field programmable gate or field programmable logic arrays.

a.8. [RESERVED]

a.9. Neural network integrated circuits;

a.10. Custom integrated circuits for which the function is unknown, or the control status of the equipment in which the integrated circuits will be used is unknown to the manufacturer, having any of the following:

a.10.a. More than 1,000 terminals;

a.10.b. A typical ''basic gate propagation delay time'' of less than 0.1 ns; *or*

a.10.c. An operating frequency exceeding 3 GHz;

a.11. Digital integrated circuits, other than those described in 3A001.a.3 to 3A001.a.10 and 3A001.a.12, based upon any compound semiconductor and having any of the following:

a.11.a. An equivalent gate count of more than 3,000 (2 input gates); *or*

a.11.b. A toggle frequency exceeding 1.2 GHz;

a.12. Fast Fourier Transform (FFT) processors having a rated execution time for an N-point complex FFT of less than (N $\log_2$ N)/20,480 ms, where N is the number of points;

Technical Note: When N is equal to 1,024 points, the formula in 3A001.a.12 gives an execution time of 500 µs.

b. Microwave or millimeter wave components, as follows:

b.1. Electronic vacuum tubes and cathodes, as follows:

Note 1: 3A001.b.1 does not control tubes designed or rated for operation in any frequency band which meets all of the following characteristics:

(a) Does not exceed 31.8 GHz; *and*

(b) Is ''allocated by the ITU'' for radio-communications services, but not for radio-determination.

Note 2: 3A001.b.1 does not control non-''space-qualified'' tubes which meet all the following characteristics:

(a) An average output power equal to or less than 50 W; *and*

(b) Designed or rated for operation in any frequency band which meets all of the following characteristics:

(1) Exceeds 31.8 GHz but does not exceed 43.5 GHz; *and*

(2) Is ''allocated by the ITU'' for radio-communications services, but not for radio-determination.

b.1.a. Traveling wave tubes, pulsed or continuous wave, as follows:

b.1.a.1. Operating at frequencies exceeding 31.8 GHz;

b.1.a.2. Having a cathode heater element with a turn on time to rated RF power of less than 3 seconds;

b.1.a.3. Coupled cavity tubes, or derivatives thereof, with a ''fractional bandwidth'' of more than 7% or a peak power exceeding 2.5 kW;

b.1.a.4. Helix tubes, or derivatives thereof, with any of the following characteristics:

b.1.a.4.a. An ''instantaneous bandwidth'' of more than one octave, and average power (expressed in kW) times frequency (expressed in GHz) of more than 0.5;

b.1.a.4.b. An ''instantaneous bandwidth'' of one octave or less, and average power (expressed in kW) times frequency (expressed in GHz) of more than 1; *or*

b.1.a.4.c. Being ''space qualified'';

b.1.b. Crossed-field amplifier tubes with a gain of more than 17 dB;

b.1.c. Impregnated cathodes designed for electronic tubes producing a continuous emission current density at rated operating conditions exceeding 5 A/cm^2;

b.2. Microwave monolithic integrated circuits (MMIC) power amplifiers having any of the following:

b.2.a. Rated for operation at frequencies exceeding 3.2 GHz up to and including 6 GHz and with an average output power greater than 4W (36 dBm) with a ''fractional bandwidth'' greater than 15%;

b.2.b. Rated for operation at frequencies exceeding 6 GHz up to and including 16 GHz and with an average output power greater than 1W (30 dBm) with a ''fractional bandwidth'' greater than 10%;

b.2.c. Rated for operation at frequencies exceeding 16 GHz up to and including 31.8 GHz and with an average output power greater than 0.8W (29 dBm) with a ''fractional bandwidth'' greater than 10%;

b.2.d. Rated for operation at frequencies exceeding 31.8 GHz up to and including 37.5 GHz;

b.2.e. Rated for operation at frequencies exceeding 37.5 GHz up to and including 43.5 GHz and with an average output power greater than 0.25W (24 dBm) with a ''fractional bandwidth'' greater than 10%; or

b.2.f. Rated for operation at frequencies exceeding 43.5 GHz.

Note 1: 3A001.b.2 does not control broadcast satellite equipment designed or rated to operate in the frequency range of 40.5 to 42.5 GHz.

Note 2: The control status of the MMIC whose operating frequency spans more than one frequency range, as defined by 3A001.b.2., is determined by the lowest average output power control threshold.

Note 3: Notes 1 and 2 following the Category 3 heading for A. Systems, Equipment, and Components mean that 3A001.b.2. does not control MMICs if they are specially designed for other applications, *e.g.*, telecommunications, radar, automobiles.

b.3. Microwave transistors having any of the following:

b.3.a. Rated for operation at frequencies exceeding 3.2 GHz up to and including 6 GHz and having an average output power greater than 60W (47.8 dBm);

b.3.b. Rated for operation at frequencies exceeding 6 GHz up to and including 31.8 GHz and having an average output power greater than 20W (43 dBm);

b.3.c. Rated for operation at frequencies exceeding 31.8 GHz up to and including 37.5 GHz and having an average output power greater than 0.5W (27 dBm);

b.3.d. Rated for operation at frequencies exceeding 37.5 GHz up to and including 43.5 GHz and having an average output power greater than 1W (30 dBm); or

b.3.e. Rated for operation at frequencies exceeding 43.5 GHz.

Note: The control status of an item whose operating frequency spans more than one frequency range, as defined by 3A001.b.3, is determined by the lowest average output power control threshold.

b.4. Microwave solid state amplifiers and microwave assemblies/modules containing microwave amplifiers having any of the following:

b.4.a. Rated for operation at frequencies exceeding 3.2 GHz up to and including 6 GHz and with an average output power greater than 60W (47.8 dBm) with a ''fractional bandwidth'' greater than 15%;

b.4.b. Rated for operation at frequencies exceeding 6 GHz up to and including 31.8 GHz and with an average output power greater than 15W (42 dBm) with a ''fractional bandwidth'' greater than 10%;

b.4.c. Rated for operation at frequencies exceeding 31.8 GHz up to and including 37.5 GHz;

b.4.d. Rated for operation at frequencies exceeding 37.5 GHz up to and including 43.5 GHz and with an average output power greater than 1W (30 dBm) with a ''fractional bandwidth'' greater than 10%;

b.4.e. Rated for operation at frequencies exceeding 43.5 GHz; *or*

b.4.f. Rated for operation at frequencies above 3 GHz and all of the following:

b.4.f.1. An average output power (in watts), P, greater than 150 divided by the maximum operating frequency (in GHz) squared [P>150 W*GHz^2/f_{GHz}^2];

b.4.f.2. A fractional bandwidth of 5% or greater; *and*

b.4.f.3. Any two sides perpendicular to one another with length d (in cm) equal to or less than 15 divided by the lowest operating frequency in GHz [d≤15cm*GHz/f_{GHz}].

N.B.: MMIC power amplifiers should be evaluated against the criteria in 3A001.b.2.

Note 1: 3A001.b.4. does not control broadcast satellite equipment designed or rated to operate in the frequency range of 40.5 to 42.5 GHz.

Note 2: The control status of an item whose operating frequency spans more than one frequency range, as defined by 3A001.b.4, is determined by the lowest average output power control threshold.

b.5. Electronically or magnetically tunable band-pass or band-stop filters having more than 5 tunable resonators capable of tuning across a 1.5:1 frequency band (f_{max}/f_{min}) in less than 10 µs having any of the following:

b.5.a. A band-pass bandwidth of more than 0.5% of center frequency; *or*

b.5.b. A band-stop bandwidth of less than 0.5% of center frequency;

b.6. [RESERVED]

b.7. Mixers and converters designed to extend the frequency range of equipment described in 3A002.c, 3A002.e or 3A002.f beyond the limits stated therein;

b.8. Microwave power amplifiers containing tubes controlled by 3A001.b and having all of the following:

b.8.a. Operating frequencies above 3 GHz;

b.8.b. An average output power density exceeding 80 W/kg; *and*

b.8.c. A volume of less than 400 cm^3;

Note: 3A001.b.8 does not control equipment designed or rated for operation in any frequency band which is ''allocated by the ITU'' for radio-communications services, but not for radio-determination.

c. Acoustic wave devices, as follows, and specially designed components therefor:

c.1. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices (*i.e.*, ''signal processing'' devices employing elastic waves in materials), having any of the following:

c.1.a. A carrier frequency exceeding 2.5 GHz;

c.1.b. A carrier frequency exceeding 1 GHz, but not exceeding 2.5 GHz, and having any of the following:

c.1.b.1. A frequency side-lobe rejection exceeding 55 dB;

c.1.b.2. A product of the maximum delay time and the bandwidth (time in µs and bandwidth in MHz) of more than 100;

c.1.b.3. A bandwidth greater than 250 MHz; *or*

c.1.b.4. A dispersive delay of more than 10 µs; *or*

c.1.c. A carrier frequency of 1 GHz or less, having any of the following:

c.1.c.1. A product of the maximum delay time and the bandwidth (time in μs and bandwidth in MHz) of more than 100;

c.1.c.2. A dispersive delay of more than 10 μs; or

c.1.c.3. A frequency side-lobe rejection exceeding 55 dB and a bandwidth greater than 50 MHz;

c.2. Bulk (volume) acoustic wave devices (*i.e.*, ''signal processing'' devices employing elastic waves) that permit the direct processing of signals at frequencies exceeding 1 GHz;

c.3. Acoustic-optic ''signal processing'' devices employing interaction between acoustic waves (bulk wave or surface wave) and light waves that permit the direct processing of signals or images, including spectral analysis, correlation or convolution;

d. Electronic devices and circuits containing components, manufactured from ''superconductive'' materials specially designed for operation at temperatures below the ''critical temperature'' of at least one of the ''superconductive'' constituents, with any of the following:

d.1. Current switching for digital circuits using ''superconductive'' gates with a product of delay time per gate (in seconds) and power dissipation per gate (in watts) of less than 10^{-14} J; *or*

d.2. Frequency selection at all frequencies using resonant circuits with Q-values exceeding 10,000;

e. High energy devices, as follows:

e.1. Batteries and photovoltaic arrays, as follows:

Note: 3A001.e.1 does not control batteries with volumes equal to or less than 27 cm^3 (*e.g.*, standard C-cells or R14 batteries).

e.1.a. Primary cells and batteries having an energy density exceeding 480 Wh/kg and rated for operation in the temperature range from below 243 K (−30°C) to above 343 K (70°C);

e.1.b. Rechargeable cells and batteries having an energy density exceeding 150 Wh/kg after 75 charge/discharge cycles at a discharge current equal to C/5 hours (C being the nominal capacity in ampere hours) when operating in the temperature range from below 253 K (−20°C) to above 333 K (60°C);

Technical Note: Energy density is obtained by multiplying the average power in watts (average voltage in volts times average current in amperes) by the duration of the discharge in hours to 75% of the open circuit voltage divided by the total mass of the cell (or battery) in kg.

e.1.c. ''Space qualified'' and radiation hardened photovoltaic arrays with a specific power exceeding 160 W/m^2 at an operating temperature of 301 K (28°C) under a tungsten illumination of 1 kW/m^2 at 2,800 K (2,527°C);

e.2. High energy storage capacitors, as follows:

e.2.a. Capacitors with a repetition rate of less than 10 Hz (single shot capacitors) having all of the following:

e.2.a.1. A voltage rating equal to or more than 5 kV;

e.2.a.2. An energy density equal to or more than 250 J/kg; *and*

e.2.a.3. A total energy equal to or more than 25 kJ;

e.2.b. Capacitors with a repetition rate of 10 Hz or more (repetition rated capacitors) having all of the following:

e.2.b.1. A voltage rating equal to or more than 5 kV;

e.2.b.2. An energy density equal to or more than 50 J/kg;

e.2.b.3. A total energy equal to or more than 100 J; *and*

e.2.b.4. A charge/discharge cycle life equal to or more than 10,000;

e.3. ''Superconductive'' electromagnets and solenoids specially designed to be fully charged or discharged in less than one second, having all of the following:

Note: 3A001.e.3 does not control ''superconductive'' electromagnets or solenoids specially designed for Magnetic Resonance Imaging (MRI) medical equipment.

e.3.a. Energy delivered during the discharge exceeding 10 kJ in the first second;

e.3.b. Inner diameter of the current carrying windings of more than 250 mm; *and*

e.3.c. Rated for a magnetic induction of more than 8 T or ''overall current density'' in the winding of more than 300 A/mm^2;

f. Rotary input type shaft absolute position encoders having any of the following:

f.1. A resolution of better than 1 part in 265,000 (18 bit resolution) of full scale; *or*

f.2. An accuracy better than ± 2.5 seconds of arc.

■ 12. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3A002 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

3A002 General purpose electronic equipment, as follows (see List of Items Controlled).

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items:

a. Recording equipment, as follows, and specially designed test tape therefor:

a.1. Analog instrumentation magnetic tape recorders, including those permitting the recording of digital signals (*e.g.*, using a high density digital recording (HDDR) module), having any of the following:

a.1.a. A bandwidth exceeding 4 MHz per electronic channel or track;

a.1.b. A bandwidth exceeding 2 MHz per electronic channel or track and having more than 42 tracks; *or*

a.1.c. A time displacement (base) error, measured in accordance with applicable IRIG or EIA documents, of less than ± 0.1 μs;

Note: Analog magnetic tape recorders specially designed for civilian video purposes are not considered to be instrumentation tape recorders.

a.2. Digital video magnetic tape recorders having a maximum digital interface transfer rate exceeding 360 Mbit/s;

Note: 3A002.a.2 does not control digital video magnetic tape recorders specially designed for television recording using a signal format, which may include a compressed signal format, standardized or recommended by the ITU, the IEC, the SMPTE, the EBU , the ETSI, or the IEEE for civil television applications.

a.3. Digital instrumentation magnetic tape data recorders employing helical scan techniques or fixed head techniques, having any of the following:

a.3.a. A maximum digital interface transfer rate exceeding 175 Mbit/s; *or*

a.3.b. Being ''space qualified'';

Note: 3A002.a.3 does not control analog magnetic tape recorders equipped with HDDR conversion electronics and configured to record only digital data.

a.4. Equipment, having a maximum digital interface transfer rate exceeding 175 Mbit/s, designed to convert digital video magnetic tape recorders for use as digital instrumentation data recorders;

a.5. Waveform digitizers and transient recorders having all of the following:

N.B.: *See also* 3A292.

a.5.a. Digitizing rates equal to or more than 200 million samples per second and a resolution of 10 bits or more; *and*

a.5.b. A continuous throughput of 2 Gbit/s or more;

Technical Note: For those instruments with a parallel bus architecture, the continuous throughput rate is the highest word rate multiplied by the number of bits in a word. Continuous throughput is the fastest data rate the instrument can output to mass storage without the loss of any information while sustaining the sampling rate and analog-to-digital conversion.

a.6. Digital instrumentation data recorders, using magnetic disk storage technique, having all of the following:

a.6.a. Digitizing rate equal to or more than 100 million samples per second and a resolution of 8 bits or more; *and*

a.6.b. A continuous throughput of 1 Gbit/s or more;

b. ''Frequency synthesizer'', ''electronic assemblies'' having a ''frequency switching time'' from one selected frequency to another of less than 1 ms;

c. Radio frequency ''signal analyzers'', as follows:

c.1. ''Signal analyzers'' capable of analyzing frequencies exceeding 31.8 GHz but less than 37.5 GHz or exceeding 43.5 GHz;

c.2. ''Dynamic signal analyzers'' having a ''real-time bandwidth'' exceeding 500 kHz;

Note: 3A002.c.2 does not control those ''dynamic signal analyzers'' using only constant percentage bandwidth filters (also known as octave or fractional octave filters).

d. Frequency synthesized signal generators producing output frequencies, the accuracy and short term and long term stability of which are controlled, derived from or disciplined by the internal master frequency, and having any of the following:

d.1. A maximum synthesized frequency exceeding 31.8 GHz, but not exceeding 43.5 GHz and rated to generate a pulse duration of less than 100 ns;

d.2. A maximum synthesized frequency exceeding 43.5 GHz;

d.3. A ''frequency switching time'' from one selected frequency to another of less than 1 ms; *or*

d.4. A single sideband (SSB) phase noise better than $-(126 + 20 \log_{10}F - 20 \log_{10}f)$ in dBc/Hz, where F is the off-set from the operating frequency in Hz and f is the operating frequency in MHz;

Technical Note: For the purposes of 3A002.d.1., 'pulse duration' is defined as the time interval between the leading edge of the pulse achieving 90% of the peak and the trailing edge of the pulse achieving 10% of the peak.

Note: 3A002.d does not control equipment in which the output frequency is either produced by the addition or subtraction of two or more crystal oscillator frequencies, or by an addition or subtraction followed by a multiplication of the result.

e. Network analyzers with a maximum operating frequency exceeding 43.5 GHz;

f. Microwave test receivers having all of the following:

f.1. A maximum operating frequency exceeding 43.5 GHz; *and*

f.2. Being capable of measuring amplitude and phase simultaneously;

g. Atomic frequency standards having any of the following:

g.1. Long-term stability (aging) less (better) than 1×10^{-11}/month; *or*

g.2. Being ''space qualified''.

Note: 3A002.g.1 does not control non-''space qualified'' rubidium standards.

■ 13. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3A003 is added, to read as follows:

3A003 Spray cooling thermal management systems employing closed loop fluid handling and reconditioning equipment in a sealed enclosure where a dielectric fluid is sprayed onto electronic components using specially designed spray nozzles that are designed to maintain electronic components within their operating temperature range, and specially designed components therefor

License Requirements

Reason for Control: NS, AT

Control(s)	Country chart
NS applies to entire entry	NS Column 2.
AT applies to entire entry	AT Column 1.

License Exceptions

LVS: N/A
GBS: N/A
CIV: N/A

List of Items Controlled

Unit: Number of systems, components in $
Related Controls: N/A
Related Definitions: N/A
Items: The list of items controlled is contained in the ECCN heading.

■ 14. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3B001 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

3B001 Equipment for the manufacturing of semiconductor devices or materials, as follows (see List of Items Controlled), and specially designed components and accessories therefor.

* * * * *

List of Items Controlled

Unit: * * *
Related Controls: * * *
Related Definitions: * * *
Items:

a. Equipment designed for epitaxial growth, as follows:

a.1. Equipment capable of producing any of the following:

a.1.a. A silicon layer with a thickness uniform to less than ± 2.5% across a distance of 200 mm or more; or

a.1.b. A layer of any material other than silicon with a thickness uniform to less than ± 2.5% across a distance of 75 mm or more;

a.2. Metal organic chemical vapor deposition (MOCVD) reactors specially designed for compound semiconductor crystal growth by the chemical reaction between materials controlled by 3C003 or 3C004;

a.3. Molecular beam epitaxial growth equipment using gas or solid sources;

b. Equipment designed for ion implantation, having any of the following:

b.1. A beam energy (accelerating voltage) exceeding 1MeV;

b.2. Being specially designed and optimized to operate at a beam energy (accelerating voltage of less than 2 keV;

b.3. Direct write capability; *or*

b.4. A beam energy of 65 keV or more and a beam current of 45 mA or more for high energy oxygen implant into a heated semiconductor material ''substrate'';

c. Anisotropic plasma dry etching equipment, as follows:

c.1. Equipment with cassette-to-cassette operation and load-locks, and having any of the following:

c.1.a. Designed or optimized to produce critical dimensions of 0.3 µm or less with ±5% 3 sigma precision; *or*

c.1.b. Designed for generating less than 0.04 particles/cm² with a measurable particle size greater than 0.1 µm in diameter;

c.2. Equipment specially designed for equipment controlled by 3B001.e. and having any of the following:

c.2.a. Designed or optimized to produce critical dimensions of 0.3 µm or less with ±5% 3 sigma precision; *or*

c.2.b. Designed for generating less than 0.04 particles/cm² with a measurable particle size greater than 0.1 µm in diameter;

d. Plasma enhanced CVD equipment, as follows:

d.1. Equipment with cassette-to-cassette operation and load-locks, and designed according to the manufacturer's specifications or optimized for use in the production of semiconductor devices with critical dimensions of 180 nm or less;

d.2. Equipment specially designed for equipment controlled by 3B001.e. and designed according to the manufacturer's specifications or optimized for use in the production of semiconductor devices with critical dimensions of 180 nm or less;

e. Automatic loading multi-chamber central wafer handling systems, having all of the following:

e.1. Interfaces for wafer input and output, to which more than two pieces of semiconductor processing equipment are to be connected; *and*

e.2. Designed to form an integrated system in a vacuum environment for sequential multiple wafer processing;

Note: 3B001.e. does not control automatic robotic wafer handling systems not designed to operate in a vacuum environment.

f. Lithography equipment, as follows:

f.1. Align and expose step and repeat (direct step on wafer) or step and scan (scanner) equipment for wafer processing using photo-optical or X-ray methods, having any of the following:

f.1.a. A light source wavelength shorter than 350 nm; *or*

f.1.b. Capable of producing a pattern with a minimum resolvable feature size of 0.35 µm or less;

Technical Note: The minimum resolvable feature size is calculated by the following formula:

$$MRF = \frac{(\text{an exposure light source wavelength in } \mu m) \times (\text{K factor})}{\text{numerical aperture}}$$

f.2. Equipment specially designed for mask making or semiconductor device processing using deflected focused electron beam, ion beam or ''laser'' beam, having any of the following:

f.2.a. A spot size smaller than 0.2 µm;

f.2.b. Being capable of producing a pattern with a feature size of less than 1 µm; *or*

f.2.c. An overlay accuracy of better than ± 0.20 µm (3 sigma);

g. Masks and reticles designed for integrated circuits controlled by 3A001;

h. Multi-layer masks with a phase shift layer.

Note: 3B001.h. does not control multi-layer masks with a phase shift layer designed for the fabrication of memory devices not controlled by 3A001.

■ 15. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3B002 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

3B002 ''Stored program controlled'' test equipment, specially designed for testing finished or unfinished semiconductor devices, as follows (*see* List of Items Controlled), and specially designed components and accessories therefor

* * * * *

List of Items Controlled

Unit: * * *
Related Controls: * * *
Related Definitions: * * *
Items:
a. For testing S-parameters of transistor devices at frequencies exceeding 31.8 GHz;
b. For testing integrated circuits capable of performing functional (truth table) testing at a pattern rate of more than 667 MHz;

Note: 3B002.b does not control test equipment specially designed for testing:
1. ''Electronic assemblies'' or a class of ''electronic assemblies'' for home or entertainment applications;
2. Uncontrolled electronic components, ''electronic assemblies'' or integrated circuits;
3. Memories.

Technical Note: For purposes of 3B002.b, pattern rate is defined as the maximum frequency of digital operation of a tester. It is therefore equivalent to the highest data rate that a tester can provide in non-multiplexed mode. It is also referred to as test speed, maximum digital frequency or maximum digital speed.

c. For testing microwave integrated circuits controlled by 3A001.b.2.

■ 16. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3D002 is amended by revising the Heading and the ''items'' paragraph in the List of Items Controlled section, to read as follows:

3D002 ''Software'' specially designed for the ''use'' of any of the following (see List of Items Controlled)

* * * * *

List of Items Controlled

Unit: * * *
Related Controls: * * *
Related Definitions: * * *
Items: a. Equipment controlled by 3B001.a. to f.; *or*
b. Equipment controlled by 3B002.

■ 17. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3D003 is amended by revising the Heading and the ''related controls'', ''related definitions'', and ''items'' paragraphs in the List of Items Controlled section, to read as follows:

3D003 Physics-based simulation ''software'' specially designed for the ''development'' of lithographic, etching or deposition processes for translating masking patterns into specific topographical patterns in conductors, dielectrics or semiconductor materials

* * * * *

List of Items Controlled

Unit: * * *
Related Controls: N/A
Related Definitions: (1) Libraries, design attributes or associated data for the design of semiconductor devices or integrated circuits are considered as ''technology''. (2) 'Physics-based' in 3D003 means using computations to determine a sequence of physical cause and effect events based on physical properties (*e.g.*, temperature, pressure, diffusion constants and semiconductor materials properties).
Items: The list of items controlled is contained in the ECCN heading.

■ 18. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3D004 is added, to read as follows:

3D004 ''Software'' specially designed for the ''development'' of the equipment controlled by 3A003

License Requirements

Reason for Control: NS, AT

Control(s)	Country chart
NS applies to entire entry	NS Column 1
AT applies to entire entry	AT Column 1

License Exceptions

CIV: N/A
TSR: Yes

List of Items Controlled

Unit: $ value
Related Controls: N/A
Related Definitions: N/A
Items: The list of items controlled is contained in the ECCN heading.

■ 19. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3D991 is amended by revising the Heading, to read as follows:

3D991 ''Software'' specially designed for the ''development'', ''production'', or ''use'' of electronic devices or components controlled by 3A991, general purpose electronic equipment controlled by 3A992, or manufacturing and test equipment controlled by 3B991 and 3B992; or ''software'' specially designed for the ''use'' of equipment controlled by 3B001.g and .h

* * * * *

■ 20. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3E001 is amended revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

3E001 ''Technology'' according to the General Technology Note for the ''development'' or ''production'' of equipment or materials controlled by 3A (except 3A292, 3A980, 3A981, 3A991 or 3A992), 3B (except 3B991 or 3B992) or 3C

* * * * *

List of Items Controlled

Unit: * * *
Related Controls: * * *
Related Definition: * * *
Items: The list of items controlled is contained in the ECCN heading.

Note 1: 3E001 does not control ''technology'' for the ''development'' or ''production'' of integrated circuits controlled by 3A001.a.3 to a.12, having all of the following:
(a) Using ''technology'' of 0.5 µm or more; *and*
(b) Not incorporating multi-layer structures.

Technical Note: The term multi-layer structures in Note b does not include devices incorporating a maximum of three metal layers and three polysilicon layers.

Note 2: 3E001 does not control ''technology'' for the ''production'' of equipment or components controlled by 3A003.

■ 21. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3E002 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

3E002 ''Technology'' according to the General Technology Note other than that controlled in 3E001 for the ''development'' or ''production'' of ''microprocessor microcircuits'', ''micro-computer microcircuits'' and microcontroller microcircuits having a ''composite theoretical performance'' (''CTP'') of 530 million theoretical operations per second (MTOPS) or more and an arithmetic logic unit with an access width of 32 bits or more

* * * * *

List of Items Controlled

Unit: * * *
Related Controls: * * *
Related Definitions: * * *
Items: The list of items controlled is contained in the ECCN heading.

Note: 3E002 does not control ''technology'' for the ''development'' or ''production'' of integrated circuits controlled by 3A001.a.3 to a.12, having all of the following:
(a) Using ''technology'' of 0.5 µm or more; *and*

(b) Not incorporating multi-layer structures.

Technical Note: The term multi-layer structures in Note b does not include devices incorporating a maximum of three metal layers and three polysilicon layers.

■ 22. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3—Electronics, Export Control Classification Number (ECCN) 3E003 is amended by revising the ''related controls'' and ''items'' paragraphs in the List of Items Controlled section, to read as follows:

3E003 Other ''technology'' for the ''development'' or ''production'' of items described in the List of Items Controlled

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: (1) Technology for the ''development'' or ''production'' of ''space qualified'' electronic vacuum tubes operating at frequencies of 31.8 GHz or higher, described in 3E003.g, is under the export license authority of the Department of State, Office of Defense Trade Controls (22 CFR part 121); (2) See 3E001 for silicon-on-insulation (SOI) technology for the ''development'' or ''production'' related to radiation hardening of integrated circuits.

Related Definitions: * * *

Items: a. Vacuum microelectronic devices;

b. Hetero-structure semiconductor devices such as high electron mobility transistors (HEMT), hetero-bipolar transistors (HBT), quantum well and super lattice devices;

Note: 3E003.b does not control technology for high electron mobility transistors (HEMT) operating at frequencies lower than 31.8 GHz and hetero-junction bipolar transistors (HBT) operating at frequencies lower than 31.8 GHz.

c. ''Superconductive'' electronic devices;

d. Substrates of films of diamond for electronic components;

e. Substrates of silicon-on-insulator (SOI) for integrated circuits in which the insulator is silicon dioxide;

f. Substrates of silicon carbide for electronic components;

g. Electronic vacuum tubes operating at frequencies of 31.8 GHz or higher.

■ 23. In Supplement No. 1 to part 774 (the Commerce Control List), Category 4—Computers, Export Control Classification Number (ECCN) 4A002 is removed.

■ 24. In Supplement No. 1 to part 774 (the Commerce Control List), Category 4—Computers, Export Control Classification Number (ECCN) 4A994 is amended by revising the Heading and the ''items'' paragraph in the List of Items Controlled section, to read as follows:

4A994 Computers, ''electronic assemblies'', and related equipment not controlled by 4A001, or 4A003, and specially designed components therefor

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items:

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 components therefor, rated for operation at an ambient temperature above 343 K (70 °C);

b. ''Digital computers'' having a ''composite theoretical performance'' (''CTP'') equal to or greater than 6 million theoretical operations per second (MTOPS);

c. ''Electronic assemblies'' that are specially designed or modified to enhance performance by aggregation of ''computing elements'' (''CEs''), as follows:

c.1. Designed to be capable of aggregation in configurations of 16 or more ''computing elements'' (''CEs''); *or*

c.2. Having a sum of maximum data rates on all channels available for connection to associated processors exceeding 40 million Byte/s;

Note 1: 4A994.c applies only to ''electronic assemblies'' and programmable interconnections with a ''CTP'' 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.

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. Disk drives and solid state storage equipment:

d.1. Magnetic, erasable optical or magneto-optical disk drives with a ''maximum bit transfer rate'' exceeding 25 million bit/s;

d.2. Solid state storage equipment, other than ''main storage'' (also known as solid state disks or RAM disks), with a ''maximum bit transfer rate'' exceeding 36 million bit/s;

e. Input/output control units designed for use with equipment controlled by 4A994.d;

f. Equipment for ''signal processing'' or ''image enhancement'' having a ''composite theoretical performance'' (''CTP'') exceeding 8.5 million theoretical operations per second (MTOPS);

g. Graphics accelerators or graphics coprocessors that exceed a ''three dimensional vector rate'' of 400,000 or, if supported by 2–D vectors only, a ''two dimensional vector rate'' of 600,000;

Note: The provisions of 4A994.g do not apply to work stations designed for and limited to:

a. Graphic arts (*e.g.*, printing, publishing); and

b. The display of two-dimensional vectors.

h. Color displays or monitors having more than 120 resolvable elements per cm in the direction of the maximum pixel density;

Note 1: 4A994.h does not control displays or monitors not specially designed for electronic computers.

Note 2: Displays specially designed for air traffic control (ATC) systems are treated as specially designed components for ATC systems under Category 6.

i. Equipment containing ''terminal interface equipment'' exceeding the limits in 5A991.

Note: For the purposes of 4A994.i, ''terminal interface equipment'' includes ''local area network'' interfaces, modems and other communications interfaces. ''Local area network'' interfaces are evaluated as ''network access controllers''.

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 components therefor, as follows:

k.1. Containing ''digital computers'' controlled by 4A003;

k.2. Containing analog-to-digital converters having all of the following characteristics:

k.2.a. 32 channels or more; *and*

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

■ 25. In Supplement No. 1 to part 774 (the Commerce Control List), Category 4—Computers is amended by adding a *nota bene* (N.B.) after the title ''Information on How to Calculate ''composite Theoretical Performance (''CTP'') and before the Technical Note that appears at the end of Category 4, to read as follows:

* * * * *

N.B. *See* Interpretation 12: ''Computers'', § 770.2(1)(3), to find guidance as to how to calculate the Composite Theoretical Performance (CTP) for computer systems

with 'Non-Uniform Memory Access' (NUMA) architecture, and obtain a definition for NUMA.

* * * * *

■ 26. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Telecommunications and ''Information Security'', Part I—Telecommunications, Export Control Classification Number (ECCN) 5B001 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

5B001 Telecommunication test, inspection and production equipment, as follows (*See* List of Items Controlled)

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definition: * * *

Items: a. Equipment and specially designed components or accessories therefor, specially designed for the ''development'', ''production'' or ''use'' of equipment, functions or features controlled by 5A001, 5D001 or 5E001.

Note: 5B001.a. does not control optical fiber characterization equipment.

b. Equipment and specially designed components or accessories therefor, specially designed for the ''development'' of any of the following telecommunication transmission or switching equipment:

b.1. Equipment employing digital techniques designed to operate at a ''total digital transfer rate'' exceeding 15 Gbit/s;

Technical Note: For switching equipment the ''total digital transfer rate'' is measured at the highest speed port or line.

b.2. Equipment employing a ''laser'' and having any of the following:

b.2.a. A transmission wavelength exceeding 1750 nm;

b.2.b. Performing ''optical amplification'';

b.2.c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques); *or*

b.2.d. Employing analog techniques and having a bandwidth exceeding 2.5 GHz;

Note: 5B001.b.2.d. does not include equipment specially designed for the ''development'' of commercial TV systems.

b.3. Equipment employing ''optical switching'';

b.4. Radio equipment employing quadrature-amplitude-modulation (QAM) techniques above level 256; *or*

b.5. Equipment employing ''common channel signaling'' operating in non-associated mode of operation.

■ 27. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Telecommunications and ''Information Security'', Part I—Telecommunications, Export Control Classification Number (ECCN) 5D001 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

5D001 ''Software'', as described in the List of Items Controlled

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items: a. ''Software'' specially designed or modified for the ''development'', ''production'' or ''use'' of equipment, functions or features controlled by 5A001 or 5B001.

b. ''Software'' specially designed or modified to support ''technology'' controlled by 5E001.

c. Specific ''software'' as follows:

c.1. ''Software'' specially designed or modified to provide characteristics, functions or features of equipment controlled by 5A001 or 5B001;

c.2. [RESERVED];

c.3. ''Software'', other than in machine-executable form, specially designed for ''dynamic adaptive routing''.

d. ''Software'' specially designed or modified for the ''development'' of any of the following telecommunication transmission or switching equipment:

d.1. Equipment employing digital techniques, including designed to operate at a ''total digital transfer rate'' exceeding 15 Gbit/s;

Technical Note: For switching equipment the ''total digital transfer rate'' is measured at the highest speed port or line.

d.2. Equipment employing a ''laser'' and having any of the following:

d.2.a. A transmission wavelength exceeding 1750 nm; *or*

d.2.b. Employing analog techniques and having a bandwidth exceeding 2.5 GHz;

Note: 5D001.d.2.b. does not control ''software'' specially designed or modified for the ''development'' of commercial TV systems.

d.3. Equipment employing ''optical switching''; *or*

d.4. Radio equipment employing quadrature-amplitude-modulation (QAM) techniques above level 256.

■ 28. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Telecommunications and ''Information Security'', Part I—Telecommunications, Export Control Classification Number (ECCN) 5E001 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

5E001 ''Technology'', (*see* List of Items Controlled).

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items: a. ''Technology'' according to the General Technology Note for the ''development'', ''production'' or ''use'' (excluding operation) of equipment, functions or features or ''software'' controlled by 5A001, 5B001 or 5D001.

b. Specific ''technologies'', as follows:

b.1. ''Required'' ''technology'' for the ''development'' or ''production'' of telecommunications equipment specially designed to be used on board satellites;

b.2. ''Technology'' for the ''development'' or ''use'' of ''laser'' communication techniques with the capability of automatically acquiring and tracking signals and maintaining communications through exoatmosphere or sub-surface (water) media;

b.3. ''Technology'' for the ''development'' of digital cellular radio base station receiving equipment whose reception capabilities that allow multi-band, multi-channel, multi-mode, multi-coding algorithm or multi-protocol operation can be modified by changes in ''software'';

b.4. ''Technology'' for the ''development'' of ''spread spectrum'' techniques, including ''frequency hopping'' techniques.

c. ''Technology'' according the General Technology Note for the ''development'' or ''production'' of any of the following telecommunication transmission or switching equipment, functions or features:

c.1. Equipment employing digital techniques designed to operate at a ''total digital transfer rate'' exceeding 15 Gbit/s;

Technical Note: For switching equipment the ''total digital transfer rate'' is measured at the highest speed port or line.

c.2. Equipment employing a ''laser'' and having any of the following:

c.2.a. A transmission wavelength exceeding 1750 nm;

c.2.b. Performing ''optical amplification'' using praseodymium-doped fluoride fiber amplifiers (PDFFA);

c.2.c. Employing coherent optical transmission or coherent optical detection techniques (also called optical heterodyne or homodyne techniques);

c.2.d. Employing wavelength division multiplexing techniques exceeding 8 optical carriers in a single optical window; *or*

c.2.e. Employing analog techniques and having a bandwidth exceeding 2.5 GHz;

Note: 5E001.c.2.e. does not control ''technology'' for the ''development'' or ''production'' of commercial TV systems.

c.3. Equipment employing ''optical switching''; *or*

c.4. Radio equipment having any of the following:

c.4.a. Quadrature-amplitude-modulation (QAM) techniques above level 256; *or*

c.4.b. Operating at input or output frequencies exceeding 31.8 GHz; *or*

Note: 5E001.c.4.b. does not control ''technology'' for the ''development'' or ''production'' of equipment designed or modified for operation in any frequency band which is ''allocated by the ITU'' for radio-communications services, but not for radio-determination.

c.5. Equipment employing ''common channel signaling'' operating in non-associated mode of operation.

■ 29. In Supplement No. 1 to part 774 (the Commerce Control List), Category

5—Telecommunications and ''Information Security'', Part II—''Information Security'', Export Control Classification Number (ECCN) 5A002 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

5A002 Systems, equipment, application specific "electronic assemblies", modules and integrated circuits for "information security", as follows (*see* List of Items Controlled), and other specially designed components therefor

* * * * *

List of Items Controlled

Unit: * * *
Related Controls: * * *
Related Definitions: * * *
Items:

Note: 5A002 does not control the following. However, these items are instead controlled under 5A992:

(a) ''Personalized smart cards'':

(1) Where the cryptographic capability is restricted for use in equipment or systems excluded from control paragraphs (b) through (f) of this Note; *or*

(2) For general public-use applications where the cryptographic capability is not user-accessible and it is specially designed and limited to allow protection of personal data stored within.

N.B.: If a ''personalized smart card'' has multiple functions, the control status of each function is assessed individually.

(b) Receiving equipment for radio broadcast, pay television or similar restricted audience broadcast of the consumer type, without digital encryption except that exclusively used for sending the billing or program-related information back to the broadcast providers.

(c) Equipment where the cryptographic capability is not user-accessible and which is specially designed and limited to allow any of the following:

(1) Execution of copy-protected ''software'';

(2) Access to any of the following:

(a) Copy-protected contents stored on read-only media; or

(b) Information stored in encrypted form on media (*e.g.*, in connection with the protection of intellectual property rights) where the media is offered for sale in identical sets to the public; *or*

(3) Copying control of copyright protected audio/video data.

(d) Cryptographic equipment specially designed and limited for banking use or money transactions;

(e) Portable or mobile radiotelephones for civil use (*e.g.*, for use with commercial civil cellular radio communications systems) that are not capable of end-to-end encryption.

N.B.: The term ''money transactions'' includes the collection and settlement of fares or credit functions.

(f) Cordless telephone equipment not capable of end-to-end encryption where the maximum effective range of unboosted cordless operation (*e.g.*, a single, unrelayed hop between terminal and home basestation) is less than 400 meters according to the manufacturer's specifications.

Technical Note: Parity bits are not included in the key length.

a. Systems, equipment, application specific ''electronic assemblies'', modules and integrated circuits for ''information security'', as follows, and other specially designed components therefor:

N.B.: For the control of global navigation satellite systems receiving equipment containing or employing decryption (*e.g.*, GPS or GLONASS) *see* 7A005.

a.1. Designed or modified to use ''cryptography'' employing digital techniques performing any cryptographic function other than authentication or digital signature having any of the following:

Technical Notes:

1. Authentication and digital signature functions include their associated key management function.

2. Authentication includes all aspects of access control where there is no encryption of files or text except as directly related to the protection of passwords, Personal Identification Numbers (PINs) or similar data to prevent unauthorized access.

3. ''Cryptography'' does not include ''fixed'' data compression or coding techniques.

Note: 5A002.a.1 includes equipment designed or modified to use ''cryptography'' employing analog principles when implemented with digital techniques.

a.1.a. A ''symmetric algorithm'' employing a key length in excess of 56-bits; *or*

a.1.b. An ''asymmetric algorithm'' where the security of the algorithm is based on any of the following:

a.1.b.1. Factorization of integers in excess of 512 bits (*e.g.*, RSA);

a.1.b.2. Computation of discrete logarithms in a multiplicative group of a finite field of size greater than 512 bits (*e.g.*, Diffie-Hellman over Z/pZ); *or*

a.1.b.3. Discrete logarithms in a group other than mentioned in 5A002.a.1.b.2 in excess of 112 bits (*e.g.*, Diffie-Hellman over an elliptic curve);

a.2. Designed or modified to perform cryptanalytic functions;

a.3. [RESERVED]

a.4. Specially designed or modified to reduce the compromising emanations of information-bearing signals beyond what is necessary for health, safety or electromagnetic interference standards;

a.5. Designed or modified to use cryptographic techniques to generate the spreading code for ''spread spectrum'' systems, including the hopping code for ''frequency hopping'' systems;

a.6. Designed or modified to use cryptographic techniques to generate channelizing or scrambling codes for ''time-modulated ultra-wideband'' systems;

a.7. [RESERVED]

a.8. Communications cable systems designed or modified using mechanical, electrical or electronic means to detect surreptitious intrusion.

■ 30. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6—Sensors, Export Control Classification Number (ECCN) 6A001 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

6A001 Acoustics

* * * * *

List of Items Controlled

Unit: * * *
Related Controls: * * *
Related Definitions: * * *
Items: a. Marine acoustic systems, equipment and specially designed components therefor, as follows:

Note: 6A001.a.1 does not control:

a. Depth sounders operating vertically below the apparatus, not including a scanning function exceeding ±20°, and limited to measuring the depth of water, the distance of submerged or buried objects or fish finding;

b. Acoustic beacons, as follows:

1. Acoustic emergency beacons;

2. Pingers specially designed for relocating or returning to an underwater position.

a.1. Active (transmitting or transmitting-and-receiving) systems, equipment and specially designed components therefor, as follows:

a.1.a. Wide-swath bathymetric survey systems designed for sea bed topographic mapping, having all of the following:

a.1.a.1. Being designed to take measurements at an angle exceeding 20° from the vertical;

a.1.a.2. Being designed to measure depths exceeding 600 m below the water surface; *and*

a.1.a.3. Being designed to provide any of the following:

a.1.a.3.a. Incorporation of multiple beams any of which is less than 1.9°; *or*

a.1.a.3.b. Data accuracies of better than 0.3% of water depth across the swath averaged over the individual measurements within the swath;

a.1.b. Object detection or location systems having any of the following:

a.1.b.1. A transmitting frequency below 10 kHz;

a.1.b.2. Sound pressure level exceeding 224dB (reference 1 μPa at 1 m) for equipment with an operating frequency in the band from 10 kHz to 24 kHz inclusive;

a.1.b.3. Sound pressure level exceeding 235 dB (reference 1 μPa at 1 m) for equipment with an operating frequency in the band between 24 kHz and 30 kHz;

a.1.b.4. Forming beams of less than 1° on any axis and having an operating frequency of less than 100 kHz;

a.1.b.5. Designed to operate with an unambiguous display range exceeding 5,120 m; *or*

a.1.b.6. Designed to withstand pressure during normal operation at depths exceeding 1,000 m and having transducers with any of the following:

a.1.b.6.a. Dynamic compensation for pressure; *or*

a.1.b.6.b. Incorporating other than lead zirconate titanate as the transduction element;

a.1.c. Acoustic projectors, including transducers, incorporating piezoelectric, magnetostrictive, electrostrictive, electrodynamic or hydraulic elements operating individually or in a designed combination, having any of the following:

Notes: 1. The control status of acoustic projectors, including transducers, specially designed for other equipment is determined by the control status of the other equipment.

2. 6A001.a.1.c does not control electronic sources that direct the sound vertically only, or mechanical (*e.g.*, air gun or vapor-shock gun) or chemical (*e.g.*, explosive) sources.

a.1.c.1. An instantaneous radiated acoustic power density exceeding 0.01 mW/mm^2/Hz for devices operating at frequencies below 10 kHz;

a.1.c.2. A continuously radiated acoustic power density exceeding 0.001 Mw/mm^2/Hz for devices operating at frequencies below 10 kHz; *or*

Technical Note: Acoustic power density is obtained by dividing the output acoustic power by the product of the area of the radiating surface and the frequency of operation.

a.1.c.3. Side-lobe suppression exceeding 22 dB;

a.1.d. Acoustic systems, equipment and specially designed components for determining the position of surface vessels or underwater vehicles designed to operate at a range exceeding 1,000 m with a positioning accuracy of less than 10 m rms (root mean square) when measured at a range of 1,000 m;

Note: 6A001.a.1.d includes:

a. Equipment using coherent ''signal processing'' between two or more beacons and the hydrophone unit carried by the surface vessel or underwater vehicle;

b. Equipment capable of automatically correcting speed-of-sound propagation errors for calculation of a point.

a.2. Passive (receiving, whether or not related in normal application to separate active equipment) systems, equipment and specially designed components therefor, as follows:

a.2.a. Hydrophones having any of the following characteristics:

Note: The control status of hydrophones specially designed for other equipment is determined by the control status of the other equipment.

a.2.a.1. Incorporating continuous flexible sensors or assemblies of discrete sensor elements with either a diameter or length less than 20 mm and with a separation between elements of less than 20 mm;

a.2.a.2. Having any of the following sensing elements:

a.2.a.2.a. Optical fibers; or

a.2.a.2.b. Flexible piezoelectric ceramic materials;

a.2.a.3. A hydrophone sensitivity better than -180dB at any depth with no acceleration compensation;

a.2.a.4. When designed to operate at depths exceeding 35 m with acceleration compensation; *or*

a.2.a.5. Designed for operation at depths exceeding 1,000 m;

Technical Note: Hydrophone sensitivity is defined as twenty times the logarithm to the base 10 of the ratio of rms output voltage to a 1 V rms reference, when the hydrophone sensor, without a pre-amplifier, is placed in a plane wave acoustic field with an rms pressure of 1 μPa. For example, a hydrophone of -160 dB (reference 1 V per μPa) would yield an output voltage of 10^{-8} V in such a field, while one of -180 dB sensitivity would yield only 10^{-9} V output. Thus, -160 dB is better than -180 dB.

a.2.b. Towed acoustic hydrophone arrays having any of the following:

a.2.b.1. Hydrophone group spacing of less than 12.5 m or 'able to be modified' to have hydrophone group spacing of less than 12.5 m;

a.2.b.2. Designed or 'able to be modified' to operate at depths exceeding 35 m;

Technical Note: ''Able to be modified'' in 6A001.a.2.b means having provisions to allow a change of the wiring or interconnections to alter hydrophone group spacing or operating depth limits. These provisions are: spare wiring exceeding 10% of the number of wires, hydrophone group spacing adjustment blocks or internal depth limiting devices that are adjustable or that control more than one hydrophone group.

a.2.b.3. Heading sensors controlled by 6A001.a.2.d;

a.2.b.4. Longitudinally reinforced array hoses;

a.2.b.5. An assembled array of less than 40 mm in diameter;

a.2.b.6. Multiplexed hydrophone group signals designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m; *or*

a.2.b.7. Hydrophone characteristics controlled by 6A001.a.2.a;

a.2.c. Processing equipment, specially designed for towed acoustic hydrophone arrays, having ''user accessible programmability'' and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

a.2.d. Heading sensors having all of the following:

a.2.d.1. An accuracy of better than ± 0.5° *and*

a.2.d.2. Designed to operate at depths exceeding 35 m or having an adjustable or removable depth sensing device in order to operate at depths exceeding 35 m;

a.2.e. Bottom or bay cable systems having any of the following:

a.2.e.1. Incorporating hydrophones controlled by 6A001.a.2.a; *or*

a.2.e.2. Incorporating multiplexed hydrophone group signal modules having all of the following characteristics:

a.2.e.2.a. Designed to operate at depths exceeding 35 m or having an adjustable or removal depth sensing device in order to operate at depths exceeding 35 m; *and*

a.2.e.2.b. Capable of being operationally interchanged with towed acoustic hydrophone array modules;

a.2.f. Processing equipment, specially designed for bottom or bay cable systems, having ''user accessible programmability'' and time or frequency domain processing and correlation, including spectral analysis, digital filtering and beamforming using Fast Fourier or other transforms or processes;

b. Correlation-velocity sonar log equipment designed to measure the horizontal speed of the equipment carrier relative to the sea bed at distances between the carrier and the sea bed exceeding 500 m.

■ 31. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6—Sensors, Export Control Classification Number (ECCN) 6A003 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

6A003 Cameras

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items: a. Instrumentation cameras and specially designed components therefor, as follows:

Note: Instrumentation cameras, controlled by 6A003.a.3 to 6A003.a.5, with modular structures should be evaluated by their maximum capability, using plug-ins available according to the camera manufacturer's specifications.

a.1. High-speed cinema recording cameras using any film format from 8 mm to 16 mm inclusive, in which the film is continuously advanced throughout the recording period, and that are capable of recording at framing rates exceeding 13,150 frames/s;

Note: 6A003.a.1 does not control cinema recording cameras designed for civil purposes.

a.2. Mechanical high speed cameras, in which the film does not move, capable of recording at rates exceeding 1,000,000 frames/s for the full framing height of 35 mm film, or at proportionately higher rates for lesser frame heights, or at proportionately lower rates for greater frame heights;

a.3. Mechanical or electronic streak cameras having writing speeds exceeding 10 mm/μs;

a.4. Electronic framing cameras having a speed exceeding 1,000,000 frames/s;

a.5. Electronic cameras, having all of the following:

a.5.a. An electronic shutter speed (gating capability) of less than 1 μs per full frame; *and*

a.5.b. A read out time allowing a framing rate of more than 125 full frames per second.

a.6. Plug-ins, having all of the following characteristics:

a.6.a. Specially designed for instrumentation cameras which have modular structures and that are controlled by 6A003.a; *and*

a.6.b. Enabling these cameras to meet the characteristics specified in 6A003.a.3, 6A003.a.4 or 6A003.a.5, according to the manufacturer's specifications.

b. Imaging cameras, as follows:

Note: 6A003.b does not control television or video cameras specially designed for television broadcasting.

b.1. Video cameras incorporating solid state sensors, having a peak response in the wavelength range exceeding 10nm, but not exceeding 30,000 nm and having all of the following:

b.1.a. Having any of the following:

b.1.a.1. More than 4×10^6 ''active pixels'' per solid state array for monochrome (black and white) cameras;

b.1.a.2. More than 4×10^6 ''active pixels'' per solid state array for color cameras incorporating three solid state arrays; *or*

b.1.a.3. More than 12×10^6 ''active pixels'' for solid state array color cameras incorporating one solid state array; *and*

b.1.b. Having any of the following:

b.1.b.1. Optical mirrors controlled by 6A004.a.;

b.1.b.2. Optical control equipment controlled by 6A004.d.; *or*

b.1.b.3. The capability for annotating internally generated camera tracking data.

Technical Notes:

1. For the purposes of this entry, digital video cameras should be evaluated by the maximum number of ''active pixels'' used for capturing moving images.

2. For the purpose of this entry, camera tracking data is the information necessary to define camera line of sight orientation with respect to the earth. This includes: (1) the horizontal angle the camera line of sight makes with respect to the earth's magnetic field direction and; (2) the vertical angle between the camera line of sight and the earth's horizon.

b.2. Scanning cameras and scanning camera systems, having all of the following:

b.2.a. A peak response in the wavelength range exceeding 10 nm, but not exceeding 30,000 nm;

b.2.b. Linear detector arrays with more than 8,192 elements per array; *and*

b.2.c. Mechanical scanning in one direction;

b.3. Imaging cameras incorporating image intensifier tubes having the characteristics listed in 6A002.a.2.a;

b.4. Imaging cameras incorporating ''focal plane arrays'' having the characteristics listed in 6A002.a.3.

Note: 6A003.b.4 does not control imaging cameras incorporating linear ''focal plane arrays'' with twelve elements or fewer, not employing time-delay-and-integration within the element, designed for any of the following:

a. Industrial or civilian intrusion alarm, traffic or industrial movement control or counting systems;

b. Industrial equipment used for inspection or monitoring of heat flows in buildings, equipment or industrial processes;

c. Industrial equipment used for inspection, sorting or analysis of the properties of materials;

d. Equipment specially designed for laboratory use; or

e. Medical equipment.

■ 32. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6—Sensors, Export Control Classification Number (ECCN) 6A005 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

6A005 ''Lasers'' (other than those described in 0B001.g.5 or .h.6), components and optical equipment, as follows (*see* List of Items Controlled).

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items: a. Gas ''lasers'', as follows:

a.1. Excimer ''lasers'', having any of the following:

a.1.a. An output wavelength not exceeding 150 nm and having any of the following:

a.1.a.1. An output energy exceeding 50 mJ per pulse; *or*

a.1.a.2. An average output power exceeding 1 W;

a.1.b. An output wavelength exceeding 150 nm but not exceeding 190 nm and having any of the following:

a.1.b.1. An output energy exceeding 1.5 J per pulse; *or*

a.1.b.2. An average output power exceeding 120 W;

a.1.c. An output wavelength exceeding 190 nm but not exceeding 360 nm and having any of the following:

a.1.c.1. An output energy exceeding 10 J per pulse; *or*

a.1.c.2. An average output power exceeding 500 W; *or*

a.1.d. An output wavelength exceeding 360 nm and having any of the following:

a.1.d.1. An output energy exceeding 1.5 J per pulse; *or*

a.1.d.2. An average output power exceeding 30 W;

N.B.: For excimer ''lasers'' specially designed for lithography equipment, *see* 3B001.

a.2. Metal vapor ''lasers'', as follows:

a.2.a. Copper (Cu) ''lasers'' having an average output power exceeding 20 W;

a.2.b. Gold (Au) ''lasers'' having an average output power exceeding 5 W;

a.2.c. Sodium (Na) ''lasers'' having an output power exceeding 5 W;

a.2.d. Barium (Ba) ''lasers'' having an average output power exceeding 2 W;

a.3. Carbon monoxide (CO) ''lasers'' having any of the following:

a.3.a. An output energy exceeding 2 J per pulse and a pulsed ''peak power'' exceeding 5 kW; *or*

a.3.b. An average or CW output power exceeding 5 kW;

a.4. Carbon dioxide (CO_2) ''lasers'' having any of the following:

a.4.a. A CW output power exceeding 15 kW;

a.4.b. A pulsed output having a ''pulse duration'' exceeding 10 µs and having any of the following:

a.4.b.1. An average output power exceeding 10 kW; *or*

a.4.b.2. A pulsed ''peak power'' exceeding 100 kW; *or*

a.4.c. A pulsed output having a ''pulse duration'' equal to or less than 10 µs; and having any of the following:

a.4.c.1. A pulse energy exceeding 5 J per pulse; *or*

a.4.c.2. An average output power exceeding 2.5 kW;

a.5. ''Chemical lasers'', as follows:

a.5.a. Hydrogen Fluoride (HF) ''lasers'';

a.5.b. Deuterium Fluoride (DF) ''lasers'';

a.5.c. ''Transfer lasers'', as follows:

a.5.c.1. Oxygen Iodine (O_2-I) ''lasers'';

a.5.c.2. Deuterium Fluoride-Carbon dioxide (DF-CO_2) ''lasers'';

a.6. Krypton ion or argon ion ''lasers'' having any of the following:

a.6.a. An output energy exceeding 1.5 J per pulse and a pulsed ''peak power'' exceeding 50 W; *or*

a.6.b. An average or CW output power exceeding 50 W;

a.7. Other gas ''lasers'', having any of the following:

Note: 6A005.a.7 does not control nitrogen ''lasers''.

a.7.a. An output wavelength not exceeding 150 nm and having any of the following:

a.7.a.1. An output energy exceeding 50 mJ per pulse and a pulsed ''peak power'' exceeding 1 W; *or*

a.7.a.2. An average or CW output power exceeding 1 W;

a.7.b. An output wavelength exceeding 150 nm but not exceeding 800 nm and having any of the following:

a.7.b.1. An output energy exceeding 1.5 J per pulse and a pulsed ''peak power'' exceeding 30 W; *or*

a.7.b.2. An average or CW output power exceeding 30 W;

a.7.c. An output wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:

a.7.c.1. An output energy exceeding 0.25 J per pulse and a pulsed ''peak power'' exceeding 10 W; *or*

a.7.c.2. An average or CW output power exceeding 10 W; *or*

a.7.d. An output wavelength exceeding 1,400 nm and an average or CW output power exceeding 1 W.

b. Semiconductor ''lasers'', as follows:

Note 1: 6A005.b. includes semiconductor ''lasers'' having optical output connectors (*e.g.*, fiber optic pigtails).

Note 2: The control status of semiconductor ''lasers'' specially designed for other equipment is determined by the control status of the other equipment.

b.1. Individual single-transverse mode semiconductor ''lasers'' having any of the following:

b.1.a. A wavelength equal to or less than 1510 nm, and having an average or CW output power exceeding 1.5 W; *or*

b.1.b. A wavelength greater than 1510 nm, and having an average or CW output power exceeding 500 mW;

b.2. Individual, multiple-transverse mode semiconductor ''lasers'' , having any of the following:

b.2.a. A wavelength of less than 1400 nm, and having an average or CW output power exceeding 10W;

b.2.b. A wavelength equal to or greater than 1400 nm and less than 1900 nm, and having an average or CW output power exceeding 2.5 W; *or*

b.2.c. A wavelength equal to or greater than 1900 nm and having an average or CW output power exceeding 1 W.

b.3. Individual semiconductor ''laser'' arrays, having any of the following:

b.3.a. A wavelength of less than 1400 nm and having an average or CW output power exceeding 80 W; *or*

b.3.b. A wavelength equal to or greater than 1400 nm and less than 1900 nm, and having an average or CW output power exceeding 25 W; *or*

b.3.c. A wavelength equal to or greater than 1900 nm, and having an average or CW output power exceeding 10 W.

b.4. Array stacks of semiconductor ''lasers'' containing at least one array that is controlled under 6A005.b.3.

Technical Notes:

1. Semiconductor ''lasers'' are commonly called ''laser'' diodes.

2. An ''array'' consists of multiple semiconductor ''laser'' emitters fabricated as a single chip so that the centers of the emitted light beams are on parallel paths.

3. An ''array stack'' is fabricated by stacking, or otherwise assembling, ''arrays'' so that the centers of the emitted light beams are on parallel paths.

c. Solid state ''lasers'', as follows:

c.1. ''Tunable'' ''lasers'' having any of the following:

Note: 6A005.c.1 includes titanium-sapphire (Ti: Al_2O_3), thulium-YAG (Tm: YAG), thulium-YSGG (Tm: YSGG), alexandrite (Cr: $BeAl_2O_4$) and color center ''lasers''.

c.1.a. An output wavelength less than 600 nm and having any of the following:

c.1.a.1. An output energy exceeding 50 mJ per pulse and a pulsed ''peak power'' exceeding 1 W; *or*

c.1.a.2. An average or CW output power exceeding 1 W;

c.1.b. An output wavelength of 600 nm or more but not exceeding 1,400 nm and having any of the following:

c.1.b.1. An output energy exceeding 1 J per pulse and a pulsed ''peak power'' exceeding 20 W; *or*

c.1.b.2. An average or CW output power exceeding 20 W; *or*

c.1.c. An output wavelength exceeding 1,400 nm and having any of the following:

c.1.c.1. An output energy exceeding 50 mJ per pulse and a pulsed ''peak power'' exceeding 1 W; *or*

c.1.c.2. An average or CW output power exceeding 1 W;

c.2. Non-''tunable'' ''lasers'', as follows:

Note: 6A005.c.2 includes atomic transition solid state ''lasers''.

c.2.a. Neodymium glass ''lasers'', as follows:

c.2.a.1. ''Q-switched lasers'' having any of the following:

c.2.a.1.a. An output energy exceeding 20 J but not exceeding 50 J per pulse and an average output power exceeding 10 W; *or*

c.2.a.1.b. An output energy exceeding 50 J per pulse;

c.2.a.2. Non-''Q-switched lasers'' having any of the following:

c.2.a.2.a. An output energy exceeding 50 J but not exceeding 100 J per pulse and an average output power exceeding 20 W; *or*

c.2.a.2.b. An output energy exceeding 100 J per pulse;

c.2.b. Neodymium-doped (other than glass) ''lasers'', having an output wavelength exceeding 1,000 nm but not exceeding 1,100 nm, as follows:

N.B.: For neodymium-doped (other than glass) ''lasers'' having an output wavelength not exceeding 1,000 nm or exceeding 1,100 nm, *see* 6A005.c.2.c.

c.2.b.1. Pulse-excited, mode-locked, ''Q-switched lasers'' having a ''pulse duration'' of less than 1 ns and having any of the following:

c.2.b.1.a. A ''peak power'' exceeding 5 GW;

c.2.b.1.b. An average output power exceeding 10 W; *or*

c.2.b.1.c. A pulsed energy exceeding 0.1 J;

c.2.b.2. Pulse-excited, ''Q-switched lasers'' having a pulse duration equal to or more than 1 ns, and having any of the following:

c.2.b.2.a. A single-transverse mode output having:

c.2.b.2.a.1. A ''peak power'' exceeding 100 MW;

c.2.b.2.a.2. An average output power exceeding 20 W; *or*

c.2.b.2.a.3. A pulsed energy exceeding 2 J; *or*

c.2.b.2.b. A multiple-transverse mode output having:

c.2.b.2.b.1. A ''peak power'' exceeding 400 MW;

c.2.b.2.b.2. An average output power exceeding 2 kW; *or*

c.2.b.2.b.3. A pulsed energy exceeding 2 J;

c.2.b.3. Pulse-excited, non-''Q-switched lasers'', having:

c.2.b.3.a. A single-transverse mode output having:

c.2.b.3.a.1. A ''peak power'' exceeding 500 kW; *or*

c.2.b.3.a.2. An average output power exceeding 150 W; *or*

c.2.b.3.b. A multiple-transverse mode output having:

c.2.b.3.b.1. A ''peak power'' exceeding 1 MW; *or*

c.2.b.3.b.2. An average power exceeding 2 kW;

c.2.b.4. Continuously excited ''lasers'' having:

c.2.b.4.a. A single-transverse mode output having:

c.2.b.4.a.1. A ''peak power'' exceeding 500 kW; *or*

c.2.b.4.a.2. An average or CW output power exceeding 150 W; *or*

c.2.b.4.b. A multiple-transverse mode output having:

c.2.b.4.b.1. A ''peak power'' exceeding 1 MW; *or*

c.2.b.4.b.2. An average or CW output power exceeding 2 kW;

c.2.c. Other non-''tunable'' ''lasers'', having any of the following:

c.2.c.1. A wavelength less than 150 nm and having any of the following:

c.2.c.1.a. An output energy exceeding 50 mJ per pulse and a pulsed ''peak power'' exceeding 1 W; *or*

c.2.c.1.b. An average or CW output power exceeding 1 W;

c.2.c.2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:

c.2.c.2.a. An output energy exceeding 1.5 J per pulse and a pulsed ''peak power'' exceeding 30 W; *or*

c.2.c.2.b. An average or CW output power exceeding 30 W;

c.2.c.3. A wavelength exceeding 800 nm but not exceeding 1,400 nm, as follows:

c.2.c.3.a. ''Q-switched lasers'' having:

c.2.c.3.a.1. An output energy exceeding 0.5 J per pulse and a pulsed ''peak power'' exceeding 50 W; *or*

c.2.c.3.a.2. An average output power exceeding:

c.2.c.3.a.2.a. 10 W for single-mode ''lasers'';

c.2.c.3.a.2.b. 30 W for multimode ''lasers'';

c.2.c.3.b. Non-''Q-switched lasers'' having:

c.2.c.3.b.1. An output energy exceeding 2 J per pulse and a pulsed ''peak power'' exceeding 50 W; *or*

c.2.c.3.b.2. An average or CW output power exceeding 50 W; *or*

c.2.c.4. A wavelength exceeding 1,400 nm and having any of the following:

c.2.c.4.a. An output energy exceeding 100 mJ per pulse and a pulsed ''peak power'' exceeding 1 W; *or*

c.2.c.4.b. An average or CW output power exceeding 1 W;

d. Dye and other liquid ''lasers'', having any of the following:

d.1. A wavelength less than 150 nm and;

d.1.a. An output energy exceeding 50 mJ per pulse and a pulsed ''peak power'' exceeding 1 W; *or*

d.1.b. An average or CW output power exceeding 1 W;

d.2. A wavelength of 150 nm or more but not exceeding 800 nm and having any of the following:

d.2.a. An output energy exceeding 1.5 J per pulse and a pulsed ''peak power'' exceeding 20 W;

d.2.b. An average or CW output power exceeding 20 W; *or*

d.2.c. A pulsed single longitudinal mode oscillator having an average output power exceeding 1 W and a repetition rate exceeding 1 kHz if the ''pulse duration'' is less than 100 ns;

d.3. A wavelength exceeding 800 nm but not exceeding 1,400 nm and having any of the following:

d.3.a. An output energy exceeding 0.5 J per pulse and a pulsed ''peak power'' exceeding 10 W; *or*

d.3.b. An average or CW output power exceeding 10 W; *or*

d.4. A wavelength exceeding 1,400 nm and having any of the following:

d.4.a. An output energy exceeding 100 mJ per pulse and a pulsed ''peak power'' exceeding 1 W; *or*

d.4.b. An average or CW output power exceeding 1 W;

e. Components, as follows:

e.1. Mirrors cooled either by active cooling or by heat pipe cooling;

Technical Note: Active cooling is a cooling technique for optical components using flowing fluids within the subsurface (nominally less than 1 mm below the optical surface) of the optical component to remove heat from the optic.

e.2. Optical mirrors or transmissive or partially transmissive optical or electro-optical components specially designed for use with controlled ''lasers'';

f. Optical equipment, as follows:

N.B.: For shared aperture optical elements, capable of operating in ''Super-High Power Laser'' (''SHPL'') applications, see the U.S. Munitions List (22 CFR part 121).

f.1. Dynamic wavefront (phase) measuring equipment capable of mapping at least 50 positions on a beam wavefront having any of the following:

f.1.a. Frame rates equal to or more than 100 Hz and phase discrimination of at least 5% of the beam's wavelength; *or*

f.1.b. Frame rates equal to or more than 1,000 Hz and phase discrimination of at least 20% of the beam's wavelength;

f.2. ''Laser'' diagnostic equipment capable of measuring ''SHPL'' system angular beam steering errors of equal to or less than 10 µrad;

f.3. Optical equipment and components specially designed for a phased-array ''SHPL'' system for coherent beam combination to an accuracy of lambda/10 at the designed wavelength, or 0.1 µm, whichever is the smaller;

f.4. Projection telescopes specially designed for use with ''SHPL'' systems.

■ 33. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6—Sensors, Export Control Classification Number (ECCN) 6A006 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

6A006 ''Magnetometers'', ''magnetic gradiometers'', ''intrinsic magnetic gradiometers'' and compensation systems, and specially designed components therefor, as follows (*see* List of Items Controlled)

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items: a. ''Magnetometers'' using ''superconductive'', optically pumped, nuclear precession (proton/Overhauser) or triaxial fluxgate ''technology'' having a ''noise level'' (sensitivity) lower (better) than 0.05 nT rms per square root Hz;

b. Induction coil ''magnetometers'' having a ''noise level'' (sensitivity) lower (better) than any of the following:

b.1. 0.05 nT rms/square root Hz at frequencies of less than 1 Hz;

b.2. 1×10^{-3}nT rms/square root Hz at frequencies of 1 Hz or more but not exceeding 10 Hz; *or*

b.3. 1×10^{-4}nT rms/square root Hz at frequencies exceeding 10 Hz;

c. Fiber optic ''magnetometers'' having a ''noise level'' (sensitivity) lower (better) than 1 nT rms per square root Hz;

d. ''Magnetic gradiometers'' using multiple ''magnetometers'' controlled by 6A006.a, 6A006.b or 6A006.c;

e. Fiber optic ''intrinsic magnetic gradiometers'' having a magnetic gradient field ''noise level'' (sensitivity) lower (better) than 0.3 nT/m rms per square root Hz;

f. ''Intrinsic magnetic gradiometers'', using ''technology'' other than fiber-optic ''technology'', having a magnetic gradient field ''noise level'' (sensitivity) lower (better) than 0.015 nT/m rms per square root Hz;

g. Magnetic compensation systems for magnetic sensors designed for operation on mobile platforms;

h. ''Superconductive'' electromagnetic sensors, components manufactured from ''superconductive'' materials:

h.1. Designed for operation at temperatures below the ''critical temperature'' of at least one of their ''superconductive'' constituents (including Josephson effect devices or ''superconductive'' quantum interference devices (SQUIDS));

h.2. Designed for sensing electromagnetic field variations at frequencies of 1 KHz or less; *and*

h.3. Having any of the following characteristics:

h.3.a. Incorporating thin-film SQUIDS with a minimum feature size of less than 2 µm and with associated input and output coupling circuits;

h.3.b. Designed to operate with a magnetic field slew rate exceeding 1×10^{-6} magnetic flux quanta per second;

h.3.c. Designed to function without magnetic shielding in the earth's ambient magnetic field; or

h.3.d. Having a temperature coefficient less (smaller) than 0.1 magnetic flux quantum/K.

■ 34. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6—Sensors, Export Control Classification Number (ECCN) 6E003 is amended by revising the ''items'' paragraph in the List of Items Controlled section, to read as follows:

6E003 Other ''technology'', as follows (*see* List of Items Controlled)

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items: a. Acoustics. None.

b. Optical sensors. None.

c. Cameras. None.

d. Optics, ''technology'', as follows:

d.1. Optical surface coating and treatment ''technology'' ''required'' to achieve uniformity of 99.5% or better for optical coatings 500 mm or more in diameter or major axis length and with a total loss (absorption and scatter) of less than 5×10^{-3};

N.B.: *See also* 2E003.f.

d.2. Optical fabrication ''technology'' using single point diamond turning techniques to produce surface finish accuracies of better than 10 nm rms on non-planar surfaces exceeding 0.5 m^2;

e. Lasers. ''Technology'' ''required'' for the ''development'', ''production'' or ''use'' of specially designed diagnostic instruments or targets in test facilities for ''SHPL'' testing or testing or evaluation of materials irradiated by ''SHPL'' beams;

f. Magnetometers. ''Technology'' ''required'' for the ''development'' or ''production'' of non-triaxial fluxgate ''magnetometers'' or non-triaxial fluxgate ''magnetometer'' systems, having any of the following:

f.1. A ''noise level'' of less than 0.05 nT rms per square root Hz at frequencies of less than 1 Hz; *or*

f.2. A ''noise level'' of less than 1 x 10^{-3} nT rms per square root Hz at frequencies of 1 Hz or more.

■ 35. Category 7 ''Navigation and Avionics'' is amended by removing the second *Nota bene* (N.B.2.) in the beginning of section A ''Systems, Equipment and Components''.

■ 36. In Supplement No. 1 to part 774 (the Commerce Control List), Category 7—Navigation and Avionics, Export Control Classification Number (ECCN) 7A003 is amended by revising the Heading and the ''items'' paragraph in the List of Items Controlled section, to read as follows:

7A003 Inertial Systems and specially designed components therefor

* * * * *

List of Items Controlled

Unit: * * *

Related Controls: * * *

Related Definitions: * * *

Items: a. Inertial Navigation Systems (INS) (gimballed or strapdown) and inertial equipment designed for ''aircraft'', land vehicles, vessels (surface or underwater) or ''spacecraft'' for attitude, guidance or control, having any of the following characteristics, and specially designed components therefor:

a.1. Navigation error (free inertial) subsequent to normal alignment of 0.8 nautical mile per hour (nm/hr) Circular Error Probable (CEP) or less (better); *or*

a.2. Specified to function at linear acceleration levels exceeding 10 g.

b. Hybrid Inertial Navigation Systems embedded with Global Navigation Satellite System(s) (GNSS) or with ''Data-Based Referenced Navigation'' (''DBRN'') System(s) for attitude, guidance or control, subsequent to normal alignment, having an INS navigation position accuracy, after loss of GNSS or ''DBRN'' for a period of up to 4 minutes, of less (better) than 10 meters Circular Error Probable (CEP).

c. Inertial Equipment for Azimuth, Heading, or North Pointing having any of the following characteristics, and specially designed components therefor:

c.1. Designed to have an Azimuth, Heading, or North Pointing accuracy equal to, or less (better) than 6 arc minutes RMS at 45 degrees latitude; *or*

c.2. Designed to have a non-operating shock level of 900 g or greater at a duration of 1-msec, or greater.

Note 1: The parameters of 7A003.a and 7A003.b are applicable with any of the following environmental conditions:

1. Input random vibration with an overall magnitude of 7.7 g rms in the first half hour and a total test duration of one and one half hour per axis in each of the three perpendicular axes, when the random vibration meets the following:

a. A constant power spectral density (PSD) value of 0.04 g^2/Hz over a frequency interval of 15 to 1,000 Hz; *and*

b. The PSD attenuates with frequency from 0.04 g^2/Hz to 0.01 g^2/Hz over a frequency interval from 1,000 to 2,000 Hz;

2. A roll and yaw rate of equal to or more than +2.62 rad/s (150 deg/s); *or*

3. According to national standards equivalent to 1. or 2. of this note.

Note 2: 7A003 does not control inertial navigation systems that are certified for use on ''civil aircraft'' by civil authorities of a country in Country Group A:1.

Note 3: 7A003.c.1 does not control theodolite systems incorporating inertial equipment specially designed for civil surveying purposes.

Technical Notes:

1. 7A003.b refers to systems in which an INS and other independent navigation aids are built into a single unit (embedded) in order to achieve improved performance.

2. ''Circular Error Probable'' (''CEP'')—In a circular normal distribution, the radius of the circle containing 50 percent of the individual measurements being made, or the radius of the circle within which there is a 50 percent probability of being located.

Dated: April 21, 2004.

Peter Lichtenbaum,

Assistant Secretary for Export Administration.

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