

**DEPARTMENT OF COMMERCE****Bureau of Industry and Security****15 CFR Parts 740, 772, and 774**

[Docket No. 170309249–7249–01]

RIN 0694–AH35

**Wassenaar Arrangement 2016 Plenary Agreements Implementation****AGENCY:** Bureau of Industry and Security, Commerce.**ACTION:** Final rule.

**SUMMARY:** The Bureau of Industry and Security (BIS) maintains, as part of its Export Administration Regulations (EAR), the Commerce Control List (CCL), which identifies certain items subject to Department of Commerce jurisdiction. This final rule revises the CCL, as well as corresponding parts of the EAR, to implement changes made to the Wassenaar Arrangement List of Dual-Use Goods and Technologies (WA List) 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, or WA) at the December 2016 WA Plenary meeting. The Wassenaar Arrangement advocates implementation of effective export controls on strategic items with the objective of improving regional and international security and stability. This rule harmonizes the CCL with the agreements reached at the 2016 Plenary meeting by revising Export Control Classification Numbers (ECCNs) controlled for national security reasons in each category of the CCL, as well as making other associated changes to the EAR.

**DATES:** This rule is effective August 15, 2017, except that:

1. The effective date for amendatory instruction 30 (ECCN 4A003 in Supplement No. 1 to part 774) is September 25, 2017; and
2. the effective date for amendatory instruction 2 (§ 740.7 of the EAR) is November 24, 2017.

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**SUPPLEMENTARY INFORMATION:****Background**

The Wassenaar Arrangement (Wassenaar or WA) on Export Controls for Conventional Arms and Dual-Use Goods and Technologies is a group of 41 like-minded states committed to promoting responsibility and transparency in the global arms trade, and preventing destabilizing accumulations of arms. As a Participating State, the United States has committed to controlling for export all items on the WA control lists. The lists were first established in 1996 and have been revised annually thereafter. Proposals for changes to the WA control lists that achieve consensus are approved by Participating States at annual Plenary meetings. Participating States are charged with implementing the agreed list changes as soon as possible after approval. The United States’ implementation of WA list changes ensures U.S. companies have a level playing field with their competitors in other WA Participating States.

The changes in this rule, which reflect the changes to the WA control lists that were approved at the December 2016 WA Plenary meeting, update the corresponding items listed in the EAR, and reflect the most recent changes in technologies and conditions.

**Revisions to the Commerce Control List Related to WA 2016 Plenary Agreements**

*Revises (50) ECCNs:* 1A004, 1A007, 1B001, 1C007, 1C608, 1E001, 1E002, 2A001, 2B001, 2B005, 2B991, 2D992, 2E003, 3A001, 3A002, 3A991, 3B001, 3C001, 3E001, 3E002, 3E003, 4A003, 4D001, 4D993, 5A001, 5B001, 5E001, 5A002, 5A003, 5D002, 5E002, 6A001, 6A003, 6A005, 6A008, 6D003, 6E003, 7D003, 7D004, 7E001, 7E003, 7E004, 8A002, 8C001, 9A001, 9A004, 9A515, 9B002, 9B009 and 9E003.

*License Exception eligibility additions:* 3A001.b.12 to LVS, and 3A001.a.14 to GBS.

*License Exception eligibility expansion:* TSR and STA for ECCNs 4D001 and 4E001.

**Category 1 Special Materials and Related Equipment, Chemicals, “Microorganisms,” and “Toxins”***1A004 Protective and Detection Equipment and “Components”*

ECCN 1A004 is amended by adding Note 5 to the Related Controls paragraph to make sure the public knows that 1A004 does not control radionuclides incorporated in detection equipment—such materials are subject to the licensing jurisdiction of the Nuclear Regulatory Commission (See 10 CFR part 110). This rule also removes the definition of ‘adapted for use in war’ from the Related Definitions paragraph because the WA has agreed to remove that term from Items in paragraphs a.2, b.2 and c.2, as well as from Technical Note 1, because the phrase did not help clarify the control text. This rule adds a definition of ‘radioactive materials’ in Technical Note 3 that uses the same descriptive wording used in the removed definition of ‘adapted for use in war.’ This new definition does not change the scope of this ECCN because much of the text of the removed definition was retained in the control parameters. These revisions are made to more precisely describe the controlled detection equipment. At the WA Plenary meeting, the WA noted that the definition of biological agents is used in an entry on the WA dual-use list and an entry on the WA munitions list. Therefore, to make it clear that the definition applied to both entries, the WA moved it to the WA Definitions, which applies to both WA lists. In the EAR, while the term ‘biological agents’ appears in other ECCNs on the CCL, the definition used in ECCN 1A004 only applies to that ECCN. It would be inappropriate to move that definition to Part 772, which defines terms that can be applied universally in the EAR. Therefore, this rule removes the Technical Note to be consistent with the WA list and moves the definition for the term ‘biological agents’ to the Related Definitions Section of ECCN 1A004.

*1A007 Equipment and Devices, “Specially Designed” To Initiate Charges and Devices Containing “Energetic Materials,” by Electrical Means*

The heading of ECCN 1A007 is amended by adding double quotes around the term “energetic materials,”

because this is a defined term in the WA List, as well as in § 772.1 of the EAR.

**1B001 Equipment for the Production or Inspection of “Composite” Structures or Laminates Controlled by 1A002 or “Fibrous or Filamentary Materials” Controlled by 1C010**

The Technical Note to Items paragraph .b is amended by revising the parameters in the definition of ‘tape-laying machines.’ The Technical Note to paragraph 1B001.g is amended by revising the parameters in the definition for ‘tow-placement machines.’ These definitions were designed to aid in determining the control status of tow placement and tape laying equipment. These machines are identified based on the type of “fibrous or filamentary” material they process. The Missile Technology Control Regime (MTCR) adopted the WA definition in order to facilitate implementation by Participating States that adhered to both regimes. However, when the MTCR adopted the WA control parameters, they added an additional significant digit to ensure that Tape Laying Machines and Tow/Fiber Placement machines were accurately delineated at 1 inch, which is used in industry. Thus, references to 25 mm were changed to 25.4 mm (1 inch) and 305 mm is changed to 304.8 mm (12 inches). Lastly, the Technical Note to 1B001, which defines ‘filament bands,’ is amended by clarifying that it includes those coated with dry powder. These revisions are very minor, and therefore, BIS anticipates no change in submissions of license applications.

**1C007 Ceramic Powders, Ceramic-“Matrix” “Composite” Materials and “Precursor Materials”**

The Heading of ECCN 1C007 is amended by removing the phrase “non-“composite” ceramic materials” and adding single quotes around the term ‘precursor materials,’ to harmonize with revisions made to the List of Items Controlled section. The MT control paragraph is amended by removing Items paragraphs .d and .f and adding .c for consistency to changes in the List of Items Controlled section. The Special Conditions for STA paragraph is amended by removing Items paragraph d. to harmonize with revisions made to the List of Items Controlled section.

Items paragraph .a is revised by replacing “single or complex borides of titanium” with “titanium diboride (TiB<sub>2</sub>) (CAS 12045–63–5)”, and Items paragraph .b is removed and reserved because 1C007.a and .b list only borides of titanium in powered and monolithic (*i.e.*, non-composites) forms, while in

practice those controls apply only to titanium diboride (TiB<sub>2</sub>—CAS# 12045–63–5), being the only stoichiometric compound of boron and titanium. This revision will result in no change in the number of license application submissions BIS receives annually.

The control text on ceramic matrix composites (CMCs) in 1C007 was formerly split into three Items paragraphs, .c, .d and .f. This rule combines these three paragraphs under 1C007.c. Items paragraph .c is moved to c.1.b (no scope change), Items paragraph .d is moved to c.2, and Items paragraph .f is moved to c.1.a (no scope change).

Former Items paragraph 1C007.d, which is transferred to 1C007.c.2, is revised to clarify the control and add some novel ceramic composite material. The formerly used phrase “with or without metallic phase” did not contribute to the text clarity. Metallic phases in a ceramic-ceramic composite are impurities from incomplete reactions. Often, pockets of residual metallic phases are found in these materials, but it is not a desired feature; it is just an undesirable by-product of the manufacturing process. The formerly used phrase “incorporating particles, whiskers or fibers” did not influence the scope of the control because it listed all possible types of ceramic reinforcements used in CMCs. Thus, these two phrases are removed, although the removal of the phrases does not change the scope of the control and improves clarity of the text. The phrase ‘ceramic-ceramic’ is replaced with ‘ceramic-“matrix”,’ so as to control carbon fiber reinforced SiC matrix composites (C-SiC). These revisions aim to improve the control text clarity and introduce a new control of a novel, militarily significant material family. BIS receives less than five applications a year for this ECCN. BIS anticipates that adding this novel material, which has not yet become popular with industry, may only increase that number by one or two applications a year.

Paragraph 1C007.e is amended by adding “specially designed” and making other editorial revisions, because it was agreed that the only precursors that are controlled under this paragraph are those that are specially designed (*i.e.*, specially formulated) for the production of controlled ceramic materials. In addition, the control text is modified to harmonize with WA format by replacing “for producing” with the defined term “for the “production.”” This rule also adds a Technical Note to define ‘precursor materials’ to clarify the scope of control. These changes will narrow the scope of control and decrease license application

submissions. Even though more specific text is being added to the parameter, which narrows the scope of control, this revision will result in no change in the annual number of license application submissions BIS receives, because BIS currently receives zero submissions annually under this paragraph.

**1C608 “Energetic Materials” and Related Commodities**

The Heading of 1C608 is amended by adding double quotes around the defined term “energetic materials” in order to clarify the scope and correct the oversight.

**1E001 “Technology” for the “Development” or “Production” of Certain Category 1 ECCNs**

ECCN 1E001 is amended by revising the Special Conditions for STA to remove reference to 1C007.d, because Items paragraph 1C007.d is transferred to 1C007.c.2 by this rule, which is already listed in this paragraph.

**1E002 Other “Technology”**

ECCN 1E002 is amended by revising the Note to 1E002.c.2 by adding double quotes around the word “technology” to clarify the scope of the entry. The phrase “the design or production of” is removed from the Note as it is an unnecessary repetition of the text introduced in 1E002.c. This rule also revises 1E002.f to remove the reference to 1C007.d, which was moved to 1C007.c.2. 1C007.c is already referenced in 1E002.f.

**Annex to Category 1—List of Explosives**

The Annex to Category 1 List of Explosives is amended by adding a new paragraph 50 to read, “50. FTDO (5,6-(3',4'-furazano)- 1,2,3,4-tetrazine-1,3-dioxide)”, and by revising the punctuation in paragraph 49 to support this addition. As this is a military explosive, it will result in no change to license application submissions to BIS.

**Category 2—Materials Processing**

**2A001 Anti-Friction Bearings and Bearing Systems**

ECCN 2A001.a is amended by adding single quotes around the terms ‘rings’ and ‘rolling elements,’ as well as removing the citation to International Organization for Standardization (ISO) standards. This rule adds two (2) Technical Notes to define ‘ring’ and ‘rolling element,’ in order to clarify the scope of controls and to replace the reference to the ISO standard where these terms are defined.

*2B001 Machine Tools and Any Combination Thereof, for Removing (or Cutting) Metals, Ceramics or "Composites"*

ECCN 2B001 is amended by removing the Note to Items paragraph b.2 regarding the inclusion of parallel mechanism machine tools in the control of b.2, because there is no international standard to measure a positioning accuracy or UPR (unidirectional positioning repeatability) for these machine tools. This rule also revises Items paragraphs b.2.b and b.2.c in order to accommodate the removal of Items paragraph b.2.d. Additionally, this rule removes Items paragraph b.2.d 'parallel mechanism machine tool technology,' including the Technical Note for reasons stated above. BIS estimates that there will be no change in license application submissions due to the removal of Items paragraph b.2.d 'parallel mechanism machine tool technology,' because the future of machine tools is in Computer Numeric Control (CNC), where software achieves in a simpler and more robust way what multiple rods and linkages and couplings involved in parallel mechanism machine tools achieve in terms of degrees-of-freedom and flexibility. In the past year, BIS has not received any license applications for parallel mechanism machine tools.

*2B005 Equipment "Specially Designed" for the Deposition, Processing and in Process Control of Inorganic Overlays, Coatings and Surface Modifications, as Follows, for Substrates*

The Heading of ECCN 2B005 is amended by removing the ambiguous term "non-electronic" before the word "substrates," by adding the column locations in the table following 2E003.f "Materials Processing Table; Deposition Techniques," where the information referred to in the Heading may be found. The Heading is also amended by removing the reference to the 'associated Notes,' because the Notes do not specify what is controlled by this ECCN.

*2B991 Numerical Control Units for Machine Tools and "Numerically Controlled" Machine Tools, n.e.s.*

ECCN 2B991 is amended by adding a hyphen to the term "real-time processing" in the introductory text of Items paragraph 2B991.b.2 to correct the format of the term.

*2D992 Specific "Software"*

ECCN 2D992 is amended by adding a hyphen to the term "real-time processing" in the introductory text of

Items paragraph 2D992.a.2 to correct the format of the term.

*2E003 Other "Technology"*

ECCN 2E003 is amended by adding double quotes to the term "technology" in the Nota Bene (N.B.) that follows Items paragraph .f for consistency with the text in the control paragraph.

**Category 2E—Materials Processing Table; Deposition Techniques**

The Materials Processing Table is amended by revising paragraph 10 in the Notes to the Table on Deposition Techniques to more clearly state that Category 2 does not include "technology" for single-step pack cementation of solid airfoils. Paragraph 17 in the Notes to the Table on Deposition Techniques is revised by removing the term "specially designed," which expands the exclusion note for "technology" for depositing diamond-like carbon. The introductory text to paragraphs 1 through 5 in the Accompanying Technical Information to Table on Deposition Techniques is amended by replacing the defined term "technology" with the term 'technical information' to be consistent with the heading and scope of this section.

**Category 3—Electronics**

*Product Group A. "End Items," "Equipment," "Accessories," "Attachments," "Parts," "Components," and "Systems"*

Product Group A, Notes 1 and 2 and the N.B., which appear at the beginning of the product group, are amended by removing the reference to "or 3A001.a.13" and adding in its place "to 3A001.a.14," because this rule adds Item paragraph 3A001.a.14.

*3A001 Electronic Items*

The RS license requirement paragraph and the License Exception LVS eligibility paragraph are amended by replacing the term "microwave monolithic integrated circuit" with the defined term "monolithic microwave integrated circuit" to harmonize with the newly defined term and changes in ECCN 3A001, and expanded to cover newly added Items paragraph b.12.

The license Exception LVS eligibility paragraph is expanded to include newly added Items paragraph b.12, which will result in fewer licensing application submissions for low level value shipments of these items.

The license Exception GBS eligibility paragraph is amended by expanding the range of eligibility to cover newly added Items paragraph a.14, which will result in fewer license application submissions to less sensitive

destinations. The term TWTAs is replaced with 'vacuum electronic device' amplifiers, which is the new terminology in Items paragraph b.8.

The Note to 3A001.a is amended by adding "Monolithic Microwave Integrated Circuits" ("MMICs") to the list of integrated circuits listed, because of the increased presence of MMICs in 3A001, as well as adding the definition of this term to part 772 of the EAR.

Paragraph 3A001.a.2 is expanded to encompass the scope of newly added 3A001.a.14. Specifically, this rule makes editorial capitalization corrections and adds "integrated circuits that contain analog-to-digital converters and store or process the digitized data" and "Magnetic Random Access Memories (MRAMs)".

Paragraph 3A001.a.5.a (analog-to-digital converters (ADCs)) is revised by updating the ADC control thresholds (resolution) for the higher performance ADCs to reflect the technology that is used in the commercial mainstream, which will result in a decrease of license application submissions. In addition, the unit for resolution is amended by replacing "billion words per second" with "Giga Samples Per Second (GSPS)" and "million words per second" with "Mega Samples Per Second (MSPS)" to clarify what is being measured for this parameter. Technical Notes 6 and 7 are also revised to clarify the explanation of the units for output rates. In addition, a Nota Bene is added to reference 3A001.a.14 for integrated circuits that contain ADCs and store or process the digitized data. Technical Notes 6 and 7 are also clarified accordingly.

Paragraph 3A001.a.7 is amended by adding a Nota Bene to reference 3A001.a.14 for integrated circuits having field programmable logic devices that are combined with an analog-to-digital converter.

Paragraph 3A001.a.14 is added to control integrated circuits that perform the same functionality of electronic assemblies, modules, or equipment described in paragraph 3A002.h. This addition of control will result in an increase of 50 or fewer license application submissions per year. Items paragraph 3A001.a.14.b.2 is moved to a.14.b.1 and a.14.b.2 is revised to read "processing of digitized data" to clarify the description of this parameter.

Paragraph 3A001.b is amended by adding a Technical Note 2 to define 'vacuum electronic devices' for the purpose of paragraph 3A001.b.1. This control has not been modernized in more than fifteen years, during which time substantial changes have occurred. Therefore, these amendments are

intended to modernize this entry. The term “travelling wave tubes” in the text has been changed to the more general term ‘vacuum electronic devices’ that also includes klystrons. Paragraph 3A001.b.1 is amended by replacing the undefined term ‘electronic vacuum tubes’ with the newly defined term ‘vacuum electronic devices.’ This term is also replaced in the introductory text of Notes 1 and 2. Paragraph 3A001.b.1.a and b.1.b are amended by replacing the term ‘tubes’ with ‘vacuum electronic devices.’ Paragraphs 3A001.b.1.a.1 through b.1.a.3 are amended by replacing the term ‘tubes’ with ‘devices.’ Paragraph 3A001.b.1.a.4 is amended by replacing the term ‘helix tubes’ with ‘devices based on helix, folded waveguide, or serpentine waveguide circuits,’ as well as adding a parameter, ‘having a gridded electron gun,’ in paragraph b.1.a.4.d for these devices. Paragraph 3A001.b.1.a.5 is added to expand the traveling wave ‘vacuum electronic devices’ control to include devices with a “fractional bandwidth” greater than or equal to 10% and with specified beams. BIS estimates that this change will increase license application submissions by no more than 10 annually. Paragraph 3A001.b.1.c is modernized to use the term ‘thermionic cathodes’ rather than the older and more specific term ‘impregnated cathodes.’ Paragraph 3A001.b.1.d is added to control ‘vacuum electronic devices’ with the capability to operate in a ‘dual mode.’ Finally, a clear definition of the term ‘dual mode’ is added in a Technical Note to avoid ambiguity and explain how a single device can switch between continuous wave operation and pulse mode operation.

Paragraph 3A001.b.2 is amended by replacing “Microwave Monolithic Integrated Circuits (MMICs) power amplifiers” with the correct terminology “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers. Also, a Nota Bene is added to reference 3A001.b.12 for “MMIC” amplifiers that have an integrated phase shifter.

Notes 2 and 3 of paragraph b.2.h are amended by adding double quotes around the acronym “MMIC” and “MMICs.”

Paragraph 3A001.b.4.f, which is a parameter for microwave solid state amplifiers and microwave assemblies/modules, is removed and reserved, because ‘transmit/receive modules’ and ‘transmit modules’ are moved to b.12. This paragraph is moved because some people may not think to classify their MMICs with capabilities to transmit/receive under 3A001.b.4.f. Also, by separating transmit and transmit/receive modules from amplifiers, the framework

for modifying their control threshold independently is created. A Nota Bene 2 is added to reference paragraph 3A001.b.12 for ‘transmit/receive modules’ and ‘transmit modules.’ Note 3 to paragraph 3A001.b.4 is removed, because ‘transmit/receive modules’ and ‘transmit modules’ are moved to b.12.

Paragraph 3A001.b.8 and b.9 are amended by replacing the term ‘tubes’ with the term ‘vacuum electronic devices.’ Also, this rule makes corrections in capitalization, as well as correcting the term “Monolithic Microwave Integrated Circuit” and adding the acronym “MMIC”.

Paragraph 3A001.b.11 “Frequency synthesizer” “electronic assemblies” is amended by updating the parameters to align the 3A001.b.11 frequency synthesizer controls with the 3A002.d.3 signal generator controls. Specifically, Items paragraphs 3A001.b.11.a through .e are revised and b.11.c and .f are removed and reserved, which BIS estimates will decrease license application submissions by about 30 annually.

Paragraph 3A001.b.12 “transmit/receive modules, transmit/receive MMICs, transmit modules, and transmit MMICs” is added to control a mixture of new (MMICs) and existing controls (transmit/receive modules formerly controlled in paragraph 3A001.b.4). The control thresholds for 3A001.b.12 are nearly identical to those that were used in 3A001.b.4.f (transmit and transmit/receive modules), but adjusted so that 3A001.b.12 has an identical power level at 31.8 GHz, as specified in 3A001.b.4.c as 0.5 W (27 dBm). In addition, transmit modules and transmit/receive modules that have dimensional characteristics related to phased array antenna systems are distinct from amplifiers because they have phase control. Adding phase control as a control parameter ensures this distinction is clear. Furthermore, because transmit modules and transmit/receive modules are exported with or without a heat sink, a Technical Note is added to inform exporters that 3A001.b.12 includes those that are exported with or without a heat sink and that the heat sink measurements are not to be considered in the 3A001.b.12 dimensional metric. Lastly, this rule adds to the Technical Notes after Items paragraph b.12.d definitions for “transmit/receive module,” ‘transmit/receive MMIC,’ ‘transmit module,’ and ‘transmit MMIC.’ It also adds quotation marks around the term MMIC in all places it is used by itself in 3A001.b.12, as it is a defined term in part 772 of the EAR. Related Control Note 1 is also revised to add ‘transmit/receive modules’ and ‘transmit modules,’

because there may be some overlap between b.12 and ITAR category XI. BIS estimates these revisions will not affect the annual number of license application submissions.

Paragraph 3A001.f “rotary input type absolute position encoders” is revised by adding “and “specially designed” encoder rings, discs or scales therefor,” in order to close the loophole in the control for these significant parts. BIS estimates this addition will result in an increase of no more than 5 license application submissions per year.

### *3A002 General Purpose “Electronic Assemblies,” Modules and Equipment*

ECCN 3A002 is amended by revising Items paragraph c.4, to add the existing “real-time bandwidth” to the frequency mask trigger control and add commas to the definition of “real-time bandwidth” in § 772.1 of the EAR to clarify its meaning, resulting in paragraph 3A002.c.4.b moving to c.4.b.1 and the addition of a new subparagraph c.4.b.2. The citations in the Technical Notes 1 and 2 are updated to correspond to changes in 3A002.c.4.b. An exclusion Note is added for “signal analyzers” using only constant percentage bandwidth filters (also known as octave or fractional octave filters). BIS estimates these revisions will result in an increase of no more than 15 license application submissions per year. Paragraph 3A002.c.5 is removed and reserved, as it is moved to 3A002.c.4.b.2 to make “real-time bandwidth” (3A002.c.4.a) a prerequisite for control of “frequency mask trigger” functionality of signal analyzers in 3A002.c.4.

### *3A991 Electronic Devices, and “Components” Not Controlled by 3A001*

ECCN 3A991 is amended by revising the Items paragraph introductory paragraph .g, paragraph g.1, and introductory paragraph g.2 to correspond with the changes made to paragraph 3A001.b. For an explanation about these revisions, see the rationale for 3A001.b revisions. BIS estimates these revisions will result in no change to license application submissions annually.

### *3B001 Equipment for the Manufacturing of Semiconductor Devices or Materials*

ECCN 3B001.a.1 (equipment designed for epitaxial growth) is amended by replacing “capable of producing” with “designed or modified to produce,” to clarify the intended scope of control. BIS estimates that this change will result in a decrease of about 20 license application submissions per year.

**3C001 Hetero-Epitaxial Materials Consisting of a “Substrate” Having Stacked Epitaxially Grown Multiple Layers**

The exclusion Note to ECCN 3C001.d is amended by adding three non-sensitive p-type epitaxial layer materials, *i.e.*, GaAs, AlGaAs, InP. This Note excludes hetero-epitaxial materials for the manufacture of light-emitting diodes (LEDs). BIS estimates that this change will result in a decrease of about 5 license application submissions per year.

**3E001 “Technology” According to the General Technology Note for the “Development” or “Production” of Equipment or Materials Controlled by 3A, 3B and 3C**

ECCN 3E001 is amended by revising paragraph (a) of the License Exception TSR paragraph to replace “Traveling wave tube” with “Vacuum electronic device amplifiers.” Paragraph (c) of the License Exception TSR paragraph and Note 2 in the Related Controls are revised to harmonize the reference to MMICs to read “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers. Note 1 is amended by removing the phrase “the “production” of,” and Note 2 is amended by removing the phrase “the “development” or “production” of,” because these phrases do not add to the clarity of the Notes and are unnecessary.

**3E002 “Technology” Other Than That Controlled in 3E001 for the “Development” or “Production” of a “Microprocessor Microcircuit”, “Micro-computer Microcircuit” and Microcontroller Microcircuit Core**

ECCN 3E002 is amended by revising the introductory text of Note 2 to remove reference to “development” and “production”, because these terms are already referenced in the definition of “technology,” therefore there is no need to repeat this point in the control text. However, Note 3 is amended by adding the phrase “the development or production of” to clarify the scope of the Note.

**3E003 Other “Technology” for the “Development” or “Production”**

ECCN 3E003.g is amended by replacing the term “electronic vacuum tubes” with the more modern and general term ‘vacuum electronic devices,’ which is defined in Technical Note 2 at the beginning of 3A001.b.

**Category 4—Computers**

**4A003 “Digital Computers,” “Electronic Assemblies,” and Related Equipment Therefor**

ECCN 4A003 is amended by revising the AT control paragraph in the License Requirements table and the Note to the License Requirements section in order to correspond to the revision in this rule that raises the “adjusted peak performance” (APP) from 12.5 to 16 weighted TeraFLOPS (WT) in Items paragraph 4A003.b. The APP is raised to address the need to track incremental improvements (*e.g.*, “Moore’s Law”) in micro-processor technology. The Congressional notification requirement set forth in subsection 1211(d) of the National Defense Authorization Act for Fiscal Year 1998 (Pub. L. 105–85, November 18, 1997, 111 Stat. 1629, 1932–1933, as amended; 50 U.S.C. 4604 note) provides that the President must submit a report to Congress 60 days before adjusting the composite theoretical performance level above which exports of digital computers to Tier 3 countries require a license. On July 27, 2017 the Secretary of Commerce, as the President’s delegate, submitted to Congress a report to Congress that establishes and provides justification for the 16 WT control level using the APP formula. Therefore, this revision will become effective on September 25, 2017. BIS estimates that this revision will result in no change to license application submissions, because this revision is keeping pace with advancements in HPC technology.

**4D001 “Software” and 4E001 “Technology”**

ECCNs 4D001 and 4E001 are amended by revising the License Exception TSR eligibility paragraph and License Exception STA Special Conditions paragraph to correspond to the revision in this rule that raises the “adjusted peak performance” (APP) from 12.5 to 16 weighted TeraFLOPS (WT) in Items paragraph 4A003.b, because these eligible countries for these license exceptions represent allies (Country Groups A:5 and A:6) and countries that do not pose a national security threat (Country Group B). The APP is raised to address the need to track incremental improvements (*e.g.*, “Moore’s Law”) in micro-processor technology. The APP is raised from 6.0 to 8.0 WT in Items paragraph 4D001.b.1 for software “specially designed” or modified for the development or production of equipment or software controlled by 4A001, 4A003, 4A004 or 4D001 (except 4D980, 4D993 or 4D994) and 4E001.b.1 for technology other than that controlled

by 4E001.a for the development or production of digital computers. BIS estimates that this revision will result in no change to license application submissions, because this revision is keeping pace with advancements in HPC technology.

**4D993 “Program” Proof and Validation “Software”, “Software” Allowing the Automatic Generation of “Source Codes”, and Operating System “Software”**

ECCN 4D993 is amended by correcting the Heading to add a hyphen between the words “real” and “time” in the term “real-time processing.”

**Category 5—Part 1—“Telecommunications”**

**5A001 Telecommunications Systems, Equipment, “Components” and “Accessories”**

ECCN 5A001 is corrected by replacing the word “centre” with “center” in the Technical Note of Items paragraph b.5.d. For telecommunication systems and equipment that employ functions of digital “signal processing” to provide ‘voice coding,’ the output rate is lowered from less than “2,400 bit/s” to “700 bit/s” in Items paragraph b.6 to reflect advancement in technology, which BIS estimates will result in no change to annual license application submissions.

**5B001 Telecommunication Test, Inspection and Production Equipment, “Components” and “Accessories”**

ECCN 5B001 is amended by adding “or” to the end of Items paragraph b.2.a in the License Requirements section to correspond with removing and reserving Items paragraph b.2.c (telecommunication transmission or switching equipment employing a “laser” and coherent optical transmission or coherent optical detection techniques), including the Note and Technical Note, because this equipment is broadly available in all leading technology countries around the world. BIS estimates that this removal will result in 5 fewer license application submissions per year.

**5E001 “Technology”**

ECCN 5E001 is amended by revising Related Controls Note (2) and Items paragraph 5E001.d to replace the term Microwave “monolithic integrated circuits” (MMIC) power amplifiers with “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers to correspond to revisions made to 3A001.b.2 in this rule. This rule moves the word “required” from the beginning of Items paragraph b.1 to follow the

term “technology,” in order to clarify the scope of the sentence. This rule also removes Items paragraph 5E001.c.1 “Equipment employing digital techniques designed to operate at a “total digital transfer rate” exceeding 560 Gbits/s” including the Technical Note, because this telecommunication technology is broadly available in all leading technology countries around the world. Even though BIS received 100 licenses for 5E001.c technology last year, most of them had other ECCNs included as well. BIS estimates that this removal will result in 5 fewer license application submissions per year. Items paragraph 5E001.c.2.c (technology for telecommunication transmission or switching equipment employing a “laser” and coherent optical transmission or coherent optical detection techniques) is removed and reserved, including the Note and Technical Note, to correspond with the removal of this equipment in 5B001.b.2.c by this rule. BIS estimates that this removal will result in 15 fewer license application submissions per year. The Note to Items paragraphs c.2.e and c.4.b are revised to remove the phrase “the development or production of,” because these terms are already referenced in the definition of “technology” and there is no need to be repetitive.

#### **Category 5—Part 2—“Information Security”**

Category 5—Part 2 is being restructured in order to simplify the text and focus the scope of controls. The introductory sentence in Note 3 in Category 5—Part 2 is amended by updating the scope of the Cryptography Note from “ECCNs 5A002, 5A003, 5A004 and 5D002” to “ECCNs 5A002, 5D002.a.1, .b, and c.1.” Paragraph a.5 is redesignated as paragraph a.4 in Note 3 to clean up the Note, and the phrase “, 5A003 or 5A004” is removed from the Technical Note to paragraph b. in Note 3, to match the updated scope of the Cryptography Note.

Note 4 is removed and is replaced by the creation of positive text in 5A002.a to specify the items subject to control. Although the wording is different and positively stated, the scope of control remains the same except certain non-primary function uses of encryption are now excluded as noted below. The exclusion in Note 4 for entertainment, mass commercial broadcasts, digital rights management or medical records management is moved to Technical Note 1 in order to clarify that encryption used for those functions is not considered ‘cryptography for data confidentiality’ for purposes of Category

5—Part 2. 5A002.a.4 amends the text of the former Note 4 paragraph b to release products that use encryption for a non-primary function in certain circumstances.

#### **5A002 “Information Security” Systems, Equipment and “Components”**

ECCN 5A002 is amended by redesignating Related Control paragraph (3) as (5) and moving the Nota Bene from the beginning of 5A002.a to a new Related Control paragraph (3) in the List of Items Controlled section, which directs people to ECCNs 7A005, 7D005 and 7E001 for Global Navigation Satellite Systems (GNSS) receiving equipment containing or employing decryption, and related software and technology. Also a new Related Control Note (4) is added to provide examples to clarify the scope of Items paragraph 5A002.a.4, and a Nota Bene is added after Items paragraph 5A002.a.4 to point to Related Control Note (4). Items paragraph 5A002.a, including the Technical Notes and Notes, is amended to restructure it and improve readability, so that it includes an introduction of the term ‘cryptography for data confidentiality;’ the establishment of a Technical Note to explain the scope of cryptography and the cryptographic functions excluded from the controls, including defining ‘in excess of 56 bits of symmetric key length, or equivalent;’ and the introduction of a definition for “authentication.”

In addition, several revisions are made to Note 2 to 5A002.a (formerly Note to 5A002.a). Some paragraph and wording changes are made to the Note to correspond to other changes in the control text; the introductory text of the Note is revised to clarify that the Note also applies to “specially designed” “information security” components of items released by the Note; paragraph (f) of the Note is amended to clarify that it applies to any item where the encryption is limited to wireless personal area network functionality; paragraph (g) of the Note regarding dormant encryption products is removed and replaced with the positive phrase “where that cryptographic capability is usable without “cryptographic activation”” in the introductory text of 5A002.a; and the remaining paragraphs of the Note are moved up, so that former paragraphs in the Note (h), (i), and (j) are now (g), (h), and (i).

#### **5A003 “Systems,” “Equipment” and “Components,” for Non-Cryptographic “Information Security”**

ECCN 5A003 is amended by revising the Note to Items paragraph .a in the List of Items Controlled section to add a clarification of the term ‘physical layer security’ and to provide a reference to ISO/IEC 7498–1.

#### **5D002 “Software”**

5D002 is amended by revising the EI controls in the License Requirements table to exclude subparagraphs pertaining to ECCN 5A003, which is not EI controlled. The Items paragraph in the List of Items Controlled section is amended by replacing 5D002.b, which no longer controls anything, with “cryptographic activation” from 5D002.d, so that it has the same paragraph number as the equivalent controls in ECCNs 5A002 and 5E002. Paragraph 5D002.c.2 is replaced, because it no longer controls anything, and new control text is added corresponding to ECCN 5A003. Items paragraphs 5D002.a and .c are cascaded in order to create separate subparagraphs a.1, a.2, a.3 and c.1, c.2 and c.3 corresponding to ECCNs 5A002, 5A003, and 5A004.

#### **5E002 “Technology”**

ECCN 5E002 is corrected to correspond to the WA list by revising the text in Items paragraph 5E002.b.

#### **Category 6—Sensors and Lasers**

##### **6A00 Acoustic Systems, Equipment and “Components”**

ECCN 6A001 is amended by adding a hyphen to the word “real-time” in two places in the LVS paragraph in the List Based License Exceptions section; in the List of Items Controlled section, by adding double quotes around the word “accuracy” in Items paragraphs a.1.a.1.d and a.1.a.2.b.4; by adding a hyphen to the word “user-accessible” in Items paragraph a.2.c; by adding a Nota Bene to Items paragraph a.2.d.2 to reference 7A003.c for inertial heading systems; and by adding a hyphen to the word “user-accessible programmability” in items paragraph a.2.f. The majority of these revisions are editorial in nature (e.g., adding quotes or hyphens).

##### **6A003 Cameras, Systems or Equipment, and “Components” Therefor**

ECCN 6A003 is amended by correcting paragraph b.1 in Note 3 to Items paragraph b.4.b in the List of Items Controlled section to remove the word “pixel” from the units, so that the unit simply reads milli-radians or mrad;

this correction does not change the scope of this decontrol note.

**6A005 “Lasers,” “Components” and Optical Equipment**

The List of Items Controlled section of ECCN 6A005 is amended by revising Items paragraph a.6.a to raise the output power from 200 W to 500 W for non-tunable continuous wave lasers, as well as by removing “or” in Items paragraph a.7.b because this paragraph is not the last paragraph before the end of the series in Items paragraph .a. This rule adds an upper limit “not exceeding 1,850 nm” to Items paragraph a.8. This rule also adds two new Items paragraphs a.9 and a.10 to add two new output wavelength ranges for non-tunable continuous wave (CW) lasers (exceeding 1,850 nm – 2,100 nm, including output power parameters for single and multiple transverse mode lasers) and (exceeding 2,100 nm and output power exceeding 1W). In addition, this rule corrects Items paragraph b.7.b.3 (non-tunable pulsed lasers) by removing “or” because this paragraph is not the last paragraph before the end of the series in Items paragraph b. Items paragraph b.8 is revised to add an upper threshold of “not exceeding 1,850 nm.” This rule adds two new output wavelength ranges for non-tunable pulsed lasers by adding Items paragraph b.9 (exceeding 1,850 nm but not exceeding 2,100 nm) and b.10 (exceeding 2,100 nm). These changes represent a decontrol of items in 6A005 and are estimated to result in a decrease of 30 license application submissions annually.

**6A008 Radar Systems, Equipment and Assemblies**

ECCN 6A008 is amended to harmonize with the WA list by removing Related Controls Note (1) and redesignating Notes (2) and (3) as (1) and (2), because Note (1) deviated from the WA exclusion Note that already exists in ECCN 6A008, which resulted in confusion.

**6D003 Other “Software”**

ECCN 6D003 is corrected by adding a hyphen to the term “real time processing” so that it reads “real-time processing” in Items paragraphs a.1 through a.4, a.5.a, f.3, and f.4.

**6E003 Other “Technology”**

ECCN 6E003 is amended by rewriting Items paragraph d.1 and d.2 in the List of Items Controlled section to clarify the scope and use of the words “technology” and “required.”

**Category 7—Navigation and Avionics**

**7D003 Other “Software” and 7E001 “Technology”**

This rule corrects the capitalization in the Heading of 7E001. The Related Controls paragraphs of ECCNs 7D003 and 7E001 are amended by removing references to ECCNs 0D521 and 0E521, because software and technology for fly-by-wire controls systems were removed from 0D521 and 0E521 (see 80 FR 29452, May 21, 2015). Items paragraph 7D003.e is amended by revising one Items paragraph reference and adding two additional references to correspond to revisions made by this rule to ECCN 7E004.

**7D004 “Source Code” Incorporating “Development” “Technology” Specified**

The heading of 7D004 is amended by revising the reference to Items paragraphs in 7E004 to correspond to revisions this rule makes to ECCN 7E004.

**7E003 “Technology” According to the General Technology Note for the Repair, Refurbishing or Overhaul of Equipment Controlled by 7A001 to 7A004**

The Related Controls paragraph of ECCN 7E003 is amended by revising the phrase “maintenance technology” to read “technology for maintenance” to clarify the scope of the decontrol text.

**7E004 Other “Technology”**

ECCN 7E004 is amended to clarify the scope of control by removing the word “development” and capitalizing the word “Technology” in paragraphs 1 and 2 of the Note to Items paragraph b.5 in the List of Items Controlled section, because the term “development” is already in the definition of “technology” and does not need to be used again.

**Category 8—Marine**

**8A002 Marine Systems, Equipment, “Parts” and “Components”**

ECCN 8A002 is amended by adding double quotes around the word “fuel cell” in the introductory text of Items paragraph j.3 in the List of Items Controlled section to indicate that it is a defined term in part 772 of the EAR.

**8C001 ‘Syntactic Foam’ Designed for Underwater Use**

ECCN 8C001 is amended by adding double quotes around the word “matrix” in the Related Definitions paragraph of the List of Items Controlled section to indicate that it is a defined term in part 772 of the EAR.

**Category 9—Aerospace and Propulsion**

**9A001 Aero Gas Turbine Engines**

ECCN 9A001 is amended by adding double quotes around the word “technologies” in Items paragraph 9A001.a in the List of Items section to indicate that this is a defined term in part 772 of the EAR.

**9A004 Space Launch Vehicles and “Spacecraft,” “Spacecraft Buses,” “Spacecraft Payloads,” “Spacecraft” On-Board Systems or Equipment, and Terrestrial Equipment**

ECCN 9A004 is amended by removing the comma after the word “equipment” and adding a comma after the word “spacecraft” in the introductory text of Items paragraph .f in the List of Items Controlled section to correct the punctuation and clarify the scope of the paragraph (i.e., to clarify that a list of controlled terrestrial equipment is what follows Items paragraph .f and not a list of “specially designed” spacecraft).

**9A515 “Spacecraft” and Related Commodities**

ECCN 9A515 is amended by revising the Related Controls paragraph in the List of Items Controlled section to capitalize “Microwave Monolithic Integrated Circuits” and add quotes around the term and its acronym, “MMICs,” in order to correspond to the WA drafting guidelines and indicate that the term is defined in part 772 of the EAR. This rule also implements an amendment that is not a result of changes made to the WA list by revising paragraph .a to clarify that only the International Space Station and the James Webb Space Telescope, and “specially designed” “parts,” “components,” “accessories” and “attachments” for those platforms are excluded from 9A515.a. Specifically, the reference to ECCN 9A004 now reads ECCN 9A004.u or .w.

**9B002 On-Line (Real Time) Control Systems, Instrumentation (Including Sensors) or Automated Data Acquisition and Processing Equipment**

Items paragraph 9B002.b is amended by replacing the phrase “incorporating technologies” with “incorporating any of the technology” to clarify the scope of the control paragraph.

**9B009 Tooling “Specially Designed” for Producing Turbine Engine Powder Metallurgy Rotor “Parts” or “Components”**

The Heading of ECCN 9B009 is amended by moving the control parameter from the Heading to the Items paragraph, as well as adding the word

“gas” before “turbine engine” to add specificity to the control. This rule also replaces the phrase “capable of operating at” with “designed to operate at” to control the intended capability of the item versus the actual capability, as the actual capability may vary from item to item in the same production line, which complicates classification of a product against specific parameters. In addition, a new parameter, “designed to operate at a temperature of 873 K (600 °C) or more,” is added, as well as a new exclusion Note for tooling for the production of powder. Normally, more specific parameters would narrow the scope of the control and result in a decrease of license application submissions, but BIS received only one application for this entry last year. BIS estimates there will be no change in the number of license application submissions as a result of this revision.

#### 9E003 Other “Technology”

ECCN 9E003 is amended by adding a Technical Note to Items paragraph a.1 in the List of Items Controlled section to indicate that stress-rupture life testing is typically conducted on a test specimen. Items paragraph 9E003.a.2.a (thermally decoupled liners for combustors) is revised by adding single quotes around the term ‘thermally decoupled liners’ and adding a Technical Note to provide a definition for the term. To accommodate the new Technical Note, the rule redesignates the existing Technical Note as Technical Note 2 and adds the new Technical Note as Technical Note 1. The Note to Items paragraph i.3 is revised by removing the terms “development” and “production,” because these terms are already in the definition of “technology,” and there is no need to be redundant when stating the scope of the exclusion note.

#### Part 772—Definitions of Terms as Used in the Export Administration Regulations (EAR)

Section 772.1 is amended by adding the terms “authentication” (see explanation above under ECCN 5A002), “MMIC” and “Monolithic Microwave Integrated Circuit” (see explanation above under ECCN 3A001). This rule also adds quotes around the term “aircraft” in the definitions of “fly-by-light system” and “fly-by-wire system,” because the use of “aircraft” in this definition pertains to the term “aircraft,” which is defined in part 772 of the EAR. The term “real-time bandwidth” is revised to add a hyphen between words “real” and “time,” and a comma and a phrase in the definition are moved to clarify the definition. The

Category 7 reference is removed from the term “real-time processing,” because this term is no longer used in this category of the CCL. The term “stability” is revised by adding a Statement of Understanding that provides guidance on how to estimate “stability” for gyroscopes. The term “three dimensional integrated circuit” is revised, because 3D and 2.5D integrated circuit technologies allow the integration of many different types of integrated circuits, and not all 3D Integrated circuits are composed solely of semiconductor die sandwiched together. Also, a description is added for the term “interposer,” which is now used in the definition of “three dimensional integrated circuit.” This rule also revises the category reference for the following terms: Active pixel, aircraft, fibrous or filamentary materials, frequency hopping, and spacecraft.

#### Supplement No. 6 to Part 774 “Sensitive List”

Supplement No. 6 to part 774 “Sensitive List” (SL) is amended by removing reference to 1C007.d in paragraphs (iii), (vi) and (vii) of Category 1, because this paragraph was moved to 1C007.c.2, and 1C007.c is already listed. Supplement No. 6 to part 774 (SL) is also amended by revising the parameters in paragraphs (4)(ii) and (iii) to match the revisions to APP in ECCNs 4D001 and 4E001, and adding a hyphen in the term “user-accessible programmability” in paragraphs (6)(v) and (viii). In Category 6 of the SL, this rule adds double quotes around the term “magnetic gradiometers” in paragraph (xxiv)(C) and around the word “magnetometers” in paragraph (xxv), in order to indicate that these words are defined in part 772 of the EAR. Paragraph (9)(viii) is removed and reserved, because 9E003.a.1 is moving to paragraph (9)(ix). Paragraph 9E003.h is moved to its own SL paragraph, (9)(x).

The following is a change to the EAR related to the WA 2016 agreements.

#### Section 740.7 “License Exception APP”

Consistent with Executive Order 13742 of October 7, 2016, which terminated the national emergency with respect to the actions and policies of the Government of Burma (Burma) and revoked several Burma-related Executive Orders in recognition of Burma’s substantial advances to promote democracy (including historic elections held in November 2015 that resulted in the formation of a democratically elected, civilian-led government), this rule moves Burma from paragraph (d)(1) “Computer Tier

3” to paragraph (c)(1) “Computer Tier 1.” As provided in subsection 1211(e) of the National Defense Authorization Act for Fiscal Year 1998 (Pub. L. 105–85, November 18, 1997, 111 Stat. 1629, 1932–1933, as amended; 50 U.S.C. 4604 note), this revision shall not take effect until 120 days after the President submits to the Congress a report setting forth the justification. On July 27, 2017 the Secretary of Commerce, as the President’s delegate, submitted to Congress a report that provided justification for the movement of Burma from Computer Tier 3 to Tier 1. Therefore, this revision will become effective on November 24, 2017.

#### Export Administration Act

Although the Export Administration Act of 1979, as amended, expired on August 21, 2001, the President, through Executive Order 13222 of August 17, 2001, 3 CFR, 2001 Comp., p. 783 (2002), as amended by Executive Order 13637 of March 8, 2013, 78 FR 16129 (March 13, 2013), and as extended by the Notice of August 4, 2016, 81 FR 52587 (August 8, 2016), has continued the EAR in effect under the International Emergency Economic Powers Act (50 U.S.C. 1701 *et seq.*). BIS continues to carry out the provisions of the Export Administration Act, as appropriate and to the extent permitted by law, pursuant to Executive Order 13222, as amended by Executive Order 13637.

#### Saving Clause

Shipments of items removed from license exception eligibility or eligibility for export, reexport or transfer (in-country) without a license as a result of this regulatory action that were on dock for loading, on lighter, laden aboard an exporting carrier, or en route aboard a carrier to a port of export, on August 15, 2017, pursuant to actual orders for exports, reexports and transfers (in-country) to a foreign destination, may proceed to that destination under the previous license exception eligibility or without a license so long as they have been exports, reexports and transfers (in-country) before October 16, 2017. Any such items not actually exported, reexported and transferred (in-country) before midnight, on October 16, 2017, require a license in accordance with this final rule.

#### Executive Order Requirements

Executive Orders 13563 and 12866 direct agencies to assess all costs and benefits of available regulatory alternatives and, if regulation is necessary, to select regulatory approaches that maximize net benefits (including potential economic,

environmental, public health and safety effects, distributive impacts, and equity). Executive Order 13563 emphasizes the importance of quantifying both costs and benefits, of reducing costs, of harmonizing rules, and of promoting flexibility.

This rule has been designated a “significant regulatory action,” under Executive Order 12866. The Wassenaar Arrangement (WA) has been established in order to contribute 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. The aim is also to prevent the acquisition of these items by terrorists. There are presently 41 Participating States, including the United States, that seek through their national policies to ensure that transfers of these items do not contribute to the development or enhancement of military capabilities that undermine these goals, and to ensure that these items are not diverted to support such military capabilities that undermine these goals. Implementation of the WA agreements in a timely manner enhances the national security of the United States and global international trade.

This rule does not contain policies with Federalism implications as that term is defined under Executive Order 13132.

This rule is not subject to the requirements of E.O. 13771 (82 FR 9339, February 3, 2017) because it is issued with respect to a national security function of the United States.

**Paperwork Reduction Act Requirements**

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 the following OMB approved collections of information subject to the PRA: 0694–0088, “Multi-Purpose Application,” and carries a burden hour estimate of 29.6 minutes for a manual or electronic submission; 0694–0106, “Reporting and Recordkeeping Requirements under the Wassenaar Arrangement,” which carries a burden hour estimate of 21 minutes for a manual or electronic submission; 0694–0137 “License Exceptions and Exclusions,” which carries a burden

hour estimate average of 1.5 hours per submission (**Note:** submissions for License Exceptions are rarely required); 0694–0096 “Five Year Records Retention Period,” which carries a burden hour estimate of less than 1 minute; and 0607–0152 “Automated Export System (AES) Program, which carries a burden hour estimate of 3 minutes per electronic submission. Below is a table that estimates there will be a decrease in the number of license application submissions BIS receives per year as a result of the revisions in this rule. A decrease in license application submissions in turn results in a decrease in Wassenaar reporting and recordkeeping, the use of license exceptions, and the 5-year records retention burden, but does not relieve the burden to file export information in the Automated Export System. Specific license application submission estimates are discussed further in the preamble of this rule where the revision is explained. BIS estimates that revisions that are editorial, moving the location of control text on the Commerce Control List, or clarifications will result in no change in license application submissions. The estimated annual cost savings for both application submitters and the U.S. Government is \$3,547.60, and the estimated annual burden hour decrease is 34.8 hours.

Description	Total submissions	Total mins for submission (29.6 min)	Cost for respondents (\$30/hr or \$2/min)	Total min to process application (45 min)	Cost for gov't (\$40/hr or \$1.5/min)
1C007.c titanium diboride .....	0 .....	0 .....	0 .....	0 .....	0.
1C007.d ceramic composite material .....	2 .....	59.2 .....	\$118.40 .....	90 .....	\$135.00.
1C007.e precursors .....	0 .....	0 .....	0 .....	0 .....	0.
3A001.a.14 integrated circuits .....	50 .....	1480 .....	\$2,960.00 .....	2250 .....	\$3375.00.
3A001.b.1 vacuum electric devices ..	10 .....	296 .....	\$592.00 .....	450 .....	\$675.00.
3A001.b.11 frequency synthesizers ..	(30) .....	(888) .....	(\$1776.00) .....	(1350) .....	(\$2025.00).
3A001.f “specially . . . designed” encoder rings, discs or scales.	5 .....	148 .....	\$296.00 .....	225 .....	\$337.50.
3A002.c.4.b frequency mask trigger	15 .....	444 .....	\$888.00 .....	675 .....	\$1012.50.
3B001.a.1 equipment designed for epitaxial growth.	(20) .....	(592) .....	(\$1184.00) .....	(900) .....	(\$1350.00).
3C001.d non-sensitive p-type epitaxial layer materials.	(5) .....	(148) .....	(\$296.00) .....	(225) .....	(\$337.50).
4A003.b computers .....	0 .....	0 .....	0 .....	0 .....	0.
4D001 and 4E001 technology and software for computers.	0 .....	0 .....	0 .....	0 .....	0.
5A001.b.6 ‘voice coding’ .....	0 .....	0 .....	0 .....	0 .....	0.
5B001 telecom materials .....	(5) .....	(148) .....	(\$296.00) .....	(225) .....	(\$337.50).
5E001.c.1 telecom technology .....	(5) .....	(148) .....	(\$296.00) .....	(225) .....	(\$337.50).
5E001.c.2.c telecom technology .....	(15) .....	(444) .....	(\$888.00) .....	(675) .....	(\$1012.50).
6A005 lasers .....	(30) .....	(888) .....	(\$1776.00) .....	(1350) .....	(\$2025.00).
9B009 Tooling “specially designed” for producing turbine engine powder metallurgy rotor “parts” or “components.”	0 .....	0 .....	0 .....	0 .....	0.
<b>Totals .....</b>	<b>(28 fewer submissions annually).</b>	<b>(828.8 fewer burden minutes for submitters annually).</b>	<b>(\$1657.60 decrease of cost burden to submitters annually).</b>	<b>(1260 fewer burden minutes for USG annually).</b>	<b>(\$1890.00 decrease of cost burden to USG annually).</b>

Any comments regarding these burden estimates or any other aspect of these collections of information, including suggestions for reducing the burden, may be sent to OMB Desk Officer, New Executive Office Building, Washington, DC 20503; and to Jasmeet K. Sehra, Office of Management and Budget (OMB), by email to *Jasmeet.K.Sehra@omb.eop.gov*, or by fax to (202) 395-7285.

### Administrative Procedure Act and Regulatory Flexibility Act Requirements

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 action involves a military and foreign affairs function of the United States (5 U.S.C. 553(a)(1)). Immediate implementation of these amendments fulfills the United States' international commitments to the WA. The WA is committed to contributing to regional and international security and stability by promoting responsibility and transparency in the global arms trade, and preventing destabilizing accumulations of arms. As a Participating State, the United States is charged with implementing the agreed list changes as soon as possible after approval. Because the United States is a significant exporter of the list items discussed in this rule, implementation of this provision is necessary for the WA to achieve its purpose, and will enhance the national security of the United States and global international trade.

Although the APA requirements in section 553 are not applicable to this action under the provisions of paragraph (a)(1), this action also falls within two other exceptions in the section. The subsection (b) requirement that agencies publish a notice of proposed rulemaking that includes information on the public proceedings does not apply when an agency for good cause finds that the notice and public procedures are impracticable, unnecessary, or contrary to the public interest, and the agency incorporates the finding (and reasons therefor) in the rule that is issued (5 U.S.C. 553(b)(B)). In addition, the section 553(d) requirement that publication of a rule shall be made not less than 30 days before its effective date can be waived if an agency finds there is good cause to do so.

The section 553 requirements for notice and public procedures and for a delay in the date of effectiveness do not apply to this rule, as there is good cause to waive such practices. Delay in

implementation would disrupt the movement of these potential national-security controlled items globally, creating disharmony between export control measures implemented by the 41 WA Participating States. Export controls work best when all countries implement the same export controls in a timely manner. Delaying this rulemaking would prevent the United States from fulfilling its commitment to the WA in a timely manner, would injure the credibility of the United States in this and other multilateral regimes, and may impair the international community's ability to effectively control the export of national security controlled items. Therefore, this regulation is issued in final form, and is effective August 15, 2017.

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. Accordingly, no regulatory flexibility analysis is required and none has been prepared.

### List of Subjects

#### 15 CFR Part 740

Administrative practice and procedure, Exports, Reporting and recordkeeping requirements.

#### 15 CFR Part 772

Exports.

#### 15 CFR Part 774

Exports, Reporting and recordkeeping requirements.

Accordingly, Parts 740, 772, and 774 of the Export Administration Regulations (15 CFR parts 730 through 774) are amended as follows:

### PART 740—[AMENDED]

- 1. The authority citation for part 740 continues to read as follows:

**Authority:** 50 U.S.C. 4601 *et seq.*; 50 U.S.C. 1701 *et seq.*; 22 U.S.C. 7201 *et seq.*; 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 4, 2016, 81 FR 52587 (August 8, 2016).

- 2. Section 740.7 is amended by:

- a. Adding “Burma,” to paragraph (c)(1) after “Burkina Faso,”; and
- b. Removing “Burma,” from paragraph (d)(1).

### PART 772—[AMENDED]

- 3. The authority citation for part 772 continues to read as follows:

**Authority:** 50 U.S.C. 4601 *et seq.*; 50 U.S.C. 1701 *et seq.*; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; Notice of August 4, 2016, 81 FR 52587 (August 8, 2016).

- 4. Section 772.1 is amended by:

- a. Removing “(Cat 6 and 8)” and adding in its place “(Cat 6)” in the definition of “active pixel”;
- b. Removing “(Cat 1, 7, and 9)” and adding in its place “(Cat 1, 6, 7, and 9)” in the definition of “aircraft”;
- c. Adding the definition of “Authentication” in alphabetical order;
- d. Removing “(Cat 1 and 8)” and adding in its place “(Cat 1, 2, 8 and 9)” in
  - the definition of “fibrous or filamentary materials”;
  - e. Adding quotes around the term “aircraft” in the definitions of the terms “fly-by-light system” and “fly-by-wire system”;
  - f. Removing “(Cat 5 part 1 and 5 part 2)” and adding in its place “(Cat 5P1, 5P2 and 6)” in the definition of “frequency hopping”;
  - g. Adding the definitions of “MMIC” and “Monolithic Microwave Integrated Circuit” in alphabetical order;
  - h. Removing the definition of “multilevel security” including the Note;
  - i. Revising the definitions of “real-time bandwidth” and “real-time processing”;
  - j. Remove “(Cat 7 and 9)” and add in its place “(Cat 9)” in the definition of “spacecraft”; and
  - k. Revising the definitions of “stability” and “three dimensional integrated circuit”.

The additions and revisions read as follows:

#### 772.1 Definitions of terms as used in the Export Administration Regulations (EAR).

\* \* \* \* \*

“Authentication”. (Cat 5P2) Verifying the identity of a user, process or device, often as a prerequisite to allowing access to resources in an information system. This includes verifying the origin or content of a message or other information, and 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.

\* \* \* \* \*

“MMIC”. (Cat 3 and 5) See “Monolithic Microwave Integrated Circuit”

\* \* \* \* \*

“*Monolithic Microwave Integrated Circuit*” (“*MMIC*”) (Cat 3, 5P1 and 9) is a “monolithic integrated circuit” that operates at microwave or millimeter wave frequencies.

\* \* \* \* \*

**Real-time bandwidth.** (Cat 3) For “signal analyzers”, the widest frequency range for which the analyzer can continuously transform time domain data entirely into frequency-domain results using Fourier or other discrete time transform that processes every incoming time point, without a reduction of measured amplitude of more than 3 dB below the actual signal amplitude caused by gaps or windowing effects, while outputting or displaying the transformed data.

**“Real-time Processing”.** (Cat 2, 4, and 6) The processing of data by a computer system providing a required level of service, as a function of available resources, within a guaranteed response time, regardless of the load of the system, when stimulated by an external event.

\* \* \* \* \*

**“Stability”.** (Cat 7) Standard deviation (1 sigma) of the variation of a particular parameter from its calibrated value measured under stable temperature conditions. This can be expressed as a function of time.

**Note to the Definition of “Stability”:** For gyroscopes, “stability” can be estimated by determining the Allan variance noise-analysis value at the integration period (*i.e.*, sample time) consistent with the stated measurement period, which may include extrapolating the Allan variance noise analysis beyond the instability point into the rate random walk or rate ramp regions to an integration period consistent with the stated measurement period (Reference: IEEE Std. 952–1997 [R2008]). Allan variance noise analysis is often used to characterize Micro Electro Mechanical Systems (MEMS) gyroscopes, and is applicable to other gyroscopes, such as Ring Laser Gyroscopes (RLGs) and Fiber Optic Gyroscopes (FOGs).

\* \* \* \* \*

**“Three dimensional integrated circuit”.** (Cat 3) A collection of semiconductor dies or active device layers, integrated together, and having through semiconductor via connections passing completely through an interposer, substrate, die or layer to establish interconnections between the device layers. An interposer is an interface that enables electrical connections.

\* \* \* \* \*

## PART 774—[AMENDED]

■ 5. The authority citation for part 774 continues to read as follows:

**Authority:** 50 U.S.C. 4601 *et seq.*; 50 U.S.C. 1701 *et seq.*; 10 U.S.C. 7420; 10 U.S.C. 7430(e); 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; 43 U.S.C. 1354; 15 U.S.C. 1824a; 50 U.S.C. 4305; 22 U.S.C. 7201 *et seq.*; 22 U.S.C. 7210; 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 4, 2016, 81 FR 52587 (August 8, 2016).

■ 6. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 1, ECCN 1A004 is revised to read as follows:

### Supplement No. 1 to Part 774—The Commerce Control List

\* \* \* \* \*

#### 1A004 Protective and detection equipment and “components,” not “specially designed” for military use, as follows (see List of Items Controlled).

*Reason for Control:* NS, CB, RS, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 2
CB applies to chemical detection systems and dedicated detectors therefor, in 1A004.c, that also have the technical characteristics described in 2B351.a.	CB Column 2
RS apply to 1A004.d .....	RS Column 2
AT applies to entire entry.	AT Column 1

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*LVS:* N/A

*GBS:* N/A

*CIV:* N/A

#### List of Items Controlled

*Related Controls:* (1) See ECCNs 1A995, 2B351, and 2B352. (2) See ECCN 1D003 for “software” “specially designed” or modified to enable equipment to perform the functions of equipment controlled under section 1A004.c (Nuclear, biological and chemical (NBC) detection systems). (3) See ECCN 1E002.g for control libraries (parametric technical databases) “specially designed” or modified to enable equipment to perform the functions of equipment controlled under 1A004.c (Nuclear, biological and chemical (NBC) detection systems). (4) Chemical and biological protective and detection equipment specifically designed, developed, modified, configured, or adapted for military applications is “subject to the ITAR” (see 22 CFR parts 120 through 130, including USML Category XIV(f)), as is commercial equipment that incorporates “parts” or “components” controlled under that category except for domestic preparedness devices for individual protection that integrate “components” and “parts”

identified in USML Category XIV(f)(4) when such “parts” or “components” are: (i) Integral to the device; (ii) inseparable from the device; and (iii) incapable of replacement without compromising the effectiveness of the device, in which case the equipment is “subject to the EAR” under ECCN 1A004. (5) This entry does not control radionuclides incorporated in equipment listed in this entry—such materials are subject to the licensing jurisdiction of the Nuclear Regulatory Commission (See 10 CFR part 110).

**Related Definitions:** (1) ‘Biological agents’ means: Pathogens or toxins, selected or modified (such as altering purity, shelf life, virulence, dissemination characteristics, or resistance to UV radiation) to produce casualties in humans or animals, degrade equipment or damage crops or the environment. (2) ‘Riot control agents’ are substances which, under the expected conditions of use for riot control purposes, produce rapidly in humans sensory irritation or disabling physical effects which disappear within a short time following termination of exposure. (Tear gases are a subset of ‘riot control agents.’)

**Items:**

a. Full face masks, filter canisters and decontamination equipment therefor, designed or modified for defense against any of the following, and “specially designed” “components” therefor:

**Note:** 1A004.a includes Powered Air Purifying Respirators (PAPR) that are designed or modified for defense against agents or materials, listed in 1A004.a.

**Technical Notes:** For the purpose of 1A004.a:

1. Full face masks are also known as gas masks.  
2. Filter canisters include filter cartridges.

a.1. ‘Biological agents;’  
a.2. ‘Radioactive materials;’  
a.3. Chemical warfare (CW) agents; or  
a.4. ‘Riot control agents,’ as follows:  
a.4.a.  $\alpha$ -Bromobenzeneacetone nitrile, (Bromobenzyl cyanide) (CA) (CAS 5798–79–8);  
a.4.b. [(2-chlorophenyl) methylene] propanedinitrile, (o-Chlorobenzylidene malononitrile) (CS) (CAS 2698–41–1);  
a.4.c. 2-Chloro-1-phenylethanone, Phenylacetyl chloride (o-chloroacetophenone) (CN) (CAS 532–27–4);  
a.4.d. Dibenz-(b,f)-1,4-oxazepine, (CR) (CAS 257–07–8);  
a.4.e. 10-Chloro-5, 10-dihydrophenarsazine, (Phenarsazine chloride), (Adamsite), (DM) (CAS 578–94–9);  
a.4.f. N-Nonanoylmorpholine, (MPA) (CAS 5299–64–9);  
b. Protective suits, gloves and shoes, “specially designed” or modified for defense against any of the following:  
b.1. ‘Biological agents;’  
b.2. ‘Radioactive materials;’ or  
b.3. Chemical warfare (CW) agents;  
c. Detection systems, “specially designed” or modified for detection or identification of any of the following, and “specially designed” “components” therefor:

c.1. 'Biological agents';  
c.2. 'Radioactive materials;' or  
c.3. Chemical warfare (CW) agents;  
d. Electronic equipment designed for automatically detecting or identifying the presence of "explosives" (as listed in the annex at the end of Category 1) residues and utilizing 'trace detection' techniques (e.g., surface acoustic wave, ion mobility spectrometry, differential mobility spectrometry, mass spectrometry).

**Technical Note:** 'Trace detection' is defined as the capability to detect less than 1 ppm vapor, or 1 mg solid or liquid.

**Note 1:** 1A004.d. does not apply to equipment "specially designed" for laboratory use.

**Note 2:** 1A004.d. does not apply to non-contact walk-through security portals.

**Note:** 1A004 does not control:

a. Personal radiation monitoring dosimeters;  
b. Occupational health or safety equipment limited by design or function to protect against hazards specific to residential safety or civil industries, including:

1. Mining;
2. Quarrying;
3. Agriculture;
4. Pharmaceutical;
5. Medical;
6. Veterinary;
7. Environmental;
8. Waste management;
9. Food industry.

**Technical Notes:**

1. 1A004 includes equipment, "components" that have been 'identified,' successfully tested to national standards or otherwise proven effective, for the detection of or defense against 'radioactive materials' "' biological agents,' chemical warfare agents, 'simulants' or "riot control agents," even if such equipment or "components" are used in civil industries such as mining, quarrying, agriculture, pharmaceuticals, medical, veterinary, environmental, waste management, or the food industry.

2. 'Simulant': A substance or material that is used in place of toxic agent (chemical or biological) in training, research, testing or evaluation.

3. For the purposes of 1A004, 'radioactive materials' are those selected or modified to increase their effectiveness in producing casualties in humans or animals, degrading equipment or damaging crops or the environment.

■ 7. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 1, ECCN 1A007 is revised to read as follows:

**1A007 Equipment and devices, "specially designed" to initiate charges and devices containing "energetic materials," by electrical means, as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, NP, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 2
NP applies to 1A007.b, as well as 1A007.a when the detonator firing set meets or exceeds the parameters of 3A229.	NP Column 1
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of all License Exceptions)**

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

**List of Items Controlled**

*Related Controls:* High explosives and related equipment "specially designed" for military use are "subject to the ITAR" (see 22 CFR parts 120 through 130). This entry does not control detonators using only primary explosives, such as lead azide. See also ECCNs 0A604, 3A229, and 3A232. See 1E001 for "development" and "production" technology controls, and 1E201 for "use" technology controls.

*Related Definitions:* N/A

*Items:*

- a. Explosive detonator firing sets designed to drive explosive detonators specified by 1A007.b;
- b. Electrically driven explosive detonators as follows:
  - b.1. Exploding bridge (EB);
  - b.2. Exploding bridge wire (EBW);
  - b.3. Slapper;
  - b.4. Exploding foil initiators (EFI).

**Technical Notes**

1. The word initiator or igniter is sometimes used in place of the word detonator.
2. For the purpose of 1A007.b the detonators of concern all utilize a small electrical conductor (bridge, bridge wire, or foil) that explosively vaporizes when a fast, high-current electrical pulse is passed through it. In nonslapper types, the exploding conductor starts a chemical detonation in a contacting high explosive material such as PETN (pentaerythritoltetranitrate). In slapper detonators, the explosive vaporization of the electrical conductor drives a flyer or slapper across a gap, and the impact of the slapper on an explosive starts a chemical detonation. The slapper in some designs is driven by magnetic force. The term exploding foil detonator may refer to either an EB or a slapper-type detonator.

■ 8. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 1, ECCN 1B001 is revised to read as follows:

**1B001 Equipment for the production or inspection of "composite" structures or laminates controlled by 1A002 or "fibrous or filamentary materials" controlled by 1C010, as follows (see List**

**of Items Controlled), and "specially designed" "components" and "accessories" therefor.**

**License Requirements**

*Reason for Control:* NS, MT, NP, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 2
MT applies to entire entry, except 1B001.d.4, e and f.	MT Column 1
<b>Note:</b> MT applies to equipment in 1B001.d that meet or exceed the parameters of 1B101.	
NP applies to filament winding machines described in 1B001.a that are capable of winding cylindrical rotors having a diameter between 75 mm (3 in) and 400 mm (16 in) and lengths of 600 mm (24 in) or greater; AND coordinating and programming controls and precision mandrels for these filament winding machines.	NP Column 1
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

LVS: N/A for MT and for 1B001.a; \$5,000 for all other items  
GBS: N/A  
CIV: N/A

**List of Items Controlled**

*Related Controls:* (1) See ECCN 1D001 for software for items controlled by this entry and see ECCNs 1E001 ("development" and "production") and 1E101 ("use") for technology for items controlled by this entry. (2) Also see ECCNs 1B101 and 1B201.

*Related Definitions:* N/A

*Items:*

- a. Filament winding machines, of which the motions for positioning, wrapping and winding fibers are coordinated and programmed in three or more 'primary servo positioning' axes, "specially designed" for the manufacture of "composite" structures or laminates, from "fibrous or filamentary materials";
- b. 'Tape laying machines', of which the motions for positioning and laying tape are coordinated and programmed in five or more 'primary servo positioning' axes, "specially designed" for the manufacture of "composite" airframe or missile structures;

**Technical Note:** For the purposes of 1B001.b, 'tape-laying machines' have the ability to lay one or more 'filament bands' limited to widths greater than 25.4 mm and less than or equal to 304.8 mm, and to cut

and restart individual 'filament band' courses during the laying process.

c. Multidirectional, multidimensional weaving machines or interlacing machines, including adapters and modification kits, "specially designed" or modified for weaving, interlacing or braiding fibers for "composite" structures;

**Technical Note:** For the purposes of 1B001.c the technique of interlacing includes knitting.

d. Equipment "specially designed" or adapted for the production of reinforcement fibers, as follows:

d.1. Equipment for converting polymeric fibers (such as polyacrylonitrile, rayon, pitch or polycarbosilane) into carbon fibers or silicon carbide fibers, including special equipment to strain the fiber during heating;

d.2. Equipment for the chemical vapor deposition of elements or compounds, on heated filamentary substrates, to manufacture silicon carbide fibers;

d.3. Equipment for the wet-spinning of refractory ceramics (such as aluminum oxide);

d.4. Equipment for converting aluminum containing precursor fibers into alumina fibers by heat treatment;

e. Equipment for producing prepreps controlled by 1C010.e by the hot melt method;

f. Non-destructive inspection equipment "specially designed" for "composite" materials, as follows:

f.1. X-ray tomography systems for three dimensional defect inspection;

f.2. Numerically controlled ultrasonic testing machines of which the motions for positioning transmitters or receivers are simultaneously coordinated and programmed in four or more axes to follow the three dimensional contours of the "part" or "component" under inspection;

g. Tow-placement machines, of which the motions for positioning and laying tows are coordinated and programmed in two or more 'primary servo positioning' axes, "specially designed" for the manufacture of "composite" airframe or missile structures.

**Technical Note to 1B001.g:** For the purposes of 1B001.g, 'tow-placement machines' have the ability to place one or more 'filament bands' having widths less than or equal to 25.4 mm, and to cut and restart individual 'filament band' courses during the placement process.

**Technical Notes for 1B001:** 1. For the purpose of 1B001, 'primary servo positioning' axes control, under computer program direction, the position of the end effector (i.e., head) in space relative to the work piece at the correct orientation and direction to achieve the desired process.

2. For the purposes of 1B001, a 'filament band' is a single continuous width of fully or partially resin-impregnated tape, tow or fiber. Fully or partially resin-impregnated 'filament bands' include those coated with dry powder that tacks upon heating.

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

ECCN 1C007 is revised to read as follows:

**1C007 Ceramic powders, ceramic-"matrix" "composite" materials and 'precursor materials,' as follows (see List of Items Controlled).**

#### License Requirements

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 2
MT applies to items in 1C007.c when the dielectric constant is less than 6 at any frequency from 100 MHz to 100 GHz for use in "missile" radomes.	MT Column 1
AT applies to entire entry.	AT Column 1

#### Reporting Requirements

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

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*LVS:* \$5000, except N/A for MT and for 1C007.e

*GBS:* N/A

*CIV:* N/A

#### Special Conditions for STA

*STA:* License Exception STA may not be used to ship any item in 1C007.c entry to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

#### List of Items Controlled

*Related Controls:* See also 1C107.

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

a. Ceramic powders of titanium diboride (TiB<sub>2</sub>) (CAS 12045-63-5) having total metallic impurities, excluding intentional additions, of less than 5,000 ppm, an average particle size equal to or less than 5 µm and no more than 10% of the particles larger than 10 µm;

b. [Reserved]

c. Ceramic-"matrix" "composite" materials as follows:

c.1. Ceramic-ceramic "composite" materials with a glass or oxide-"matrix" and reinforced with any of the following:

c.1.a. Continuous fibers made from any of the following materials:

c.1.a.1. Al<sub>2</sub>O<sub>3</sub> (CAS 1344-28-1); or

c.1.a.2. Si-C-N; or

**Note:** 1C007.c.1.a does not apply to "composites" containing fibers with a tensile strength of less than 700 MPa at 1,273 K (1,000 °C) or tensile creep resistance of more than 1% creep strain at 100 MPa load and 1,273 K (1,000 °C) for 100 hours.

c.1.b. Fibers being all of the following:

c.1.b.1. Made from any of the following materials:

c.1.b.1.a. Si-N;

c.1.b.1.b. Si-C;

c.1.b.1.c. Si-Al-O-N; or

c.1.b.1.d. Si-O-N; and

c.1.b.2. Having a "specific tensile strength" exceeding  $12.7 \times 10^3$  m;

c.2. Ceramic-"matrix" "composite" materials with a "matrix" formed of carbides or nitrides of silicon, zirconium or boron;

*N.B.:* For items previously listed under 1C007.c see 1C007.c.1.b.

d. [Reserved]

*N.B.:* For items previously listed under 1C007.d see 1C007.c.2.

e. 'Precursor materials' "specially designed" for the "production" of materials controlled by 1C007.c, as follows:

e.1. Polydiorganosilanes;

e.2. Polysilazanes;

e.3. Polycarbosilazanes;

**Technical Note:** For the purposes of 1C007, 'precursor materials' are special purpose polymeric or metallo-organic materials used for the "production" of silicon carbide, silicon nitride, or ceramics with silicon, carbon and nitrogen.

f. [Reserved]

*N.B.:* For items previously listed under 1C007.f see 1C007.c.1.a.

■ 10. In Supplement No. 1 to part 774 (the Commerce Control List), Category 1, ECCN 1C608 is revised to read as follows:

**1C608 "Energetic materials" and related commodities (see List of Items Controlled).**

#### License Requirements

*Reason for Control:* NS, RS, MT, AT, UN

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 1
RS applies to entire entry.	RS Column 1
MT applies to 1C608.m	MT Column 1
AT applies to entire entry.	AT Column 1
UN applies to entire entry.	See § 746.1(b) for UN controls

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*LVS:* \$1500

*GBS:* N/A

*CIV:* N/A

#### Special Conditions for STA

*STA:* Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2) of the EAR) may not be used for any item in 1C608.

#### List of Items Controlled

*Related Controls:* (1) The EAR does not control devices or charges containing materials controlled by USML subparagraphs V(c)(6), V(h), or V(i). The USML controls devices containing such materials. (2) The USML in Categories III, IV, or V controls devices and charges in

this entry if they contain materials controlled by Category V (other than slurries) and such materials can be easily extracted without destroying the device or charge. (3) See also explosives and other items enumerated in ECCNs 1A006, 1A007, 1A008, 1C011, 1C111, 1C239, and 1C992. (4) See ECCN 0A919 for foreign-made "military commodities" that incorporate more than a *de minimis* amount of US-origin "600 series" controlled content.

**Related Definitions:** (1) For purposes of this entry, the term 'controlled materials' means controlled energetic materials enumerated in ECCNs 1C011, 1C111, 1C239, 1C608, or USML Category V. (2) For the purposes of this entry, the term 'propellants' means substances or mixtures that react chemically to produce large volumes of hot gases at controlled rates to perform mechanical work.

**Items:**

a. 'Single base,' 'double base,' and 'triple base' 'propellants' having nitrocellulose with nitrogen content greater than 12.6% in the form of either:

- a.1. 'Sheetstock' or 'carpet rolls;' or
- a.2. Grains with diameter greater than 0.10 inches.

**Note:** This entry does not control 'propellant' grains used in shotgun shells, small arms cartridges, or rifle cartridges.

**Technical Notes:** 1. 'Sheetstock' is 'propellant' that has been manufactured in the form of a sheet suitable for further processing.

2. A 'carpet roll' is 'propellant' that has been manufactured as a sheet, often cut to a desired width, and subsequently rolled up (like a carpet).

3. 'Single base' is 'propellant' which consists mostly of nitrocellulose.

4. 'Double base' 'propellant' consist mostly of nitrocellulose and nitroglycerine.

5. 'Triple base' consists mostly of nitrocellulose, nitroglycerine, and nitroguanidine. Such 'propellants' contain other materials, such as resins or stabilizers, that could include carbon, salts, burn rate modifiers, nitrodiphenylamine, wax, polyethylene glycol (PEG), polyglycol adipate (PGA).

b. Shock tubes containing greater than 0.064 kg per meter (300 grains per foot), but not more than 0.1 kg per meter (470 grains per foot) of 'controlled materials.'

c. Cartridge power devices containing greater than 0.70 kg, but not more than 1.0 kg of 'controlled materials.'

d. Detonators (electric or nonelectric) and "specially designed" assemblies therefor containing greater than 0.01 kg, but not more than 0.1 kg of 'controlled materials.'

e. Igniters not controlled by USML Categories III or IV that contain greater than 0.01 kg, but not more than 0.1 kg of 'controlled materials.'

f. Oil well cartridges containing greater than 0.015 kg, but not more than 0.1 kg of 'controlled materials.'

g. Commercial cast or pressed boosters containing greater than 1.0 kg, but not more than 5.0 kg of 'controlled materials.'

h. Commercial prefabricated slurries and emulsions containing greater than 10 kg and

less than or equal to thirty-five percent by weight of USML 'controlled materials.'

i. [Reserved]

j. "Pyrotechnic" devices "specially designed" for commercial purposes (*e.g.*, theatrical stages, motion picture special effects, and fireworks displays), and containing greater than 3.0 kg, but not more than 5.0 kg of 'controlled materials.'

k. Other commercial explosive devices or charges "specially designed" for commercial applications, not controlled by 1C608.c through .g above, containing greater than 1.0 kg, but not more than 5.0 kg of 'controlled materials.'

l. Propyleneimine (2 methylaziridine) (C.A.S. #75-55-8).

m. Any oxidizer or 'mixture' thereof that is a compound composed of fluorine and any of the following: Other halogens, oxygen, or nitrogen.

**Note 1 to 1C608.m:** Nitrogen trifluoride (NF<sub>3</sub>)(CAS 7783-54-2) in a gaseous state is controlled under ECCN 1C992 and not under ECCN 1C608.m.

**Note 2 to 1C608.m:** Chlorine trifluoride (ClF<sub>3</sub>)(CAS 7790-91-2) is controlled under ECCN 1C111.a.3.f and not under ECCN 1C608.m.

**Note 3 to 1C608.m:** Oxygen difluoride (OF<sub>2</sub>) is controlled under USML Category V.d.10 (see 22 CFR 121.1) and not under ECCN 1C608.m.

**Note 1 to 1C608.l and m:** If a chemical in ECCN 1C608.l or .m is incorporated into a commercial charge or device described in ECCN 1C608.c through .k or in ECCN 1C992, the classification of the commercial charge or device applies to the item.

**Technical Note to 1C608.m:** 'Mixture' refers to a composition of two or more substances with at least one substance being enumerated in 1C011, 1C111, 1C239, 1C608, USML Category V, or elsewhere on the USML.

n. Any explosives, 'propellants,' oxidizers, "pyrotechnics," fuels, binders, or additives that are "specially designed" for military application and not enumerated or otherwise described in USML Category V or elsewhere on the USML.

■ 11. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 1, ECCN 1E001 is revised to read as follows:

**1E001 "Technology" according to the General Technology Note for the "development" or "production" of items controlled by 1A002, 1A003, 1A004, 1A005, 1A006.b, 1A007, 1A008 1A101, 1B (except 1B608, 1B613 or 1B999), or 1C (except 1C355, 1C608, 1C980 to 1C984, 1C988, 1C990, 1C991, 1C995 to 1C999).**

**License Requirements**

*Reason for Control:* NS, MT, NP, CB, RS, AT

	<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to "technology" for items controlled by 1A002, 1A003, 1A005, 1A006.b, 1A007, 1B001 to 1B003, 1B018, 1C001 to 1C011, or 1C018.		NS Column 1
NS applies to "technology" for items controlled by 1A004.		NS Column 2
MT applies to "technology" for items controlled by 1A101, 1B001, 1B101, 1B102, 1B115 to 1B119, 1C001, 1C007, 1C011, 1C101, 1C102, 1C107, 1C111, 1C116, 1C117, or 1C118 for MT reasons		MT Column 1
NP applies to "technology" for items controlled by 1A002, 1A007, 1B001, 1B101, 1B201, 1B225, 1B226, 1B228 to 1B234, 1C002, 1C010, 1C111, 1C116, 1C202, 1C210, 1C216, 1C225 to 1C237, or 1C239 to 1C241 for NP reasons		NP Column 1
CB applies to "technology" for items controlled by 1C351, 1C353, or 1C354		CB Column 1
CB applies to "technology" for materials controlled by 1C350 and for chemical detection systems and dedicated detectors therefor, in 1A004.c, that also have the technical characteristics described in 2B351.a		CB Column 2
RS applies to technology for equipment controlled in 1A004.d		RS Column 2
AT applies to entire entry		AT Column 1

**Reporting Requirements**

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

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*CIV:* N/A

*TSR:* Yes, except for the following:

- (1) Items controlled for MT reasons; or (2) Exports and reexports to destinations outside of those countries listed in Country Group A:5 (See Supplement No. 1 to part 740 of the EAR) of "technology" for the "development" or "production" of the following:

- (a) Items controlled by 1C001; or  
 (b) Items controlled by 1A002.a which are composite structures or laminates having an organic “matrix” and being made from materials listed under 1C010.c or 1C010.d.

#### Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit “technology” according to the General Technology Note for the “development” or “production” of equipment and materials specified by ECCNs 1A002, 1C001, 1C007.c, 1C010.c or d or 1C012 to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

#### List of Items Controlled

*Related Controls:* (1) Also see ECCNs 1E101, 1E201, and 1E202. (2) See ECCN 1E608 for “technology” for items classified under ECCN 1B608 or 1C608 that, immediately prior to July 1, 2014, were classified under ECCN 1B018.a or 1C018.b through .m (note that ECCN 1E001 controls “development” and “production” “technology” for chlorine trifluoride controlled by ECCN 1C111.a.3.f—see ECCN 1E101 for controls on “use” “technology” for chlorine trifluoride). (3) See ECCN 1E002.g for control libraries (parametric technical databases) “specially designed” or modified to enable equipment to perform the functions of equipment controlled under ECCN 1A004.c (Nuclear, biological and chemical (NBC) detection systems) or ECCN 1A004.d (Equipment for detecting or identifying explosives residues). (4) “Technology” for lithium isotope separation (see related ECCN 1B233) and “technology” for items described in ECCN 1C012 are subject to the export licensing authority of the Department of Energy (see 10 CFR part 810). (5) “Technology” for items described in ECCN 1A102 is “subject to the ITAR” (see 22 CFR parts 120 through 130).

*Related Definitions:* N/A

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

- 12. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 1, ECCN 1E002 is revised to read as follows:

#### 1E002 Other “technology” as follows (see List of Items Controlled).

##### License Requirements

*Reason for Control:* NS, MT, NP, AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
NS applies to entire entry, except 1E002.g	NS Column 1
NS applies to 1E002.g	NS Column 2
MT applies to 1E002.e	MT Column 1
NP applies to “technology” for items controlled by 1A002 for NP reasons	NP Column 1
AT applies to entire entry	AT Column 1

#### Reporting Requirements

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

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*CIV:* N/A

*TSR:* Yes, except for 1E002.e and .f.

**License Exceptions Note:** License Exception TSU is not applicable for the repair “technology” controlled by 1E002.e or .f, see supplement no. 2 to this part.

#### Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit any item in 1E002.e or .f to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

#### List of Items Controlled

*Related Controls:* See also 1E001, 1E101, 1E102, 1E202, and 1E994 for “technology” related to 1E002.e or .f.  
*Related Definitions:* N/A

*Items:*

- a. “Technology” for the “development” or “production” of polybenzothiazoles or polybenzoxazoles;
- b. “Technology” for the “development” or “production” of fluoroelastomer compounds containing at least one vinyl ether monomer;
- c. “Technology” for the design or “production” of the following ceramic powders or non-“composite” ceramic materials:
  - c.1. Ceramic powders having all of the following:
    - c.1.a. Any of the following compositions:
      - c.1.a.1. Single or complex oxides of zirconium and complex oxides of silicon or aluminum;
      - c.1.a.2. Single nitrides of boron (cubic crystalline forms);
      - c.1.a.3. Single or complex carbides of silicon or boron; or
      - c.1.a.4. Single or complex nitrides of silicon;
      - c.1.b. Any of the following total metallic impurities (excluding intentional additions):
        - c.1.b.1. Less than 1,000 ppm for single oxides or carbides; or
        - c.1.b.2. Less than 5,000 ppm for complex compounds or single nitrides; and
      - c.1.c. Being any of the following:
        - c.1.c.1. Zirconia (CAS 1314–23–4) with an average particle size equal to or less than 1 µm and no more than 10% of the particles larger than 5 µm; or
        - c.1.c.2. Other ceramic powders with an average particle size equal to or less than 5 µm and no more than 10% of the particles larger than 10 µm;
      - c.2. Non-“composite” ceramic materials composed of the materials described in 1E002.c.1;

**Note:** 1E002.c.2 does not control “technology” for abrasives.

d. [Reserved]

e. “Technology” for the installation, maintenance or repair of materials controlled by 1C001;

f. “Technology” for the repair of “composite” structures, laminates or materials controlled by 1A002 or 1C007.c;

**Note:** 1E002.f does not control “technology” for the repair of “civil aircraft” structures using carbon “fibrous or filamentary materials” and epoxy resins, contained in “aircraft” manufacturers’ manuals.

g. “Libraries” “specially designed” or modified to enable equipment to perform the functions of equipment controlled under 1A004.c or 1A004.d.

- 13. In Supplement No. 1 to Part 774 (the Commerce Control List), Annex to Category 1—List of Explosives is revised to read as follows:

#### ANNEX to Category 1

##### List of Explosives (See ECCNs 1A004 and 1A008)

1. ADNBF (aminodinitrobenzofuroxan or 7-amino-4,6-dinitrobenzofurazane-1-oxide) (CAS 97096–78–1);
2. BNCP (cis-bis (5-nitrotetrazolato) tetra amine-cobalt (III) perchlorate) (CAS 117412–28–9);
3. CL–14 (diamino dinitrobenzofuroxan or 5,7-diamino-4,6-dinitrobenzofurazane-1-oxide) (CAS 117907–74–1);
4. CL–20 (HNIW or Hexanitrohexaazaisowurtzitane) (CAS 135285–90–4); chlathrates of CL–20;
5. CP (2-(5-cyanotetrazolato) penta amine-cobalt (III) perchlorate) (CAS 70247–32–4);
6. DADE (1,1-diamino-2,2-dinitroethylene, FOX7) (CAS 145250–81–3);
7. DATB (diaminotrinitrobenzene) (CAS 1630–08–6);
8. DDFP (1,4-dinitrodifurazanopiperazine);
9. DDPO (2,6-diamino-3,5-dinitropyrazine-1-oxide, PZO) (CAS 194486–77–6);
10. DIPAM (3,3'-diamino-2,2',4,4',6,6'-hexanitrobiphenyl or dipicramide) (CAS 17215–44–0);
11. DNGU (DINGU or dinitroglycoluril) (CAS 55510–04–8);
12. Furazans as follows:
  - a. DAAOF (diaminoazoxyfurazan);
  - b. DAAZF (diaminoazofurazan) (CAS 78644–90–3);
13. HMX and derivatives, as follows:
  - a. HMX (Cyclotetramethylenetetranitramine, octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazine, 1,3,5,7-tetranitro-1,3,5,7-tetraza-cyclooctane, octogen or octogene) (CAS 2691–41–0);
  - b. difluoroaminated analogs of HMX;
  - c. K-55 (2,4,6,8-tetranitro-2,4,6,8-tetraazabicyclo [3,3,0]-octanone-3, tetranitrosesmigicourol or keto-bicyclic HMX) (CAS 130256–72–3);
  14. HNAD (hexanitroadamantane) (CAS 143850–71–9);
  15. HNS (hexanitrostilbene) (CAS 20062–22–0);
  16. Imidazoles as follows:
    - a. BNNII (Octahydro-2,5-bis(nitroimino)imidazo [4,5-d]imidazole);
    - b. DNI (2,4-dinitroimidazole) (CAS 5213–49–0);
    - c. FDIA (1-fluoro-2,4-dinitroimidazole);
    - d. NTDNIA (N-(2-nitrotriazolo)-2,4-dinitroimidazole);

e. PTIA (1-picryl-2,4,5-trinitroimidazole);  
 17. NTNMH (1-(2-nitrotriazolo)-2-dinitromethylene hydrazine);  
 18. NTO (ONTA or 3-nitro-1,2,4-triazol-5-one) (CAS 932-64-9);  
 19. Polynitrocubanes with more than four nitro groups;  
 20. PYX (2,6-Bis(picrylamino)-3,5-dinitropyridine) (CAS 38082-89-2);  
 21. RDX and derivatives, as follows:  
 a. RDX (cyclotrimethylenetrinitramine, cyclonite, T4, hexahydro-1,3,5-trinitro-1,3,5-triazine, 1,3,5-trinitro-1,3,5-triazacyclohexane, hexogen or hexogene) (CAS 121-82-4);  
 b. Keto-RDX (K-6 or 2,4,6-trinitro-2,4,6-triazacyclohexanone) (CAS 115029-35-1);  
 22. TAGN (triaminoguanidinenitrate) (CAS 4000-16-2);  
 23. TATB (triaminotrinitrobenzene) (CAS 3058-38-6);  
 24. TEDDZ (3,3,7,7-tetrakis(difluoroamine) octahydro-1,5-dinitro-1,5-diazocine);  
 25. Tetrazoles as follows:  
 a. NTAT (nitrotriazol aminotetrazole);  
 b. NTNT (1-N-(2-nitrotriazolo)-4-nitrotetrazole);  
 26. Tetryl (trinitrophenylmethyl nitramine) (CAS 479-45-8);  
 27. TNAD (1,4,5,8-tetranitro-1,4,5,8-tetraazadecalin) (CAS 135877-16-6);  
 28. TNAZ (1,3,3-trinitroazetidine) (CAS 97645-24-4);  
 29. TNGU (SORGUYL or tetranitroglycoluril) (CAS 55510-03-7);  
 30. TNP (1,4,5,8-tetranitro-pyridazino[4,5-d]pyridazine) (CAS 229176-04-9);  
 31. Triazines as follows:  
 a. DNAM (2-oxy-4,6-dinitroamino-s-triazine) (CAS 19899-80-0);  
 b. NNHT (2-nitroimino-5-nitro-hexahydro-1,3,5-triazine) (CAS 130400-13-4);  
 32. Triazoles as follows:  
 a. 5-azido-2-nitrotriazole;  
 b. ADHTDN (4-amino-3,5-dihydrazino-1,2,4-triazole dinitramide) (CAS 1614-08-0);  
 c. ADNT (1-amino-3,5-dinitro-1,2,4-triazole);  
 d. BDNTA ((bis-dinitrotriazole)amine);  
 e. DBT (3,3'-dinitro-5,5-bi-1,2,4-triazole) (CAS 30003-46-4);  
 f. DNBT (dinitrobistriazole) (CAS 70890-46-9);  
 g. [Reserved]  
 h. NTDNT (1-N-(2-nitrotriazolo) 3,5-dinitrotriazole);  
 i. PDNT (1-picryl-3,5-dinitrotriazole);  
 j. TACOT (tetranitrobenzotriazolobenzotriazole) (CAS 25243-36-1);  
 33. "Explosives" not listed elsewhere in this list having a detonation velocity exceeding 8,700 m/s, at maximum density, or a detonation pressure exceeding 34 GPa (340 kbar);  
 34. [Reserved]  
 35. Nitrocellulose (containing more than 12.5% nitrogen) (CAS 9004-70-0);  
 36. Nitroglycol (CAS 628-96-6);  
 37. Pentaerythritol tetranitrate (PETN) (CAS 78-11-5);  
 38. Picryl chloride (CAS 88-88-0);  
 39. 2,4,6 Trinitrotoluene (TNT) (CAS 118-96-7);  
 40. Nitroglycerine (NG) (CAS 55-63-0);  
 41. Triacetone Triperoxide (TATP) (CAS 17088-37-8);

42. Guanidine nitrate (CAS 506-93-4);  
 43. Nitroguanidine (NQ) (CAS 556-88-7);  
 44. DNAN (2,4-dinitroanisole) (CAS 119-27-7);  
 45. TEX (4,10-Dinitro-2,6,8,12-tetraoxa-4,10-diazaisowurtzitane);  
 46. GUDN (Guanylurea dinitramide) FOX-12 (CAS 217464-38-5);  
 47. Tetrazines as follows:  
 a. BTAT (Bis(2,2,2-trinitroethyl)-3,6-diaminotetrazine);  
 b. LAX-112 (3,6-diamino-1,2,4,5-tetrazine-1,4-dioxide);  
 48. Energetic ionic materials melting between 343 K (70 °C) and 373 K (100 °C) and with detonation velocity exceeding 6,800 m/s or detonation pressure exceeding 18 GPa (180 kbar);  
 49. BTNEN (Bis(2,2,2-trinitroethyl)-nitramine) (CAS 19836-28-3);  
 50. FTDO (5,6-(3',4'-furazano)-1,2,3,4-tetrazine-1,3-dioxide).

■ 14. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 2, ECCN 2A001 is revised to read as follows:

**2A001 Anti-friction bearings and bearing systems, as follows, (see List of Items Controlled) and "components" therefor.**  
*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 2
MT applies to radial ball bearings having all tolerances specified in accordance with ISO 492 Tolerance Class 2 (or ANSI/ABMA Std 20 Tolerance Class ABEC-9, or other national equivalents) or better and having all the following characteristics: An inner ring bore diameter between 12 and 50 mm; an outer ring outside diameter between 25 and 100 mm; and a width between 10 and 20 mm.	MT Column 1
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$3000, N/A for MT  
*GBS:* Yes, for 2A001.a, N/A for MT  
*CIV:* Yes, for 2A001.a, N/A for MT

**List of Items Controlled**

*Related Controls:* (1) See also 2A991. (2) Quiet running bearings are "subject to the ITAR" (see 22 CFR parts 120 through 130). Items:

**Note 1:** 2A001.a includes ball bearing and roller elements "specially designed" for the items specified therein.

**Note 2:** 2A001 does not control balls with tolerances specified by the manufacturer in accordance with ISO 3290 as grade 5 or worse.

a. Ball bearings and solid roller bearings, having all tolerances specified by the manufacturer in accordance with ISO 492 Tolerance Class 4 (or national equivalents), or better, and having both 'rings' and 'rolling elements', made from monel or beryllium;

**Note:** 2A001.a does not control tapered roller bearings.

**Technical Notes:**

1. 'Ring'—annular part of a radial rolling bearing incorporating one or more raceways (ISO 5593:1997).

2. 'Rolling element'—ball or roller which rolls between raceways (ISO 5593:1997).

b. [Reserved]

c. Active magnetic bearing systems using any of the following:

c.1. Materials with flux densities of 2.0 T or greater and yield strengths greater than 414 MPa;

c.2. All-electromagnetic 3D homopolar bias designs for actuators; or

c.3. High temperature (450 K (177 °C) and above) position sensors.

■ 15. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 2, ECCN 2B001 is revised 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"; as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, NP, AT

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

Control(s)	Country chart (See Supp. No. 1 to part 738)	<p>a. Machine tools for turning having two or more axes which can be coordinated simultaneously for “contouring control” having any of the following:</p> <p>a.1. “Unidirectional positioning repeatability” equal to or less (better) than 0.9 μm along one or more linear axis with a travel length less than 1.0 m; <i>or</i></p> <p>a.2. “Unidirectional positioning repeatability” equal to or less (better) than 1.1 μm along one or more linear axis with a travel length equal to or greater than 1.0 m;</p> <p><b>Note 1:</b> 2B001.a does not control turning machines “specially designed” for producing contact lenses, having all of the following:</p> <p>a. Machine controller limited to using ophthalmic based “software” for part programming data input; and</p> <p>b. No vacuum chucking.</p> <p><b>Note 2:</b> 2B001.a does not apply to bar machines (Swissturn), limited to machining only bar feed thru, if maximum bar diameter is equal to or less than 42 mm and there is no capability of mounting chucks. Machines may have drilling and/or milling capabilities for machining parts with diameters less than 42 mm.</p> <p>b. Machine tools for milling having any of the following:</p> <p>b.1. Three linear axes plus one rotary axis which can be coordinated simultaneously for “contouring control” having any of the following:</p> <p>b.1.a. “Unidirectional positioning repeatability” equal to or less (better) than 0.9 μm along one or more linear axis with a travel length less than 1.0 m; <i>or</i></p> <p>b.1.b. “Unidirectional positioning repeatability” equal to or less (better) than 1.1 μm along one or more linear axis with a travel length equal to or greater than 1.0 m;</p> <p>b.2. Five or more axes which can be coordinated simultaneously for “contouring control” having any of the following:</p> <p>b.2.a. “Unidirectional positioning repeatability” equal to or less (better) than 0.9 μm along one or more linear axis with a travel length less than 1.0 m;</p> <p>b.2.b. “Unidirectional positioning repeatability” equal to or less (better) than 1.4 μm along one or more linear axis with a travel length equal to or greater than 1 m and less than 4 m; <i>or</i></p> <p>b.2.c. “Unidirectional positioning repeatability” equal to or less (better) than 6.0 μm along one or more linear axis with a travel length equal to or greater than 4 m;</p> <p>b.3. A “unidirectional positioning repeatability” for jig boring machines, equal to or less (better) than 1.1 μm along one or more linear axis; <i>or</i></p> <p>b.4. Fly cutting machines having all of the following:</p> <p>b.4.a. Spindle “run-out” and “camming” less (better) than 0.0004 mm TIR; <i>and</i></p> <p>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;</p> <p>c. Machine tools for grinding having any of the following:</p> <p>c.1. Having all of the following:</p> <p>c.1.a. “Unidirectional positioning repeatability” equal to or less (better) than 1.1 μm along one or more linear axis; <i>and</i></p> <p>c.1.b. Three or more axes which can be coordinated simultaneously for “contouring control”; <i>or</i></p> <p>c.2. Five or more axes which can be coordinated simultaneously for “contouring control” having any of the following:</p> <p>c.2.a. “Unidirectional positioning repeatability” equal to or less (better) than 1.1 μm along one or more linear axis with a travel length less than 1m;</p> <p>c.2.b. “Unidirectional positioning repeatability” equal to or less (better) than 1.4 μm along one or more linear axis with a travel length equal to or greater than 1 m and less than 4 m; <i>or</i></p> <p>c.2.c. “Unidirectional positioning repeatability” equal to or less (better) than 6.0 μm along one or more linear axis with a travel length equal to or greater than 4 m.</p> <p><b>Notes:</b> 2B001.c does not control grinding machines as follows: a. Cylindrical external, internal, and external-internal grinding machines, having all of the following:</p> <p>a.1. Limited to cylindrical grinding; and</p> <p>a.2. Limited to a maximum workpiece capacity of 150 mm outside diameter or length.</p> <p>b. Machines designed specifically as jig grinders that do not have a z-axis or a w-axis, with a “unidirectional positioning repeatability” less (better) than 1.1 μm.</p> <p>c. Surface grinders.</p> <p>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”;</p> <p>e. Machine tools for removing metals, ceramics or “composites”, having all of the following:</p> <p>e.1. Removing material by means of any of the following:</p> <p>e.1.a. Water or other liquid jets, including those employing abrasive additives;</p> <p>e.1.b. Electron beam; <i>or</i></p> <p>e.1.c. “Laser” beam; and</p> <p>e.2. At least two rotary axes having all of the following:</p> <p>e.2.a. Can be coordinated simultaneously for “contouring control”; and</p> <p>e.2.b. A positioning “accuracy” of less (better) than 0.003”;</p> <p>f. Deep-hole-drilling machines and turning machines modified for deep-hole-drilling, having a maximum depth-of-bore capability exceeding 5 m.</p>	<p>c.1.b. Three or more axes which can be coordinated simultaneously for “contouring control”; <i>or</i></p> <p>c.2. Five or more axes which can be coordinated simultaneously for “contouring control” having any of the following:</p> <p>c.2.a. “Unidirectional positioning repeatability” equal to or less (better) than 1.1 μm along one or more linear axis with a travel length less than 1m;</p> <p>c.2.b. “Unidirectional positioning repeatability” equal to or less (better) than 1.4 μm along one or more linear axis with a travel length equal to or greater than 1 m and less than 4 m; <i>or</i></p> <p>c.2.c. “Unidirectional positioning repeatability” equal to or less (better) than 6.0 μm along one or more linear axis with a travel length equal to or greater than 4 m.</p> <p><b>Notes:</b> 2B001.c does not control grinding machines as follows: a. Cylindrical external, internal, and external-internal grinding machines, having all of the following:</p> <p>a.1. Limited to cylindrical grinding; and</p> <p>a.2. Limited to a maximum workpiece capacity of 150 mm outside diameter or length.</p> <p>b. Machines designed specifically as jig grinders that do not have a z-axis or a w-axis, with a “unidirectional positioning repeatability” less (better) than 1.1 μm.</p> <p>c. Surface grinders.</p> <p>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”;</p> <p>e. Machine tools for removing metals, ceramics or “composites”, having all of the following:</p> <p>e.1. Removing material by means of any of the following:</p> <p>e.1.a. Water or other liquid jets, including those employing abrasive additives;</p> <p>e.1.b. Electron beam; <i>or</i></p> <p>e.1.c. “Laser” beam; and</p> <p>e.2. At least two rotary axes having all of the following:</p> <p>e.2.a. Can be coordinated simultaneously for “contouring control”; and</p> <p>e.2.b. A positioning “accuracy” of less (better) than 0.003”;</p> <p>f. Deep-hole-drilling machines and turning machines modified for deep-hole-drilling, having a maximum depth-of-bore capability exceeding 5 m.</p> <p>■ 16. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 2, ECCN 2B005 is revised to read as follows:</p> <p><b>2B005 Equipment “specially designed” for the deposition, processing and in-process control of inorganic overlays, coatings and surface modifications, as follows, for substrates specified in column 2, by processes shown in column 1 in the “Materials Processing Table; Deposition Techniques” following 2E003.f (see List of Items Controlled), and “specially designed” automated handling, positioning, manipulation and control “components” therefor.</b></p>
<p>NP applies to 2B001.a, .b, .c, and .d, EX-CEPT: (1) turning machines under 2B001.a with a capacity no greater than 35 mm diameter; (2) bar machines (Swissturn), limited to machining only bar feed through, if maximum bar diameter is equal to or less than 42 mm and there is no capability of mounting chucks. (Machines may have drilling and/or milling capabilities for machining “parts” or “components” with diameters less than 42 mm); or (3) milling machines under 2B001.b with x-axis travel greater than two meters and overall positioning accuracy according to ISO 230/2 (2006) on the x-axis more (worse) than 22.5 μm.</p>	NP Column 1		
<p>AT applies to entire entry.</p>	AT Column 1		
<p><b>List Based License Exceptions (See Part 740 for a Description of All License Exceptions)</b></p>			
<p>LVS: N/A GBS: N/A CIV: N/A</p>			
<p><b>List of Items Controlled</b></p>			
<p><i>Related Controls:</i> (1) See ECCN 2B002 for optical finishing machines. (2) See ECCNs 2D001 and 2D002 for software for items controlled under this entry. (3) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry. (4) Also see ECCNs 2B201 and 2B991.</p>			
<p><i>Related Definitions:</i> N/A <i>Items:</i></p>			
<p><b>Note 1:</b> 2B001 does not control special purpose machine tools limited to the manufacture of gears. For such machines, see 2B003.</p>			
<p><b>Note 2:</b> 2B001 does not control special purpose machine tools limited to the manufacture of any of the following:</p> <p>a. Crank shafts or cam shafts;</p> <p>b. Tools or cutters;</p> <p>c. Extruder worms;</p> <p>d. Engraved or faceted jewelry parts; or</p> <p>e. Dental prostheses.</p>			
<p><b>Note 3:</b> 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.</p>			

#### License Requirements

Reason for Control: NS, AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
NS applies to entire entry.	NS Column 2
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

LVS: \$1000

GBS: N/A

CIV: N/A

**List of Items Controlled**

*Related Controls:* (1) This entry does not control chemical vapor deposition, cathodic arc, sputter deposition, ion plating or ion implantation equipment, "specially designed" for cutting or machining tools. (2) Vapor deposition equipment for the production of filamentary materials are controlled by 1B001 or 1B101. (3) Chemical Vapor Deposition furnaces designed or modified for densification of carbon-carbon composites are controlled by 2B105. (4) See also 2B999.i.

*Related Definitions:* N/A

*Items:*

a. Chemical vapor deposition (CVD) "production equipment" having all of the following:

a.1. A process modified for one of the following:

a.1.a. Pulsating CVD;

a.1.b. Controlled nucleation thermal deposition (CNTD); or

a.1.c. Plasma enhanced or plasma assisted CVD; and

a.2. Having any of the following:

a.2.a. Incorporating high vacuum (equal to or less than 0.01 Pa) rotating seals; or

a.2.b. Incorporating in situ coating thickness control;

b. Ion implantation "production equipment" having beam currents of 5 mA or more;

c. Electron beam physical vapor deposition (EB-PVD) "production equipment" incorporating power systems rated for over 80 kW and having any of the following:

c.1. A liquid pool level "laser" control system which regulates precisely the ingots feed rate; or

c.2. A computer controlled rate monitor operating on the principle of photoluminescence of the ionized atoms in the evaporant stream to control the deposition rate of a coating containing two or more elements;

d. Plasma spraying "production equipment" having any of the following:

d.1. Operating at reduced pressure controlled atmosphere (equal or less than 10 kPa measured above and within 300 mm of the gun nozzle exit) in a vacuum chamber capable of evacuation down to 0.01 Pa prior to the spraying process; or

d.2. Incorporating in situ coating thickness control;

e. Sputter deposition "production equipment" capable of current densities of 0.1 mA/mm<sup>2</sup> or higher at a deposition rate 15 μm/h or more;

f. Cathodic arc deposition "production equipment" incorporating a grid of electromagnets for steering control of the arc spot on the cathode;

g. Ion plating "production equipment" capable of *in situ* measurement of any of the following:

g.1. Coating thickness on the substrate and rate control; or

g.2. Optical characteristics.

■ 17. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 2, ECCN 2B991 is revised to read as follows:

**2B991 Numerical control units for machine tools and "numerically controlled" machine tools, n.e.s. (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

LVS: N/A

GBS: N/A

CIV: N/A

**List of Items Controlled**

*Related Controls:* See also ECCNs 2B001 and 2B201.

*Related Definitions:* N/A

*Items:*

a. "Numerical control" units for machine tools:

a.1. Having four interpolating axes that can be coordinated simultaneously for "contouring control;" or

a.2. Having two or more axes that can be coordinated simultaneously for "contouring control" and a minimum programmable increment better (less) than 0.001 mm;

a.3. "Numerical control" units for machine tools having two, three or four interpolating axes that can be coordinated simultaneously for "contouring control," and capable of receiving directly (on-line) and processing computer-aided-design (CAD) data for internal preparation of machine instructions; or

b. "Motion control boards" "specially designed" for machine tools and having any of the following characteristics:

b.1. Interpolation in more than four axes;

b.2. Capable of "real-time processing" of data to modify tool path, feed rate and spindle data, during the machining operation, by any of the following:

b.2.a. Automatic calculation and modification of part program data for machining in two or more axes by means of measuring cycles and access to source data; or

b.2.b. "Adaptive control" with more than one physical variable measured and processed by means of a computing model (strategy) to change one or more machining instructions to optimize the process.

b.3. Capable of receiving and processing CAD data for internal preparation of machine instructions; or

c. "Numerically controlled" machine tools that, according to the manufacturer's technical specifications, can be equipped with electronic devices for simultaneous "contouring control" in two or more axes and that have both of the following characteristics:

c.1. Two or more axes that can be coordinated simultaneously for contouring control; and

c.2. Positioning accuracies according to ISO 230/2 (2006), with all compensations available:

c.2.a. Better than 15 μm along any linear axis (overall positioning) for grinding machines;

c.2.b. Better than 15 μm along any linear axis (overall positioning) for milling machines; or

c.2.c. Better than 15 μm along any linear axis (overall positioning) for turning machines; or

d. Machine tools, as follows, for removing or cutting metals, ceramics or composites, that, according to the manufacturer's technical specifications, can be equipped with electronic devices for simultaneous "contouring control" in two or more axes:

d.1. Machine tools for turning, grinding, milling or any combination thereof, having two or more axes that can be coordinated simultaneously for "contouring control" and having any of the following characteristics:

d.1.a. One or more contouring "tilting spindles;"

**Note:** 2B991.d.1.a. applies to machine tools for grinding or milling only.

d.1.b. "Camming" (axial displacement) in one revolution of the spindle less (better) than 0.0006 mm total indicator reading (TIR);

**Note:** 2B991.d.1.b. applies to machine tools for turning only.

d.1.c. "Run out" (out-of-true running) in one revolution of the spindle less (better) than 0.0006 mm total indicator reading (TIR);

d.1.d. The "positioning accuracies", with all compensations available, are less (better) than: 0.001° on any rotary axis;

d.2. Electrical discharge machines (EDM) of the wire feed type that have five or more axes that can be coordinated simultaneously for "contouring control."

■ 18. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 2, ECCN 2D992 is revised to read as follows:

**2D992 Specific "software", as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

CIV: N/A  
TSR: N/A

**List of Items Controlled**

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

- a. "Software" to provide "adaptive control" and having both of the following characteristics:
  - a.1. For "flexible manufacturing units" (FMUs) which consist at least of equipment described in b.1 and b.2 of the definition of "flexible manufacturing unit" contained in part 772 of the EAR; and
  - a.2. Capable of generating or modifying, in "real-time processing", programs or data by using the signals obtained simultaneously by means of at least two detection techniques, such as:
    - a.2.a. Machine vision (optical ranging);
    - a.2.b. Infrared imaging;
    - a.2.c. Acoustical imaging (acoustical ranging);
    - a.2.d. Tactile measurement;
    - a.2.e. Inertial positioning;
    - a.2.f. Force measurement; and
    - a.2.g. Torque measurement.

**Note:** 2D992.a does not control "software" which only provides rescheduling of functionally identical equipment within "flexible manufacturing units" using pre-stored part programs and a pre-stored strategy for the distribution of the part programs.

b. Reserved.

■ 19. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 2, ECCN 2E003 is revised to read as follows:

**2E003 Other "technology", as follows (see List of Items Controlled).**

**License Requirements**

Reason for Control: NS, AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
NS applies to entire entry.	NS Column 1
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

CIV: N/A  
TSR: Yes, except 2E003.a, .b, .e and .f

**List of Items Controlled**

Related Controls: See 2E001, 2E002, and 2E101 for "development" and "use" technology for equipment that are designed or modified for densification of carbon-carbon composites, structural composite rocket nozzles and reentry vehicle nose tips.

Related Definitions: N/A  
Items:

- a. "Technology" for the "development" of interactive graphics as an integrated part in

"numerical control" units for preparation or modification of part programs;

- b. "Technology" for metal-working manufacturing processes, as follows:
  - b.1. "Technology" for the design of tools, dies or fixtures "specially designed" for any of the following processes:
    - b.1.a. "Superplastic forming";
    - b.1.b. "Diffusion bonding"; or
    - b.1.c. "Direct-acting hydraulic pressing";
  - b.2. Technical data consisting of process methods or parameters as listed below used to control:
    - b.2.a. "Superplastic forming" of aluminum alloys, titanium alloys or "superalloys":
      - b.2.a.1. Surface preparation;
      - b.2.a.2. Strain rate;
      - b.2.a.3. Temperature;
      - b.2.a.4. Pressure;
    - b.2.b. "Diffusion bonding" of "superalloys" or titanium alloys:
      - b.2.b.1. Surface preparation;
      - b.2.b.2. Temperature;
      - b.2.b.3. Pressure;
    - b.2.c. "Direct-acting hydraulic pressing" of aluminum alloys or titanium alloys:
      - b.2.c.1. Pressure;
      - b.2.c.2. Cycle time;
    - b.2.d. "Hot isostatic densification" of titanium alloys, aluminum alloys or "superalloys":
      - b.2.d.1. Temperature;
      - b.2.d.2. Pressure;
      - b.2.d.3. Cycle time;
  - c. "Technology" for the "development" or "production" of hydraulic stretch-forming machines and dies therefor, for the manufacture of airframe structures;
  - d. "Technology" for the "development" of generators of machine tool instructions (e.g., part programs) from design data residing inside "numerical control" units;
  - e. "Technology for the development" of integration "software" for incorporation of expert systems for advanced decision support of shop floor operations into "numerical control" units;
  - f. "Technology" for the application of inorganic overlay coatings or inorganic surface modification coatings (specified in column 3 of the following table) to non-electronic substrates (specified in column 2 of the following table), by processes specified in column 1 of the following table and defined in the Technical Note.
 

*N.B. This table should be read to control the technology of a particular 'Coating Process' only when the resultant coating in column 3 is in a paragraph directly across from the relevant 'Substrate' under column 2. For example, Chemical Vapor Deposition (CVD) 'coating process' control the "technology" for a particular application of 'silicides' to 'Carbon-carbon, Ceramic and Metal "matrix" "composites" substrates, but are not controlled for the application of 'silicides' to 'Cemented tungsten carbide (16), Silicon carbide (18)' substrates. In the second case, the resultant coating is not listed in the paragraph under column 3 directly across from the paragraph under column 2 listing 'Cemented tungsten carbide (16), Silicon carbide (18)'.*

■ 20. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 2, Category 2E—Materials Processing

Table; the Notes to Table on Deposition Techniques and the Accompanying Technical Information to Table on Deposition Techniques are revised to read as follows:

**Category 2E—Materials Processing Table; Deposition Techniques**

\* \* \* \* \*

**Notes to Table on Deposition Techniques**

1. The term 'coating process' includes coating repair and refurbishing as well as original coating.
2. The term 'alloyed aluminide coating' includes single or multiple-step coatings in which an element or elements are deposited prior to or during application of the aluminide coating, even if these elements are deposited by another coating process. It does not, however, include the multiple use of single-step pack cementation processes to achieve alloyed aluminides.
3. The term 'noble metal modified aluminide' coating includes multiple-step coatings in which the noble metal or noble metals are laid down by some other coating process prior to application of the aluminide coating.
4. The term 'mixtures thereof' includes infiltrated material, graded compositions, co-deposits and multilayer deposits and are obtained by one or more of the coating processes specified in the Table.
5. MCrAlX refers to a coating alloy where M equals cobalt, iron, nickel or combinations thereof and X equals hafnium, yttrium, silicon, tantalum in any amount or other intentional additions over 0.01% by weight in various proportions and combinations, except:
  - a. CoCrAlY coatings which contain less than 22% by weight of chromium, less than 7% by weight of aluminum and less than 2% by weight of yttrium;
  - b. CoCrAlY coatings which contain 22 to 24% by weight of chromium, 10 to 12% by weight of aluminum and 0.5 to 0.7% by weight of yttrium; or
  - c. NiCrAlY coatings which contain 21 to 23% by weight of chromium, 10 to 12% by weight of aluminum and 0.9 to 1.1% by weight of yttrium.
6. The term 'aluminum alloys' refers to alloys having an ultimate tensile strength of 190 MPa or more measured at 293 K (20 °C).
7. The term 'corrosion resistant steel' refers to AISI (American Iron and Steel Institute) 300 series or equivalent national standard steels.
8. 'Refractory metals and alloys' include the following metals and their alloys: niobium (columbium), molybdenum, tungsten and tantalum.
9. 'Sensor window materials', as follows: alumina, silicon, germanium, zinc sulphide, zinc selenide, gallium arsenide, diamond, gallium phosphide, sapphire and the following metal halides: sensor window materials of more than 40 mm diameter for zirconium fluoride and hafnium fluoride.
10. Category 2 does not include "technology" for single-step pack cementation of solid airfoils.
11. 'Polymers', as follows: Polyimide, polyester, polysulfide, polycarbonates and polyurethanes.

12. 'Modified zirconia' refers to additions of other metal oxides, (e.g., calcia, magnesia, yttria, hafnia, rare earth oxides) to zirconia in order to stabilize certain crystallographic phases and phase compositions. Thermal barrier coatings made of zirconia, modified with calcia or magnesia by mixing or fusion, are not controlled.

13. 'Titanium alloys' refers only to aerospace alloys having an ultimate tensile strength of 900 MPa or more measured at 293 K (20 °C).

14. 'Low-expansion glasses' refers to glasses which have a coefficient of thermal expansion of  $1 \times 10^{-7} \text{ K}^{-1}$  or less measured at 293 K (20 °C).

15. 'Dielectric layers' are coatings constructed of multi-layers of insulator materials in which the interference properties of a design composed of materials of various refractive indices are used to reflect, transmit or absorb various wavelength bands. Dielectric layers refers to more than four dielectric layers or dielectric/metal "composite" layers.

16. 'Cemented tungsten carbide' does not include cutting and forming tool materials consisting of tungsten carbide/(cobalt, nickel), titanium carbide/(cobalt, nickel), chromium carbide/nickel-chromium and chromium carbide/nickel.

17. "Technology" for depositing 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, medical devices or molds, for casting or molding of plastics, manufactured from alloys containing less than 5% beryllium.

18. 'Silicon carbide' does not include cutting and forming tool materials.

19. Ceramic substrates, as used in this entry, does not include ceramic materials containing 5% by weight, or greater, clay or cement content, either as separate constituents or in combination.

#### Technical Note to Table on Deposition

**Techniques:** Processes specified in Column 1 of the Table are defined as follows:

a. Chemical Vapor Deposition (CVD) is an overlay coating or surface modification coating process wherein a metal, alloy, "composite", dielectric or ceramic is deposited upon a heated substrate. Gaseous reactants are decomposed or combined in the vicinity of a substrate resulting in the deposition of the desired elemental, alloy or compound material on the substrate. Energy for this decomposition or chemical reaction process may be provided by the heat of the substrate, a glow discharge plasma, or "laser" irradiation.

**Note 1:** CVD includes the following processes: directed gas flow out-of-pack deposition, pulsating CVD, controlled nucleation thermal decomposition (CNTD), plasma enhanced or plasma assisted CVD processes.

**Note 2:** Pack denotes a substrate immersed in a powder mixture.

**Note 3:** The gaseous reactants used in the out-of-pack process are produced using the same basic reactions and parameters as the pack cementation process, except that the substrate to be coated is not in contact with the powder mixture.

b. Thermal Evaporation-Physical Vapor Deposition (TE-PVD) is an overlay coating process conducted in a vacuum with a pressure less than 0.1 Pa wherein a source of thermal energy is used to vaporize the coating material. This process results in the condensation, or deposition, of the evaporated species onto appropriately positioned substrates. The addition of gases to the vacuum chamber during the coating process to synthesize compound coatings is an ordinary modification of the process. The use of ion or electron beams, or plasma, to activate or assist the coating's deposition is also a common modification in this technique. The use of monitors to provide in-process measurement of optical characteristics and thickness of coatings can be a feature of these processes. Specific TE-PVD processes are as follows:

1. Electron Beam PVD uses an electron beam to heat and evaporate the material which forms the coating;

2. Ion Assisted Resistive Heating PVD employs electrically resistive heating sources in combination with impinging ion beam(s) to produce a controlled and uniform flux of evaporated coating species;

3. "Laser" Vaporization uses either pulsed or continuous wave "laser" beams to vaporize the material which forms the coating;

4. Cathodic Arc Deposition employs a consumable cathode of the material which forms the coating and has an arc discharge established on the surface by a momentary contact of a ground trigger. Controlled motion of arcing erodes the cathode surface creating a highly ionized plasma. The anode can be either a cone attached to the periphery of the cathode, through an insulator, or the chamber. Substrate biasing is used for non line-of-sight deposition.

**Note:** This definition does not include random cathodic arc deposition with non-biased substrates.

5. Ion Plating is a special modification of a general TE-PVD process in which a plasma or an ion source is used to ionize the species to be deposited, and a negative bias is applied to the substrate in order to facilitate the extraction of the species from the plasma. The introduction of reactive species, evaporation of solids within the process chamber, and the use of monitors to provide in-process measurement of optical characteristics and thicknesses of coatings are ordinary modifications of the process.

c. Pack Cementation is a surface modification coating or overlay coating process wherein a substrate is immersed in a powder mixture (a pack), that consists of:

1. The metallic powders that are to be deposited (usually aluminum, chromium, silicon or combinations thereof);
2. An activator (normally a halide salt); and
3. An inert powder, most frequently alumina.

**Note:** The substrate and powder mixture is contained within a retort which is heated to between 1,030 K (757 °C) to 1,375 K (1,102 °C) for sufficient time to deposit the coating.

d. Plasma Spraying is an overlay coating process wherein a gun (spray torch) which produces and controls a plasma accepts powder or wire coating materials, melts them and propels them towards a substrate, whereon an integrally bonded coating is formed. Plasma spraying constitutes either low pressure plasma spraying or high velocity plasma spraying.

**Note 1:** Low pressure means less than ambient atmospheric pressure.

**Note 2:** High velocity refers to nozzle-exit gas velocity exceeding 750 m/s calculated at 293 K (20 °C) at 0.1 MPa.

e. Slurry Deposition is a surface modification coating or overlay coating process wherein a metallic or ceramic powder with an organic binder is suspended in a liquid and is applied to a substrate by either spraying, dipping or painting, subsequent air or oven drying, and heat treatment to obtain the desired coating.

f. Sputter Deposition is an overlay coating process based on a momentum transfer phenomenon, wherein positive ions are accelerated by an electric field towards the surface of a target (coating material). The kinetic energy of the impacting ions is sufficient to cause target surface atoms to be released and deposited on an appropriately positioned substrate.

**Note 1:** The Table refers only to triode, magnetron or reactive sputter deposition which is used to increase adhesion of the coating and rate of deposition and to radio frequency (RF) augmented sputter deposition used to permit vaporization of non-metallic coating materials.

**Note 2:** Low-energy ion beams (less than 5 keV) can be used to activate the deposition.

g. Ion Implantation is a surface modification coating process in which the element to be alloyed is ionized, accelerated through a potential gradient and implanted into the surface region of the substrate. This includes processes in which ion implantation is performed simultaneously with electron beam physical vapor deposition or sputter deposition.

#### Accompanying Technical Information to Table on Deposition Techniques:

1. Technical information for pretreatments of the substrates listed in the Table, as follows:

a. Chemical stripping and cleaning bath cycle parameters, as follows:

1. Bath composition;
  - a. For the removal of old or defective coatings corrosion product or foreign deposits;
  - b. For preparation of virgin substrates;
2. Time in bath;
3. Temperature of bath;
4. Number and sequences of wash cycles;
- b. Visual and macroscopic criteria for acceptance of the cleaned part;
- c. Heat treatment cycle parameters, as follows:

- 1. Atmosphere parameters, as follows:
  - a. Composition of the atmosphere;
  - b. Pressure of the atmosphere;
- 2. Temperature for heat treatment;
- 3. Time of heat treatment;
- d. Substrate surface preparation parameters, as follows:
  - 1. Grit blasting parameters, as follows:
    - a. Grit composition;
    - b. Grit size and shape;
    - c. Grit velocity;
  - 2. Time and sequence of cleaning cycle after grit blast;
  - 3. Surface finish parameters;
  - 4. Application of binders to promote adhesion;
  - e. Masking technique parameters, as follows:
    - 1. Material of mask;
    - 2. Location of mask;
    - 2. Technical information for in situ quality assurance techniques for evaluation of the coating processes listed in the Table, as follows:
      - a. Atmosphere parameters, as follows:
        - 1. Composition of the atmosphere;
        - 2. Pressure of the atmosphere;
        - b. Time parameters;
        - c. Temperature parameters;
        - d. Thickness parameters;
        - e. Index of refraction parameters;
        - f. Control of composition;
      - 3. Technical information for post deposition treatments of the coated substrates listed in the Table, as follows:
        - a. Shot peening parameters, as follows:
          - 1. Shot composition;
          - 2. Shot size;
          - 3. Shot velocity;
        - b. Post shot peening cleaning parameters;
        - c. Heat treatment cycle parameters, as follows:
          - 1. Atmosphere parameters, as follows:
            - a. Composition of the atmosphere;
            - b. Pressure of the atmosphere;
          - 2. Time-temperature cycles;
          - d. Post heat treatment visual and macroscopic criteria for acceptance of the coated substrates;
          - 4. Technical information for quality assurance techniques for the evaluation of the coated substrates listed in the Table, as follows:
            - a. Statistical sampling criteria;
            - b. Microscopic criteria for:
              - 1. Magnification;
              - 2. Coating thickness, uniformity;
              - 3. Coating integrity;
              - 4. Coating composition;
              - 5. Coating and substrates bonding;

- 6. Microstructural uniformity.
- c. Criteria for optical properties assessment (measured as a function of wavelength):
  - 1. Reflectance;
  - 2. Transmission;
  - 3. Absorption;
  - 4. Scatter;
  - 5. Technical information and parameters related to specific coating and surface modification processes listed in the Table, as follows:
    - a. For Chemical Vapor Deposition (CVD):
      - 1. Coating source composition and formulation;
      - 2. Carrier gas composition;
      - 3. Substrate temperature;
      - 4. Time-temperature-pressure cycles;
      - 5. Gas control and part manipulation;
    - b. For Thermal Evaporation-Physical Vapor Deposition (PVD):
      - 1. Ingot or coating material source composition;
      - 2. Substrate temperature;
      - 3. Reactive gas composition;
      - 4. Ingot feed rate or material vaporization rate;
      - 5. Time-temperature-pressure cycles;
      - 6. Beam and part manipulation;
      - 7. "Laser" parameters, as follows:
        - a. Wave length;
        - b. Power density;
        - c. Pulse length;
        - d. Repetition ratio;
      - e. Source;
      - c. For Pack Cementation:
        - 1. Pack composition and formulation;
        - 2. Carrier gas composition;
        - 3. Time-temperature-pressure cycles;
        - d. For Plasma Spraying:
          - 1. Powder composition, preparation and size distributions;
          - 2. Feed gas composition and parameters;
          - 3. Substrate temperature;
          - 4. Gun power parameters;
          - 5. Spray distance;
          - 6. Spray angle;
          - 7. Cover gas composition, pressure and flow rates;
        - 8. Gun control and part manipulation;
      - e. For Sputter Deposition:
        - 1. Target composition and fabrication;
        - 2. Geometrical positioning of part and target;
        - 3. Reactive gas composition;
        - 4. Electrical bias;
        - 5. Time-temperature-pressure cycles;
        - 6. Triode power;
        - 7. Part manipulation;
      - f. For Ion Implantation:
        - 1. Beam control and part manipulation;

- 2. Ion source design details;
- 3. Control techniques for ion beam and deposition rate parameters;
- 4. Time-temperature-pressure cycles.
- g. For Ion Plating:
  - 1. Beam control and part manipulation;
  - 2. Ion source design details;
  - 3. Control techniques for ion beam and deposition rate parameters;
  - 4. Time-temperature-pressure cycles;
  - 5. Coating material feed rate and vaporization rate;
  - 6. Substrate temperature;
  - 7. Substrate bias parameters.

■ 21. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, Product Group A, the Notes and Nota Bene at the beginning of Product Group A are revised to read as follows:

**Category 3—Electronics**

**A. "End Items", "Equipment", "Accessories", "Attachments", "Parts", "Components" and "Systems"**

**Note 1:** The control status of equipment and components described in 3A001 or 3A002, other than those described in 3A001.a.3 to 3A001.a.10, 3A001.a.12 or 3A001.a.14, which are "specially designed" for or which have the same functional characteristics as other equipment is determined by the control status of the other equipment.

**Note 2:** The control status of integrated circuits described in 3A001.a.3 to 3A001.a.9, 3A001.a.12 or 3A001.a.14 that are unalterably programmed or designed for a specific function for other equipment is determined by the control status of the other equipment.

*N.B.: When the manufacturer or applicant cannot determine the control status of the other equipment, the control status of the integrated circuits is determined in 3A001.a.3 to 3A001.a.9, 3A001.a.12 and 3A001.a.14.*

■ 22. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, ECCN 3A001 is revised to read as follows:

**3A001 Electronic items as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, RS, MT, NP, AT

*Country chart (see Supp. No. 1 to part 738)*

**Control(s)**

NS applies to "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers in 3A001.b.2 and discrete microwave transistors in 3A001.b.3, except those 3A001.b.2 and b.3 items being exported or reexported for use in civil telecommunications applications.	NS Column 1
NS applies to entire entry .....	NS Column 2
RS applies "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers in 3A001.b.2 and discrete microwave transistors in 3A001.b.3, except those 3A001.b.2 and b.3 items being exported or reexported for use in civil telecommunications applications.	RS Column 1

## Control(s)

Country chart  
(see Supp. No. 1 to part 738)

<p>MT applies to 3A001.a.1.a when usable in “missiles”; and to 3A001.a.5.a when “designed or modified” for military use, hermetically sealed and rated for operation in the temperature range from below <math>-54^{\circ}\text{C}</math> to above <math>+125^{\circ}\text{C}</math> MT Column 1.</p> <p>NP applies to pulse discharge capacitors in in 3A001.e.2 and superconducting solenoidal electromagnets in 3A001.e.3 that meet or exceed the technical parameters in 3A201.a and 3A201.b, respectively NP Column 1.</p> <p>AT applies to entire entry AT Column 1 .....</p>	<p>MT applies to 3A001.a.1.a when usable in “missiles”; and to 3A001.a.5.a when “designed or modified” for military use, hermetically sealed and rated for operation in the temperature range from below <math>-54^{\circ}\text{C}</math> to above <math>+125^{\circ}\text{C}</math> MT Column 1</p> <p>NP applies to pulse discharge capacitors in in 3A001.e.2 and superconducting solenoidal electromagnets in 3A001.e.3 that meet or exceed the technical parameters in 3A201.a and 3A201.b, respectively NP Column 1</p> <p>AT applies to entire entry AT Column 1</p>
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**License Requirements Note:** See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating “information security” functionality, and associated “software” and “technology” for the “production” or “development” of such microprocessors.

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

**LVS:** N/A for MT or NP; N/A for “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers in 3A001.b.2 and discrete microwave transistors in 3A001.b.3, except those that are being exported or reexported for use in civil telecommunications applications.

Yes for:

\$1500: 3A001.c

\$3000: 3A001.b.1, b.2 (exported or reexported for use in civil telecommunications applications), b.3 (exported or reexported for use in civil telecommunications applications), b.9, .d, .e, .f, and .g.

\$5000: 3A001.a (except a.1.a and a.5.a when controlled for MT), .b.4 to b.7, and b.12.

**GBS:** Yes for 3A001.a.1.b, a.2 to a.14 (except .a.5.a when controlled for MT), b.2 (exported or reexported for use in civil telecommunications applications), b.8 (except for vacuum electronic device amplifiers exceeding 18 GHz), b.9., b.10, .g, and .h.

**CIV:** Yes for 3A001.a.3, a.7, and a.11.

**Special Conditions for STA**

**STA:** License Exception STA may not be used to ship any item in 3A001.b.2 or b.3, except those that are being exported or reexported for use in civil telecommunications applications, to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No. 1 to part 740 of the EAR).

**List of Items Controlled**

**Related Controls:** (1) See Category XV of the USML for certain “space-qualified” electronics and Category XI of the USML for certain ASICs, “transmit/receive modules,” or “transmit modules” “subject to the ITAR” (see 22 CFR parts 120 through

130). (2) See also 3A101, 3A201, 3A611, 3A991, and 9A515.

**Related Definitions:** ‘Microcircuit’ means a device in which a number of passive or active elements are considered as indivisibly associated on or within a continuous structure to perform the function of a circuit. For the purposes of integrated circuits in 3A001.a.1,  $5 \times 10^3$  Gy(Si) =  $5 \times 10^5$  Rads (Si);  $5 \times 10^6$  Gy (Si)/s =  $5 \times 10^8$  Rads (Si)/s. Spacecraft/satellite: Solar concentrators, power conditioners and or controllers, bearing and power transfer assembly, and or deployment hardware/systems are controlled under the export licensing authority of the Department of State, Directorate of Defense Trade Controls (22 CFR part 121).

**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;
- “Three dimensional integrated circuits”;
- “Monolithic Microwave Integrated Circuits” (“MMICs”).

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

- a.1.a. A total dose of  $5 \times 10^3$  Gy (Si), or higher;
- a.1.b. A dose rate upset of  $5 \times 10^6$  Gy (Si)/s, or higher; or
- a.1.c. A fluence (integrated flux) of neutrons (1 MeV equivalent) of  $5 \times 10^{13}$  n/cm<sup>2</sup> 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, integrated circuits that contain analog-to-digital converters and store or process the digitized data, digital-to-analog converters, electro-optical or “optical integrated circuits” designed for “signal processing,” field programmable logic

devices, 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 is unknown, Fast Fourier Transform (FFT) processors, Electrical Erasable Programmable Read-Only Memories (EEPROMs), flash memories, Static Random-Access Memories (SRAMs), or Magnetic Random Access Memories (MRAMs), 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,” “microcomputer microcircuits” and microcontroller microcircuits, manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz;

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

a.4. [Reserved]

a.5. Analog-to-Digital Converter (ADC) and Digital-to-Analog Converter (DAC) integrated circuits, as follows:

- a.5.a. ADCs having any of the following:
  - a.5.a.1. A resolution of 8 bit or more, but less than 10 bit, with an output rate greater than 1.3 Giga Samples Per Second (GSPS);
  - a.5.a.2. A resolution of 10 bit or more, but less than 12 bit, with an output rate greater than 600 Mega Samples Per Second (MSPS);
  - a.5.a.3. A resolution of 12 bit or more, but less than 14 bit, with an output rate greater than 400 Mega Samples Per Second (MSPS);
  - a.5.a.4. A resolution of 14 bit or more, but less than 16 bit, with an output rate greater than 250 Mega Samples Per Second (MSPS); or
  - a.5.a.5. A resolution of 16 bit or more with an output rate greater than 65 Mega Samples Per Second (MSPS);

*N.B.:* For integrated circuits that contain analog-to-digital converters and store or process the digitized data see 3A001.a.14.

**Technical Notes:** 1. A resolution of n bit corresponds to a quantization of  $2^n$  levels.

2. The number of bits in the output word is equal to the resolution of the ADC.

3. The output rate is the maximum output rate of the converter, regardless of architecture or oversampling.

4. For 'multiple channel ADCs', the outputs are not aggregated and the output rate is the maximum output rate of any single channel.

5. For 'interleaved ADCs' or for 'multiple channel ADCs' that are specified to have an interleaved mode of operation, the outputs are aggregated and the output rate is the maximum combined total output rate of all of the outputs.

6. Vendors may also refer to the output rate as sampling rate, conversion rate or throughput rate. It is often specified in megahertz (MHz), mega words per second or Mega Samples Per Second (MSPS).

7. For the purpose of measuring output rate, one sample per second is equivalent to one Hertz or one output word per second.

8. 'Multiple channel ADCs' are defined as devices which integrate more than one ADC, designed so that each ADC has a separate analog input.

9. 'Interleaved ADCs' are defined as devices which have multiple ADC units that sample the same analog input at different times such that when the outputs are aggregated, the analog input has been effectively sampled and converted at a higher sampling rate.

a.5.b. Digital-to-Analog Converters (DAC) having any of the following:

a.5.b.1. A resolution of 10 bit or more with an 'adjusted update rate' of greater than 3,500 MSPS; or

a.5.b.2. A resolution of 12-bit or more with an 'adjusted update rate' of greater than 1,250 MSPS and having any of the following:

a.5.b.2.a. A settling time less than 9 ns to 0.024% of full scale from a full scale step; or  
a.5.b.2.b. A 'Spurious Free Dynamic Range' (SFDR) greater than 68 dBc (carrier) when synthesizing a full scale analog signal of 100 MHz or the highest full scale analog signal frequency specified below 100 MHz.

**Technical Notes:** 1. 'Spurious Free Dynamic Range' (SFDR) is defined as the ratio of the RMS value of the carrier frequency (maximum signal component) at the input of the DAC to the RMS value of the next largest noise or harmonic distortion component at its output.

2. SFDR is determined directly from the specification table or from the characterization plots of SFDR versus frequency.

3. A signal is defined to be full scale when its amplitude is greater than  $-3$  dBfs (full scale).

4. 'Adjusted update rate' for DACs is:  
a. For conventional (non-interpolating) DACs, the 'adjusted update rate' is the rate at which the digital signal is converted to an analog signal and the output analog values are changed by the DAC. For DACs where the interpolation mode may be bypassed (interpolation factor of one), the DAC should be considered as a conventional (non-interpolating) DAC.

b. For interpolating DACs (oversampling DACs), the 'adjusted update rate' is defined as the DAC update rate divided by the smallest interpolating factor. For interpolating DACs, the 'adjusted update rate' may be referred to by different terms including:

- Input data rate
- Input word rate
- Input sample rate
- Maximum total input bus rate
- Maximum DAC clock rate for DAC clock input.

a.6. Electro-optical and "optical integrated circuits", designed for "signal processing" and 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. A maximum number of single-ended digital input/outputs of greater than 700; or

a.7.b. An 'aggregate one-way peak serial transceiver data rate' of 500 Gb/s or greater;

**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)

—Field Programmable Interconnects (FPICs)

*N.B.: For integrated circuits having field programmable logic devices that are combined with an analog-to-digital converter, see 3A001.a.14.*

**Technical Notes:** 1. Maximum number of digital input/outputs in 3A001.a.7.a is also referred to as maximum user input/outputs or maximum available input/outputs, whether the integrated circuit is packaged or bare die.

2. 'Aggregate one-way peak serial transceiver data rate' is the product of the peak serial one-way transceiver data rate times the number of transceivers on the FPGA.

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 1,500 terminals;

a.10.b. A typical "basic gate propagation delay time" of less than 0.02 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  $\mu$ s.

a.13. Direct Digital Synthesizer (DDS) integrated circuits having any of the following:

a.13.a. A Digital-to-Analog Converter (DAC) clock frequency of 3.5 GHz or more and a DAC resolution of 10 bit or more, but less than 12 bit; or

a.13.b. A DAC clock frequency of 1.25 GHz or more and a DAC resolution of 12 bit or more;

**Technical Note:** The DAC clock frequency may be specified as the master clock frequency or the input clock frequency.

a.14. Integrated circuits that perform all of the following:

a.14.a. Analog-to-digital conversions meeting any of the following:

a.14.a.1. A resolution of 8 bit or more, but less than 10 bit, with an input sample rate greater than 1.3 Giga Samples Per Second (GSPS);

a.14.a.2. A resolution of 10 bit or more, but less than 12 bit, with an input sample rate greater than 1.0 Giga Samples Per Second (GSPS);

a.14.a.3. A resolution of 12 bit or more, but less than 14 bit, with an input sample rate greater than 1.0 Giga Samples Per Second (GSPS);

a.14.a.4. A resolution of 14 bit or more, but less than 16 bit, with an input sample rate greater than 400 Mega Samples Per Second (MSPS); or

a.14.a.5. A resolution of 16 bit or more with an input sample rate greater than 180 Mega Samples Per Second (MSPS); and

a.14.b. Any of the following:

a.14.b.1. Storage of digitized data; or

a.14.b.2. Processing of digitized data;

*N.B. 1: For analog-to-digital converter integrated circuits see 3A001.a.5.a.*

*N.B. 2: For field programmable logic devices see 3A001.a.7.*

b. Microwave or millimeter wave items, as follows:

**Technical Notes:** 1. For purposes of 3A001.b, the parameter peak saturated power output may also be referred to on product data sheets as output power, saturated power output, maximum power output, peak power output, or peak envelope power output.

2. For purposes of 3A001.b.1, 'vacuum electronic devices' are electronic devices based on the interaction of an electron beam with an electromagnetic wave propagating in a vacuum circuit or interacting with radio-frequency vacuum cavity resonators. 'Vacuum electronic devices' include klystrons, traveling-wave tubes, and their derivatives.

b.1. 'Vacuum electronic devices' and cathodes, as follows:

**Note 1:** 3A001.b.1 does not control 'vacuum electronic devices' designed or rated for operation in any frequency band and having all of the following:

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’ ‘vacuum electronic devices’ having all the following:

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

b. Designed or rated for operation in any frequency band and having all of the following:

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 ‘vacuum electronic devices,’ pulsed or continuous wave, as follows:

b.1.a.1. Devices operating at frequencies exceeding 31.8 GHz;

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

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

b.1.a.4. Devices based on helix, folded waveguide, or serpentine waveguide circuits, or derivatives thereof, having any of the following:

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;

b.1.a.4.c. Being ‘‘space-qualified’’; *or*

b.1.a.4.d. Having a gridded electron gun;

b.1.a.5. Devices with a ‘‘fractional bandwidth’’ greater than or equal to 10%, with any of the following:

b.1.a.5.a. An annular electron beam;

b.1.a.5.b. A non-axisymmetric electron beam; *or*

b.1.a.5.c. Multiple electron beams;

b.1.a.5.d. Crossed-field amplifier ‘vacuum electronic devices’ with a gain of more than 17 dB;

b.1.a.5.e. Thermionic cathodes, designed for ‘vacuum electronic devices,’ producing an emission current density at rated operating conditions exceeding 5 A/cm<sup>2</sup> or a pulsed (non-continuous) current density at rated operating conditions exceeding 10 A/cm<sup>2</sup>;

b.1.a.5.f. ‘Vacuum electronic devices’ with the capability to operate in a ‘dual mode.’

**Technical Note:** ‘Dual mode’ means the ‘vacuum electronic device’ beam current can be intentionally changed between continuous-wave and pulsed mode operation by use of a grid and produces a peak pulse output power greater than the continuous-wave output power.

b.2. ‘Monolithic Microwave Integrated Circuit’ (‘MMIC’) amplifiers that are any of the following:

*N.B.: For ‘‘MMIC’’ amplifiers that have an integrated phase shifter see 3A001.b.12.*

b.2.a. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz with a ‘‘fractional bandwidth’’ greater than 15%, and having any of the following:

b.2.a.1. A peak saturated power output greater than 75 W (48.75 dBm) at any

frequency exceeding 2.7 GHz up to and including 2.9 GHz;

b.2.a.2. A peak saturated power output greater than 55 W (47.4 dBm) at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;

b.2.a.3. A peak saturated power output greater than 40 W (46 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; *or*

b.2.a.4. A peak saturated power output greater than 20 W (43 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

b.2.b. Rated for operation at frequencies exceeding 6.8 GHz up to and including 16 GHz with a ‘‘fractional bandwidth’’ greater than 10%, and having any of the following:

b.2.b.1. A peak saturated power output greater than 10 W (40 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz; *or*

b.2.b.2. A peak saturated power output greater than 5 W (37 dBm) at any frequency exceeding 8.5 GHz up to and including 16 GHz;

b.2.c. Rated for operation with a peak saturated power output greater than 3 W (34.77 dBm) at any frequency exceeding 16 GHz up to and including 31.8 GHz, and with a ‘‘fractional bandwidth’’ of greater than 10%;

b.2.d. Rated for operation with a peak saturated power output greater than 0.1 n W (–70 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;

b.2.e. Rated for operation with a peak saturated power output greater than 1 W (30 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz, and with a ‘‘fractional bandwidth’’ of greater than 10%;

b.2.f. Rated for operation with a peak saturated power output greater than 31.62 mW (15 dBm) at any frequency exceeding 43.5 GHz up to and including 75 GHz, and with a ‘‘fractional bandwidth’’ of greater than 10%;

b.2.g. Rated for operation with a peak saturated power output greater than 10 mW (10 dBm) at any frequency exceeding 75 GHz up to and including 90 GHz, and with a ‘‘fractional bandwidth’’ of greater than 5%; *or*

b.2.h. Rated for operation with a peak saturated power output greater than 0.1 nW (–70 dBm) at any frequency exceeding 90 GHz;

**Note 1:** [Reserved]

**Note 2:** The control status of the ‘‘MMIC’’ whose rated operating frequency includes frequencies listed in more than one frequency range, as defined by 3A001.b.2.a through 3A001.b.2.h, is determined by the lowest peak saturated power output control threshold.

**Note 3:** Notes 1 and 2 following the Category 3 heading for product group 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. Discrete microwave transistors that are any of the following:

b.3.a. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz and having any of the following:

b.3.a.1. A peak saturated power output greater than 400 W (56 dBm) at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;

b.3.a.2. A peak saturated power output greater than 205 W (53.12 dBm) at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;

b.3.a.3. A peak saturated power output greater than 115 W (50.61 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; *or*

b.3.a.4. A peak saturated power output greater than 60 W (47.78 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

b.3.b. Rated for operation at frequencies exceeding 6.8 GHz up to and including 31.8 GHz and having any of the following:

b.3.b.1. A peak saturated power output greater than 50 W (47 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz;

b.3.b.2. A peak saturated power output greater than 15 W (41.76 dBm) at any frequency exceeding 8.5 GHz up to and including 12 GHz;

b.3.b.3. A peak saturated power output greater than 40 W (46 dBm) at any frequency exceeding 12 GHz up to and including 16 GHz; *or*

b.3.b.4. A peak saturated power output greater than 7 W (38.45 dBm) at any frequency exceeding 16 GHz up to and including 31.8 GHz;

b.3.c. Rated for operation with a peak saturated power output greater than 0.5 W (27 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;

b.3.d. Rated for operation with a peak saturated power output greater than 1 W (30 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz; *or*

b.3.e. Rated for operation with a peak saturated power output greater than 0.1 nW (–70 dBm) at any frequency exceeding 43.5 GHz;

**Note 1:** The control status of a transistor, whose rated operating frequency includes frequencies listed in more than one frequency range, as defined by 3A001.b.3.a through 3A001.b.3.e, is determined by the lowest peak saturated power output control threshold.

**Note 2:** 3A001.b.3 includes bare dice, dice mounted on carriers, or dice mounted in packages. Some discrete transistors may also be referred to as power amplifiers, but the status of these discrete transistors is determined by 3A001.b.3.

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

b.4.a. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz with a ‘‘fractional bandwidth’’ greater than 15%, and having any of the following:

b.4.a.1. A peak saturated power output greater than 500 W (57 dBm) at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;

b.4.a.2. A peak saturated power output greater than 270 W (54.3 dBm) at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;

b.4.a.3. A peak saturated power output greater than 200 W (53 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; or

b.4.a.4. A peak saturated power output greater than 90 W (49.54 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

b.4.b. Rated for operation at frequencies exceeding 6.8 GHz up to and including 31.8 GHz with a "fractional bandwidth" greater than 10%, and having any of the following:

b.4.b.1. A peak saturated power output greater than 70 W (48.54 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz;

b.4.b.2. A peak saturated power output greater than 50 W (47 dBm) at any frequency exceeding 8.5 GHz up to and including 12 GHz;

b.4.b.3. A peak saturated power output greater than 30 W (44.77 dBm) at any frequency exceeding 12 GHz up to and including 16 GHz; or

b.4.b.4. A peak saturated power output greater than 20 W (43 dBm) at any frequency exceeding 16 GHz up to and including 31.8 GHz;

b.4.c. Rated for operation with a peak saturated power output greater than 0.5 W (27 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;

b.4.d. Rated for operation with a peak saturated power output greater than 2 W (33 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz, and with a "fractional bandwidth" of greater than 10%;

b.4.e. Rated for operation at frequencies exceeding 43.5 GHz and having any of the following:

b.4.e.1. A peak saturated power output greater than 0.2 W (23 dBm) at any frequency exceeding 43.5 GHz up to and including 75 GHz, and with a "fractional bandwidth" of greater than 10%;

b.4.e.2. A peak saturated power output greater than 20 mW (13 dBm) at any frequency exceeding 75 GHz up to and including 90 GHz, and with a "fractional bandwidth" of greater than 5%; or

b.4.e.3. A peak saturated power output greater than 0.1 nW (−70 dBm) at any frequency exceeding 90 GHz; or

b.4.f. [Reserved]

*N.B.: 1. For "MMIC" amplifiers see 3A001.b.2.*

*2. For 'transmit/receive modules' and 'transmit modules' see 3A001.b.12.*

**Note 1:** [Reserved]

**Note 2:** The control status of an item whose rated operating frequency includes frequencies listed in more than one frequency range, as defined by 3A001.b.4.a through 3A001.b.4.e, is determined by the lowest peak saturated power output 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  $\mu$ s and 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. Converters and harmonic mixers, that are any of the following:

b.7.a. Designed to extend the frequency range of "signal analyzers" beyond 90 GHz;

b.7.b. Designed to extend the operating range of signal generators as follows:

b.7.b.1. Beyond 90 GHz;

b.7.b.2. To an output power greater than 100 mW (20 dBm) anywhere within the frequency range exceeding 43.5 GHz but not exceeding 90 GHz;

b.7.c. Designed to extend the operating range of network analyzers as follows:

b.7.c.1. Beyond 110 GHz;

b.7.c.2. To an output power greater than 31.62 mW (15 dBm) anywhere within the frequency range exceeding 43.5 GHz but not exceeding 90 GHz;

b.7.c.3. To an output power greater than 1 mW (0 dBm) anywhere within the frequency range exceeding 90 GHz but not exceeding 110 GHz; or

b.7.d. Designed to extend the frequency range of microwave test receivers beyond 110 GHz;

b.8. Microwave power amplifiers containing 'vacuum electronic devices' controlled by 3A001.b.1 and having all of the following:

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

b.8.b. An average output power to mass ratio exceeding 80 W/kg; and

b.8.c. A volume of less than 400 cm<sup>3</sup>;

**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.

b.9. Microwave Power Modules (MPM) consisting of, at least, a traveling-wave 'vacuum electronic device', a "Monolithic Microwave Integrated Circuit" ("MMIC") and an integrated electronic power conditioner and having all of the following:

b.9.a. A 'turn-on time' from off to fully operational in less than 10 seconds;

b.9.b. A volume less than the maximum rated power in Watts multiplied by 10 cm<sup>3</sup>/W; and

b.9.c. An "instantaneous bandwidth" greater than 1 octave ( $f_{\max} > 2f_{\min}$ ) and having any of the following:

b.9.c.1. For frequencies equal to or less than 18 GHz, an RF output power greater than 100 W; or

b.9.c.2. A frequency greater than 18 GHz;

**Technical Notes:** 1. To calculate the volume in 3A001.b.9.b., the following example is provided: for a maximum rated power of 20 W, the volume would be: 20 W × 10 cm<sup>3</sup>/W = 200 cm<sup>3</sup>.

2. The 'turn-on time' in 3A001.b.9.a. refers to the time from fully-off to fully operational, i.e., it includes the warm-up time of the MPM.

b.10. Oscillators or oscillator assemblies, specified to operate with a single sideband

(SSB) phase noise, in dBc/Hz, less (better) than  $-(126 + 20\log_{10}F - 20\log_{10}f)$  anywhere within the range of 10 Hz ≤ F ≤ 10 kHz;

**Technical Note:** In 3A001.b.10, F is the offset from the operating frequency in Hz and f is the operating frequency in MHz.

b.11. "Frequency synthesizer" "electronic assemblies" having a "frequency switching time" as specified by any of the following:

b.11.a. Less than 143 ps;

b.11.b. Less than 100  $\mu$ s for any frequency change exceeding 2.2 GHz within the synthesized frequency range exceeding 4.8 GHz but not exceeding 31.8 GHz;

b.11.c. [Reserved]

b.11.d. Less than 500  $\mu$ s for any frequency change exceeding 550 MHz within the synthesized frequency range exceeding 31.8 GHz but not exceeding 37 GHz; or

b.11.e. Less than 100  $\mu$ s for any frequency change exceeding 2.2 GHz within the synthesized frequency range exceeding 37 GHz but not exceeding 90 GHz; or

b.11.f. [Reserved]

b.11.g. Less than 1 ms within the synthesized frequency range exceeding 90 GHz;

*N.B.: For general purpose "signal analyzers", signal generators, network analyzers and microwave test receivers, see 3A002.c, 3A002.d, 3A002.e and 3A002.f, respectively.*

b.12. 'Transmit/receive modules,' 'transmit/receive MMICs,' 'transmit modules,' and 'transmit MMICs,' rated for operation at frequencies above 2.7 GHz and having all of the following:

b.12.a. A peak saturated power output (in watts),  $P_{\text{sat}}$ , greater than 505.62 divided by the maximum operating frequency (in GHz) squared [ $P_{\text{sat}} > 505.62 \text{ W} * \text{GHz}^2 / f_{\text{GHz}}^2$ ] for any channel;

b.12.b. A "fractional bandwidth" of 5% or greater for any channel;

b.12.c. Any planar side with length d (in cm) equal to or less than 15 divided by the lowest operating frequency in GHz [ $d \leq 15 \text{ cm} * \text{GHz} * N / f_{\text{GHz}}$ ] where N is the number of transmit or transmit/receive channels; and

b.12.d. An electronically variable phase shifter per channel.

**Technical Notes:**

1. A 'transmit/receive module' is a multifunction "electronic assembly" that provides bi-directional amplitude and phase control for transmission and reception of signals.

2. A 'transmit module' is an "electronic assembly" that provides amplitude and phase control for transmission of signals.

3. A 'transmit/receive MMIC' is a multifunction "MMIC" that provides bi-directional amplitude and phase control for transmission and reception of signals.

4. A 'transmit MMIC' is a "MMIC" that provides amplitude and phase control for transmission of signals.

5. 2.7 GHz should be used as the lowest operating frequency ( $f_{\text{GHz}}$ ) in the formula in 3A001.b.4.12.c for transmit/receive or transmit modules that have a rated operation range extending downward to 2.7 GHz and below [ $d \leq 15 \text{ cm} * \text{GHz} * N / 2.7 \text{ GHz}$ ].

6. 3A001.b.12 applies to 'transmit/receive modules' or 'transmit modules' with or

without a heat sink. The value of *d* in 3A001.b.12.c does not include any portion of the 'transmit/receive module' or 'transmit module' that functions as a heat sink.

7. 'Transmit/receive modules' or 'transmit modules,' 'transmit/receive MMICs' or 'transmit MMICs' may or may not have *N* integrated radiating antenna elements where *N* is the number of transmit or transmit/receive channels.

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

c.1. Surface acoustic wave and surface skimming (shallow bulk) acoustic wave devices, having any of the following:

c.1.a. A carrier frequency exceeding 6 GHz;

c.1.b. A carrier frequency exceeding 1 GHz, but not exceeding 6 GHz and having any of the following:

c.1.b.1. A 'frequency side-lobe rejection' exceeding 65 dB;

c.1.b.2. A product of the maximum delay time and the bandwidth (time in  $\mu$ s 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  $\mu$ s; *or*

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

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

c.1.c.2. A dispersive delay of more than 10  $\mu$ s; *or*

c.1.c.3. A 'frequency side-lobe rejection' exceeding 65 dB and a bandwidth greater than 100 MHz;

**Technical Note:** 'Frequency side-lobe rejection' is the maximum rejection value specified in data sheet.

c.2. Bulk (volume) acoustic wave devices that permit the direct processing of signals at frequencies exceeding 6 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;

**Note:** 3A001.c does not control acoustic wave devices that are limited to a single band pass, low pass, high pass or notch filtering, or resonating function.

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 and having 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. 'Cells' as follows:

e.1.a. 'Primary cells' having an 'energy density' exceeding 550 Wh/kg at 293 K (20 °C);

e.1.b. 'Secondary cells' having an 'energy density' exceeding 350 Wh/kg at 293 K (20 °C);

**Technical Notes:** 1. For the purpose of 3A001.e.1., 'energy density' (Wh/kg) is calculated from the nominal voltage multiplied by the nominal capacity in ampere-hours (Ah) divided by the mass in kilograms. If the nominal capacity is not stated, energy density is calculated from the nominal voltage squared then multiplied by the discharge duration in hours divided by the discharge load in Ohms and the mass in kilograms.

2. For the purpose of 3A001.e.1., a 'cell' is defined as an electrochemical device, which has positive and negative electrodes, an electrolyte, and is a source of electrical energy. It is the basic building block of a battery.

3. For the purpose of 3A001.e.1.a., a 'primary cell' is a 'cell' that is not designed to be charged by any other source.

4. For the purpose of 3A001.e.1.b., a 'secondary cell' is a 'cell' that is designed to be charged by an external electrical source.

**Note:** 3A001.e. does not control batteries, including single-cell batteries.

e.2. High energy storage capacitors as follows:

e.2.a. Capacitors with a repetition rate of less than 10 Hz (single shot capacitors) and 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) and 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 and 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<sup>2</sup>;

e.4. Solar cells, cell-interconnect-coverglass (CIC) assemblies, solar panels, and solar arrays, which are "space-qualified," having a minimum average efficiency exceeding 20% at an operating temperature of 301 K (28 °C) under simulated 'AM0' illumination with an irradiance of 1,367 Watts per square meter (W/m<sup>2</sup>);

**Technical Note:** 'AM0,' or 'Air Mass Zero,' refers to the spectral irradiance of sunlight in the earth's outer atmosphere when the distance between the earth and sun is one astronomical unit (AU).

f. Rotary input type absolute position encoders having an "accuracy" equal to or less (better) than  $\pm 1.0$  second of arc and "specially designed" encoder rings, discs or scales therefor;

g. Solid-state pulsed power switching thyristor devices and 'thyristor modules', using either electrically, optically, or electron radiation controlled switch methods and having any of the following:

g.1. A maximum turn-on current rate of rise (di/dt) greater than 30,000 A/ $\mu$ s and off-state voltage greater than 1,100 V; *or*

g.2. A maximum turn-on current rate of rise (di/dt) greater than 2,000 A/ $\mu$ s and having all of the following:

g.2.a. An off-state peak voltage equal to or greater than 3,000 V; *and*

g.2.b. A peak (surge) current equal to or greater than 3,000 A;

**Note 1:** 3A001.g. includes:

—Silicon Controlled Rectifiers (SCRs)

—Electrical Triggering Thyristors (ETTs)

—Light Triggering Thyristors (LTTs)

—Integrated Gate Commutated Thyristors (IGCTs)

—Gate Turn-off Thyristors (GTOs)

—MOS Controlled Thyristors (MCTs)

—Solidtrons

**Note 2:** 3A001.g. does not control thyristor devices and 'thyristor modules' incorporated into equipment designed for civil railway or "civil aircraft" applications.

**Technical Note:** For the purposes of 3A001.g, a "thyristor module" contains one or more thyristor devices.

h. Solid-state power semiconductor switches, diodes, or 'modules', having all of the following:

h.1. Rated for a maximum operating junction temperature greater than 488 K (215 °C);

h.2. Repetitive peak off-state voltage (blocking voltage) exceeding 300 V; *and*

h.3. Continuous current greater than 1 A.

**Technical Note:** For the purposes of 3A001.h, 'modules' contain one or more solid-state power semiconductor switches or diodes.

**Note 1:** Repetitive peak off-state voltage in 3A001.h includes drain to source voltage, collector to emitter voltage, repetitive peak reverse voltage and peak repetitive off-state blocking voltage.

**Note 2:** 3A001.h. includes:

—Junction Field Effect Transistors (JFETs)

—Vertical Junction Field Effect Transistors (VJFETs)

—Metal Oxide Semiconductor Field Effect Transistors (MOSFETs)

—Double Diffused Metal Oxide Semiconductor Field Effect Transistor (DMOSFET)

—Insulated Gate Bipolar Transistor (IGBT)

—High Electron Mobility Transistors (HEMTs)

—Bipolar Junction Transistors (BJTs)  
 —Thyristors and Silicon Controlled Rectifiers (SCRs)  
 —Gate Turn-Off Thyristors (GTOs)  
 —Emitter Turn-Off Thyristors (ETOs)  
 —PiN Diodes  
 —Schottky Diodes

**Note 3:** 3A001.h. does not apply to switches, diodes, or ‘modules’, incorporated into equipment designed for civil automobile, civil railway, or ‘civil aircraft’ applications.

■ 23. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, ECCN 3A002 is revised to read as follows:

**3A002 General purpose ‘electronic assemblies,’ modules and equipment, as follows (see List of Items Controlled).**

#### License Requirements

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 2
MT applies to 3A002.h when the parameters in 3A101.a.2.b are met or exceeded.	MT Column 1
AT applies to entire entry.	AT Column 1

#### Reporting Requirements

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

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*LVS:* \$3000: 3A002.a, .e, .f, and .g  
 \$5000: 3A002.c to .d, and .h (unless controlled for MT);

*GBS:* Yes, for 3A002.h (unless controlled for MT)

*CIV:* Yes, for 3A002.h (unless controlled for MT)

#### Special Conditions for STA

*STA:* License Exception STA may not be used to ship any item in 3A002.g.1 to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

#### List of Items Controlled

*Related Controls:* See Category XV(e)(9) of the USML for certain ‘space-qualified’ atomic frequency standards ‘subject to the ITAR’ (see 22 CFR parts 120 through 130). See also 3A101, 3A992 and 9A515.x.

*Related Definitions:* Constant percentage bandwidth filters are also known as octave or fractional octave filters.

#### Items:

a. Recording equipment and oscilloscopes, as follows:  
 a.1–a.5 [Reserved]  
*N.B.:* For waveform digitizers and transient recorders, see 3A002.h.

**Technical Notes:** 1. 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.

2. ‘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.

3. For the purposes of 3A002.a.5.c, acquisition can be triggered internally or externally.

a.6. Digital data recorders having all of the following:

a.6.a. A sustained ‘continuous throughput’ of more than 6.4 Gbit/s to disk or solid-state drive memory; *and*

a.6.b. A processor that performs analysis of radio frequency signal data while it is being recorded;

**Technical Notes:** 1. For recorders with a parallel bus architecture, the ‘continuous throughput’ rate is the highest word rate multiplied by the number of bits in a word.

2. ‘Continuous throughput’ is the fastest data rate the instrument can record to disk or solid-state drive memory without the loss of any information while sustaining the input digital data rate or digitizer conversion rate.

a.7. Real-time oscilloscopes having a vertical root-mean-square (rms) noise voltage of less than 2% of full-scale at the vertical scale setting that provides the lowest noise value for any input 3dB bandwidth of 60 GHz or greater per channel;

**Note:** 3A002.a.7 does not apply to equivalent-time sampling oscilloscopes.

b. [Reserved]

c. ‘Signal analyzers’ as follows:

c.1. ‘Signal analyzers’ having a 3 dB resolution bandwidth (RBW) exceeding 10 MHz anywhere within the frequency range exceeding 31.8 GHz but not exceeding 37 GHz;

c.2. ‘Signal analyzers’ having Displayed Average Noise Level (DANL) less (better) than—150 dBm/Hz anywhere within the frequency range exceeding 43.5 GHz but not exceeding 90 GHz;

c.3. ‘Signal analyzers’ having a frequency exceeding 90 GHz;

c.4. ‘Signal analyzers’ having all of the following:

c.4.a. ‘Real-time bandwidth’ exceeding 170 MHz; *and*

c.4.b. Having any of the following:  
 c.4.b.1. 100% probability of discovery, with less than a 3 dB reduction from full amplitude due to gaps or windowing effects, of signals having a duration of 15 μs or less; *or*

c.4.b.2. A ‘frequency mask trigger’ function, with 100% probability of trigger (capture) for signals having a duration of 15 μs or less;

#### Technical Notes:

1. Probability of discovery in 3A002.c.4.b.1 is also referred to as probability of intercept or probability of capture.

2. For the purposes of 3A002.c.4.b.1, the duration for 100% probability of discovery is equivalent to the minimum signal duration

necessary for the specified level measurement uncertainty.

**Note:** 3A002.c.4 does not apply to those ‘signal analyzers’ using only constant percentage bandwidth filters (also known as octave or fractional octave filters).

c.5. [Reserved]

d. Signal generators having any of the following:

d.1. Specified to generate pulse-modulated signals having all of the following, anywhere within the frequency range exceeding 31.8 GHz but not exceeding 37 GHz:

d.1.a. ‘Pulse duration’ of less than 25 ns; *and*

d.1.b. On/off ratio equal to or exceeding 65 dB;

d.2. An output power exceeding 100 mW (20 dBm) anywhere within the frequency range exceeding 43.5 GHz but not exceeding 90 GHz;

d.3. A ‘frequency switching time’ as specified by any of the following:

d.3.a. [Reserved];

d.3.b. Less than 100 μs for any frequency change exceeding 2.2 GHz within the frequency range exceeding 4.8 GHz but not exceeding 31.8 GHz;

d.3.c. [Reserved]

d.3.d. Less than 500 μs for any frequency change exceeding 550 MHz within the frequency range exceeding 31.8 GHz but not exceeding 37 GHz; *or*

d.3.e. Less than 100 μs for any frequency change exceeding 2.2 GHz within the frequency range exceeding 37 GHz but not exceeding 90 GHz;

d.3.f. [Reserved]

d.4. Single sideband (SSB) phase noise, in dBc/Hz, specified as being any of the following:

d.4.a. Less (better) than— $(126 + 20 \log_{10} F - 20 \log_{10} f)$  for anywhere within the range of  $10 \text{ Hz} \leq F \leq 10 \text{ kHz}$  anywhere within the frequency range exceeding 3.2 GHz but not exceeding 90 GHz; *or*

d.4.b. Less (better) than— $(206 - 20 \log_{10} f)$  for anywhere within the range of  $10 \text{ kHz} < F \leq 100 \text{ kHz}$  anywhere within the frequency range exceeding 3.2 GHz but not exceeding 90 GHz; *or*

**Technical Note:** In 3A002.d.4, F is the offset from the operating frequency in Hz and f is the operating frequency in MHz.

d.5. A maximum frequency exceeding 90 GHz;

**Note 1:** For the purpose of 3A002.d, signal generators include arbitrary waveform and function generators.

**Note 2:** 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.

**Technical Notes:** 1. The maximum frequency of an arbitrary waveform or function generator is calculated by dividing the sample rate, in samples/second, by a factor of 2.5.

2. For the purposes of 3A002.d.1.a, ‘pulse duration’ is defined as the time interval from

the point on the leading edge that is 50% of the pulse amplitude to the point on the trailing edge that is 50% of the pulse amplitude.

e. Network analyzers having any of the following:

e.1. An output power exceeding 31.62 mW (15 dBm) anywhere within the operating frequency range exceeding 43.5 GHz but not exceeding 90 GHz;

e.2. An output power exceeding 1 mW (0 dBm) anywhere within the operating frequency range exceeding 90 GHz but not exceeding 110 GHz;

e.3. 'Nonlinear vector measurement functionality' at frequencies exceeding 50 GHz but not exceeding 110 GHz; or

**Technical Note:** 'Nonlinear vector measurement functionality' is an instrument's ability to analyze the test results of devices driven into the large-signal domain or the non-linear distortion range.

e.4. A maximum operating frequency exceeding 110 GHz;

f. Microwave test receivers having all of the following:

f.1. Maximum operating frequency exceeding 110 GHz; and

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

g. Atomic frequency standards being any of the following:

g.1. "Space-qualified";

g.2. Non-rubidium and having a long-term stability less (better) than  $1 \times 10^{-11}/\text{month}$ ; or

g.3. Non-"space-qualified" and having all of the following:

g.3.a. Being a rubidium standard;

g.3.b. Long-term stability less (better) than  $1 \times 10^{-11}/\text{month}$ ; and

g.3.c. Total power consumption of less than 1 Watt.

h. "Electronic assemblies," modules or equipment, specified to perform all of the following:

h.1. Analog-to-digital conversions meeting any of the following:

h.1.a. A resolution of 8 bit or more, but less than 10 bit, with an input sample rate greater than 1.3 billion samples per second;

h.1.b. A resolution of 10 bit or more, but less than 12 bit, with an input sample rate greater than 1.0 billion samples per second;

h.1.c. A resolution of 12 bit or more, but less than 14 bit, with an input sample rate greater than 1.0 billion samples per second;

h.1.d. A resolution of 14 bit or more but less than 16 bit, with an input sample rate greater than 400 million samples per second; or

h.1.e. A resolution of 16 bit or more with an input sample rate greater than 180 million samples per second; and

h.2. Any of the following:

h.2.a. Output of digitized data;

h.2.b. Storage of digitized data; or

h.2.c. Processing of digitized data;

*N.B.: Digital data recorders, oscilloscopes, "signal analyzers," signal generators, network analyzers and microwave test receivers, are specified by 3A002.a.6, 3A002.a.7, 3A002.c, 3A002.d, 3A002.e and 3A002.f, respectively.*

**Technical Note:** For multiple-channel "electronic assemblies" or modules, control

status is determined by the highest single-channel specified performance.

**Note:** 3A002.h includes ADC cards, waveform digitizers, data acquisition cards, signal acquisition boards and transient recorders.

■ 24. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, ECCN 3A991 is revised to read as follows:

**3A991 Electronic devices, and "components" not controlled by 3A001.**

**License Requirements**

*Reason for Control:* AT

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

**License Requirements Note:** See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating "information security" functionality, and associated "software" and "technology" for the "production" or "development" of such microprocessors.

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* N/A

*GBS:* N/A

*CIV:* N/A

**List of Items Controlled**

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

a. "Microprocessor microcircuits", "microcomputer microcircuits", and microcontroller microcircuits having any of the following:

a.1. A performance speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more;

a.2. A clock frequency rate exceeding 25 MHz; or

a.3. 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 of 2.5 Mbyte/s.

b. Storage integrated circuits, as follows:

b.1. Electrical erasable programmable read-only memories (EEPROMs) with a storage capacity;

b.1.a. Exceeding 16 Mbits per package for flash memory types; or

b.1.b. Exceeding either of the following limits for all other EEPROM types:

b.1.b.1. Exceeding 1 Mbit per package; or

b.1.b.2. Exceeding 256 kbit per package and a maximum access time of less than 80 ns;

b.2. Static random access memories (SRAMs) with a storage capacity:

b.2.a. Exceeding 1 Mbit per package; or

b.2.b. Exceeding 256 kbit per package and a maximum access time of less than 25 ns;

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

c.1. A resolution of 8 bit or more, but less than 12 bit, with an output rate greater than 200 million words per second;

c.2. A resolution of 12 bit with an output rate greater than 105 million words per second;

c.3. A resolution of more than 12 bit but equal to or less than 14 bit with an output rate greater than 10 million words per second; or

c.4. A resolution of more than 14 bit with an output rate greater than 2.5 million words per second.

d. Field programmable logic devices having a maximum number of single-ended digital input/outputs between 200 and 700;

e. Fast Fourier Transform (FFT) processors having a rated execution time for a 1,024 point complex FFT of less than 1 ms.

f. Custom integrated circuits for which either 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:

f.1. More than 144 terminals; or

f.2. A typical "basic propagation delay time" of less than 0.4 ns.

g. Traveling-wave 'vacuum electronic devices,' pulsed or continuous wave, as follows:

g.1. Coupled cavity devices, or derivatives thereof;

g.2. Helix devices based on helix, folded waveguide, or serpentine waveguide circuits, or derivatives thereof, with any of the following:

g.2.a. An "instantaneous bandwidth" of half an octave or more; and

g.2.b. The product of the rated average output power (expressed in kW) and the maximum operating frequency (expressed in GHz) of more than 0.2;

g.2.c. An "instantaneous bandwidth" of less than half an octave; and

g.2.d. The product of the rated average output power (expressed in kW) and the maximum operating frequency (expressed in GHz) of more than 0.4;

h. Flexible waveguides designed for use at frequencies exceeding 40 GHz;

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

i.1. A carrier frequency exceeding 1 GHz; or

i.2. A carrier frequency of 1 GHz or less; and

i.2.a. A frequency side-lobe rejection exceeding 55 Db;

i.2.b. A product of the maximum delay time and bandwidth (time in microseconds and bandwidth in MHz) of more than 100; or

i.2.c. A dispersive delay of more than 10 microseconds.

j. Cells as follows:

j.1. Primary cells having an energy density of 550 Wh/kg or less at 293 K (20 °C);

j.2. Secondary cells having an energy density of 300 Wh/kg or less at 293 K (20 °C).

**Note :** 3A991.j. does not control batteries, including single cell batteries.

**Technical Notes:** 1. For the purpose of 3A991.j energy density (Wh/kg) is calculated from the nominal voltage multiplied by the nominal capacity in ampere-hours divided by the mass in kilograms. If the nominal capacity is not stated, energy density is calculated from the nominal voltage squared then multiplied by the discharge duration in hours divided by the discharge load in Ohms and the mass in kilograms.

2. For the purpose of 3A991.j, a 'cell' is defined as an electrochemical device, which has positive and negative electrodes, and electrolyte, and is a source of electrical energy. It is the basic building block of a battery.

3. For the purpose of 3A991.j.1, a 'primary cell' is a 'cell' that is not designed to be charged by any other source.

4. For the purpose of 3A991.j.2., a 'secondary cell' is a 'cell' that is designed to be charged by an external electrical source.

k. "Superconductive" electromagnets or solenoids "specially designed" to be fully charged or discharged in less than one minute, having all of the following:

**Note:** 3A991.k does not control "superconductive" electromagnets or solenoids designed for Magnetic Resonance Imaging (MRI) medical equipment.

k.1. Maximum energy delivered during the discharge divided by the duration of the discharge of more than 500 kJ per minute;

k.2. Inner diameter of the current carrying windings of more than 250 mm; *and*

k.3. Rated for a magnetic induction of more than 8T or "overall current density" in the winding of more than 300 A/mm<sup>2</sup>.

l. Circuits or systems for electromagnetic energy storage, containing "components" manufactured from "superconductive" materials "specially designed" for operation at temperatures below the "critical temperature" of at least one of their "superconductive" constituents, having all of the following:

l.1. Resonant operating frequencies exceeding 1 MHz;

l.2. A stored energy density of 1 MJ/M<sup>3</sup> or more; *and*

l.3. A discharge time of less than 1 ms;

m. Hydrogen/hydrogen-isotope thytrons of ceramic-metal construction and rate for a peak current of 500 A or more;

n. Digital integrated circuits based on any compound semiconductor having an equivalent gate count of more than 300 (2 input gates).

o. Solar cells, cell-interconnect-coverglass (CIC) assemblies, solar panels, and solar

arrays, which are "space qualified" and not controlled by 3A001.e.4.

■ 25. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, ECCN 3B001 is revised 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.**

**License Requirements**

*Reason for Control:* NS, AT

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$500

*GBS:* Yes, except a.3 (molecular beam epitaxial growth equipment using gas sources), .e (automatic loading multi-chamber central wafer handling systems *only* if connected to equipment controlled by 3B001. a.3, or .f), and .f (lithography equipment).

*CIV:* Yes for equipment controlled by 3B001.a.1 and a.2.

**List of Items Controlled**

*Related Controls:* See also 3B991.

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

a. Equipment designed for epitaxial growth as follows:

a.1. Equipment designed or modified to produce 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;

**Note:** 3B001.a.1 includes atomic layer epitaxy (ALE) equipment.

a.2. Metal Organic Chemical Vapor Deposition (MOCVD) reactors designed for compound semiconductor epitaxial growth of material having two or more of the following elements: aluminum, gallium, indium, arsenic, phosphorus, antimony, or nitrogen;

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

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

b.1. [Reserved];

b.2. Being designed and optimized to operate at a beam energy of 20 keV or more and a beam current of 10 mA or more for hydrogen, deuterium, or helium implant;

b.3. Direct write capability;

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"; *or*

b.5. Being designed and optimized to operate at beam energy of 20keV or more and a beam current of 10mA or more for silicon implant into a semiconductor material "substrate" heated to 600 °C or greater;

c. [Reserved]

d. [Reserved]

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 functionally different 'semiconductor process tools' controlled by 3B001.a.1, 3B001.a.2, 3B001.a.3 or 3B001.b are designed 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 "specially designed" for parallel wafer processing.

**Technical Notes:**

1. For the purpose of 3B001.e, 'semiconductor process tools' refers to modular tools that provide physical processes for semiconductor production that are functionally different, such as deposition, implant or thermal processing.

2. For the purpose of 3B001.e, 'sequential multiple wafer processing' means the capability to process each wafer in different 'semiconductor process tools', such as by transferring each wafer from one tool to a second tool and on to a third tool with the automatic loading multi-chamber central wafer handling systems.

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 and having any of the following:

f.1.a. A light source wavelength shorter than 193 nm; *or*

f.1.b. Capable of producing a pattern with a "Minimum Resolvable Feature size" (MRF) of 45 nm or less;

**Technical Note:** The 'Minimum Resolvable Feature size' (MRF) is calculated by the following formula:

*(an exposure light source*

*wavelength in nm) x (K factor)*

*MRF =*

*-----*  
*numerical aperture*

where the K factor = 0.35

f.2 Imprint lithography equipment capable of production features of 45 nm or less;

**Note:** 3B001.f.2 includes:

- Micro contact printing tools
- Hot embossing tools
- Nano-imprint lithography tools
- Step and flash imprint lithography (S-FIL) tools

f.3. Equipment “specially designed” for mask making having all of the following:

f.3.a. A deflected focused electron beam, ion beam or “laser” beam; *and*

f.3.b. Having any of the following:

f.3.b.1. A Full-Width Half-Maximum (FWHM) spot size smaller than 65 nm and an image placement less than 17 nm (mean + 3 sigma); *or*

f.3.b.2. [Reserved]

f.3.b.3. A second-layer overlay error of less than 23 nm (mean + 3 sigma) on the mask;

f.4. Equipment designed for device processing using direct writing methods, having all of the following:

f.4.a. A deflected focused electron beam; *and*

f.4.b. Having any of the following:

f.4.b.1. A minimum beam size equal to or smaller than 15 nm; *or*

f.4.b.2. An overlay error less than 27 nm (mean + 3 sigma);

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

h. Multi-layer masks with a phase shift layer not specified by 3B001.g and having any of the following:

h.1. Made on a mask “substrate blank” from glass specified as having less than 7 nm/cm birefringence; *or*

h.2. Designed to be used by lithography equipment having a light source wavelength less than 245 nm;

**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.

i. Imprint lithography templates designed for integrated circuits by 3A001.

■ 26. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, ECCN 3C001 is revised to read as follows:

**3C001 Hetero-epitaxial materials consisting of a “substrate” having stacked epitaxially grown multiple layers of any of the following (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

AT applies to entire entry. AT Column 1

**Reporting Requirements**

See § 743.1 of the EAR for reporting requirements for exports under License

Exceptions, and Validated End-User authorizations

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$3000

*GBS:* N/A

*CIV:* N/A

**List of Items Controlled**

*Related Controls:* This entry does not control equipment or material whose functionality has been unalterably disabled are not controlled.

*Related Definitions:* N/A

*Items:*

- a. Silicon (Si);
- b. Germanium (Ge);
- c. Silicon Carbide (SiC); *or*
- d. “III/V compounds” of gallium or indium.

**Note:** 3C001.d does not apply to a “substrate” having one or more P-type epitaxial layers of GaN, InGaN, AlGaN, InAlN, InAlGaIn, GaP, GaAs, AlGaAs, InP, InGaP, AlInP or InGaAlP, independent of the sequence of the elements, except if the P-type epitaxial layer is between N-type layers.

■ 27. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, ECCN 3E001 is revised 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 3A980, 3A981, 3A991, 3A992, or 3A999), 3B (except 3B991 or 3B992) or 3C (except 3C992).**

**License Requirements**

*Reason for Control:* NS, MT, NP, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
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NS applies to “technology” for items controlled by 3A001, 3A002, 3A003, 3B001, 3B002, or 3C001 to 3C006. NS Column 1

MT applies to “technology” for equipment controlled by 3A001 or 3A101 for MT reasons. MT Column 1

NP applies to “technology” for equipment controlled by 3A001, 3A201, or 3A225 to 3A234 for NP reasons. NP Column 1

AT applies to entire entry. AT Column 1

**License Requirements Note:** See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating “information security” functionality, and associated “software” and

“technology” for the “production” or “development” of such microprocessors.

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*CIV:* Yes for “technology” for equipment in 3B001.c.

*TSR:* Yes, except N/A for MT, and “technology” for the “development” or “production” of: (a) Vacuum electronic device amplifiers described in 3A001.b.8, having operating frequencies exceeding 19 GHz; (b) solar cells, coverglass-interconnect-cells or covered-interconnect-cells (CIC) “assemblies,” solar arrays and/or solar panels described in 3A001.e.4; (c) “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers in 3A001.b.2; and (d) discrete microwave transistors in 3A001.b.3.

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship or transmit “technology” according to the General Technology Note for the “development” or “production” of equipment specified by ECCNs 3A002.g.1 or 3B001.a.2 to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR). License Exception STA may not be used to ship or transmit “technology” according to the General Technology Note for the “development” or “production” of components specified by ECCN 3A001.b.2 or b.3 to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* (1) “Technology” according to the General Technology Note for the “development” or “production” of certain “space-qualified” atomic frequency standards described in Category XV(e)(9), MMICs described in Category XV(e)(14), and oscillators described in Category XV(e)(15) of the USML are “subject to the ITAR” (see 22 CFR parts 120 through 130). See also 3E101, 3E201 and 9E515. (2) “Technology” for “development” or “production” of “Microwave Monolithic Integrated Circuits” (“MMIC”) amplifiers in 3A001.b.2 is controlled in this ECCN 3E001; 5E001.d refers only to that additional “technology” “required” for telecommunications.

*Related Definition:* N/A

*Items:*

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

**Note 1:** 3E001 does not control “technology” for equipment or “components” controlled by 3A003.

**Note 2:** 3E001 does not control “technology” for integrated circuits controlled by 3A001.a.3 to a.12, having all of the following:

- (a) Using “technology” at or above 0.130 μm; and
- (b) Incorporating multi-layer structures with three or fewer metal layers.

■ 28. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, ECCN 3E002 is revised to read as follows:

**3E002 “Technology” according to the General Technology Note other than that controlled in 3E001 for the “development” or “production” of a “microprocessor microcircuit,” “micro-computer microcircuit” and microcontroller microcircuit core, having an arithmetic logic unit with an access width of 32 bits or more and any of the following features or characteristics (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

**License Requirements Note:** See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating “information security” functionality, and associated “software” and “technology” for the “production” or “development” of such microprocessors.

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*CIV:* Yes, for deemed exports, as described in § 734.13(a)(2) of the EAR, of “technology” for the “development” or “production” of general purpose microprocessor cores with a vector processor unit with operand length of 64-bit or less, 64-bit floating operations not exceeding 50 GFLOPS, or 16-bit or more floating-point operations not exceeding 50 GMACS (billions of 16-bit fixed-point multiply-accumulate operations per second). License Exception *CIV* does not apply to ECCN 3E002 technology also required for the development or production of items controlled under ECCNs beginning with 3A, 3B, or 3C, or to ECCN 3E002 technology also controlled under ECCN 3E003.

*TSR:* Yes.

**List of Items Controlled**

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

- a. A ‘vector processor unit’ designed to perform more than two calculations on floating-point vectors (one dimensional arrays of 32-bit or larger numbers) simultaneously;

**Technical Note:** A ‘vector processor unit’ is a processor element with built-in instructions that perform multiple calculations on floating-point vectors (one-dimensional arrays of 32-bit or larger numbers) simultaneously, having at least one vector arithmetic logic unit and vector registers of at least 32 elements each.

- b. Designed to perform more than four 64-bit or larger floating-point operation results per cycle; *or*
- c. Designed to perform more than eight 16-bit fixed-point multiply-accumulate results per cycle (e.g., digital manipulation of analog information that has been previously converted into digital form, also known as digital “signal processing”).

**Note 1:** 3E002 does not control “technology” for multimedia extensions.

**Note 2:** 3E002 does not control “technology” for microprocessor cores, having all of the following:

- a. Using “technology” at or above 0.130 μm; *and*
- b. Incorporating multi-layer structures with five or fewer metal layers.

**Note 3:** 3E002 includes “technology” for the “development” or “production” of digital signal processors and digital array processors.

■ 29. In Supplement No. 1 to part 774 (the Commerce Control List), Category 3, ECCN 3E003 is revised to read as follows:

**3E003 Other “technology” for the “development” or “production” of the following (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*CIV:* N/A  
*TSR:* Yes, except .f and .g

**List of Items Controlled**

*Related Controls:* See 3E001 for silicon-on-insulation (SOI) technology for the “development” or “production” related to radiation hardening of integrated circuits.

*Related Definitions:* N/A

- Items:*
- a. Vacuum microelectronic devices;
  - b. Hetero-structure semiconductor electronic 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. ‘Vacuum electronic devices’ operating at frequencies of 31.8 GHz or higher.

■ 30. In Supplement No. 1 to part 774 (the Commerce Control List), Category 4, ECCN 4A003 is revised to read as follows:

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

**License Requirements**

*Reason for Control:* NS, CC, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to 4A003.b and .c.	NS Column 1
NS applies to 4A003.e and .g.	NS Column 2
CC applies to “digital computers” for computerized finger-print equipment.	CC Column 1
AT applies to entire entry (refer to 4A994 for controls on “digital computers” with an APP > 0.0128 but ≤ 16 WT).	AT Column 1

**Note:** For all destinations, except those countries in Country Group E:1 or E:2 of Supplement No. 1 to part 740 of the EAR, no license is required (NLR) for computers with an “Adjusted Peak Performance” (“APP”) not exceeding 16 Weighted TeraFLOPS (WT) and for “electronic assemblies” described in 4A003.c that are not capable of exceeding an “Adjusted Peak Performance” (“APP”) exceeding 16 Weighted TeraFLOPS (WT) in aggregation, except certain transfers as set forth in § 746.3 (Iraq).

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

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

other technical parameters. See § 740.7 of the EAR.

CIV: Yes, for 4A003.g.

#### List of Items Controlled

*Related Controls:* See also 4A994 and 4A980

*Related Definitions:* N/A

*Items:*

**Note 1:** 4A003 includes the following:

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

—Array processors;

—Digital signal processors;

—Logic processors;

—Equipment designed for ‘image enhancement.’

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

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

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

*N.B. 1: The control status of ‘signal processing’ or ‘image enhancement’ equipment ‘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. [Reserved]

b. ‘Digital computers’ having an ‘Adjusted Peak Performance’ (‘APP’) exceeding 16 weighted TeraFLOPS (WT);

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

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

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

d. to f. [Reserved]

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

g. Equipment ‘specially designed’ for aggregating the performance of ‘digital computers’ by providing external interconnections which allow communications at unidirectional data rates exceeding 2.0 Gbyte/s per link.

**Note:** 4A003.g does not control internal interconnection equipment (e.g., backplanes,

buses) passive interconnection equipment, ‘network access controllers’ or ‘communication channel controllers.’

■ 31. In Supplement No. 1 to part 774 (the Commerce Control List), Category 4, ECCN 4D001 is revised to read as follows:

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

#### License Requirements

*Reason for Control:* NS, CC, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
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NS applies to entire entry.	NS Column 1
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CC applies to ‘software’ for computerized finger-print equipment controlled by 4A003 for CC reasons.	CC Column 1
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AT applies to entire entry.	AT Column 1
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#### Reporting Requirements

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

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*CIV:* N/A

*TSR:* Yes, except for ‘software’ for the ‘development’ or ‘production’ of commodities with an ‘Adjusted Peak Performance’ (‘APP’) exceeding 16 WT.

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

#### Special Conditions for STA

*STA:* License Exception STA may not be used to ship or transmit ‘software’ ‘specially designed’ for the ‘development’ or ‘production’ of equipment specified by ECCN 4A001.a.2 or for the ‘development’ or ‘production’ of ‘digital computers’ having an ‘Adjusted Peak Performance’ (‘APP’) exceeding 16 Weighted TeraFLOPS (WT) to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

#### List of Items Controlled

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

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

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

b.1. ‘Digital computers’ having an ‘Adjusted Peak Performance’ (‘APP’) exceeding 8.0 Weighted TeraFLOPS (WT);

b.2. ‘Electronic assemblies’ ‘specially designed’ or modified for enhancing performance by aggregation of processors so

that the ‘APP’ of the aggregation exceeds the limit in 4D001.b.1.

■ 32. In Supplement No. 1 to part 774 (the Commerce Control List), Category 4, ECCN 4D993 is revised to read as follows:

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

#### License Requirements

*Reason for Control:* AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
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AT applies to entire entry.	AT Column 1
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#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*CIV:* N/A

*TSR:* N/A

#### List of Items Controlled

*Related Controls:* N/A

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

*Items:*

a. ‘Program’ proof and validation ‘software’ using mathematical and analytical techniques and designed or modified for ‘programs’ having more than 500,000 ‘source code’ instructions;

b. ‘Software’ allowing the automatic generation of ‘source codes’ from data acquired online from external sensors described in the Commerce Control List; or

c. Operating system ‘software’ ‘specially designed’ for ‘real-time processing’ equipment that guarantees a ‘global interrupt latency time’ of less than 20 microseconds.

■ 33. In Supplement No. 1 to part 774 (the Commerce Control List), Category 4, ECCN 4E001 is revised to read as follows:

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

#### License Requirements

*Reason for Control:* NS, MT, CC, AT

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

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*CIV:* N/A

*TSR:* Yes, except for “technology” for the “development” or “production” of commodities with an “Adjusted Peak Performance” (“APP”) exceeding 16 WT.

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

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship or transmit “technology” according to the General Technology Note for the “development” or “production” of any of the following equipment or “software”: a. Equipment specified by ECCN 4A001.a.2; b. “Digital computers” having an ‘Adjusted Peak Performance’ (“APP”) exceeding 16 Weighted TeraFLOPS (WT); or c. “software” specified in the License Exception STA paragraph found in the License Exception section of ECCN 4D001 to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

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

or 4A994) or 4D (except 4D980, 4D993, 4D994).

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

b.1. “Digital computers” having an “Adjusted Peak Performance” (“APP”) exceeding 8.0 Weighted TeraFLOPS (WT);

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

■ 34. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Part 1, ECCN 5A001 is revised to read as follows:

**5A001 Telecommunications systems, equipment, “components” and “accessories,” as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, SL, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to 5A001.a, .e, .b.5, f.3 and .h .....	NS Column 1
NS applies to 5A001.b (except .b.5), .c, .d, f (except f.3), and .g .....	NS Column 2
SL applies to 5A001.f.1 .....	A license is required for all destinations, as specified in § 742.13 of the EAR. Accordingly, a column specific to this control does not appear on the Commerce Country Chart (Supplement No. 1 to Part 738 of the EAR)
	<b>Note to SL paragraph:</b> <i>This licensing requirement does not supersede, nor does it implement, construe or limit the scope of any criminal statute, including, but not limited to the Omnibus Safe Streets Act of 1968, as amended</i>
AT applies to entire entry .....	AT Column 1

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* N/A for 5A001.a, b.5, .e, f.3 and .h; \$5000 for 5A001.b.1, .b.2, .b.3, .b.6, .d, f.2, f.4, and .g; \$3000 for 5A001.c.

*GBS:* Yes, except 5A001.a, b.5, e, and h.

*CIV:* Yes, except 5A001.a, b.3, b.5, e, and h.

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship any commodity in 5A001.b.3, .b.5 or .h to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* (1) See USML Category XI for controls on direction-finding “equipment” including types of “equipment” in ECCN 5A001.e and any other military or intelligence electronic “equipment” that is “subject to the ITAR.” (2) See USML Category XI(a)(4)(iii) for controls on electronic attack and jamming “equipment” defined in 5A001.f and .h that are subject to the ITAR. (3) See also ECCNs 5A101, 5A980, and 5A991.

*Related Definitions:* N/A

*Items:*

a. Any type of telecommunications equipment having any of the following characteristics, functions or features:

a.1. “Specially designed” to withstand transitory electronic effects or electromagnetic pulse effects, both arising from a nuclear explosion;

a.2. Specially hardened to withstand gamma, neutron or ion radiation; or

a.3. “Specially designed” to operate outside the temperature range from 218 K (– 55 °C) to 397 K (124 °C).

**Note:** 5A001.a.3 applies only to electronic equipment.

b. Telecommunication systems and equipment, and “specially designed” “components” and “accessories” therefor, having any of the following characteristics, functions or features:

b.1 Being underwater untethered communications systems having any of the following:

b.1.a. An acoustic carrier frequency outside the range from 20 kHz to 60 kHz;

b.1.b. Using an electromagnetic carrier frequency below 30 kHz; or

b.1.c. Using electronic beam steering techniques; or

b.1.d. Using “lasers” or light-emitting diodes (LEDs), with an output wavelength

greater than 400 nm and less than 700 nm, in a “local area network”;

b.2. Being radio equipment operating in the 1.5 MHz to 87.5 MHz band and having all of the following:

b.2.a. Automatically predicting and selecting frequencies and “total digital transfer rates” per channel to optimize the transmission; and

b.2.b. Incorporating a linear power amplifier configuration having a capability to support multiple signals simultaneously at an output power of 1 kW or more in the frequency range of 1.5 MHz or more but less than 30 MHz, or 250 W or more in the frequency range of 30 MHz or more but not exceeding 87.5 MHz, over an “instantaneous bandwidth” of one octave or more and with an output harmonic and distortion content of better than – 80 dB;

b.3. Being radio equipment employing “spread spectrum” techniques, including “frequency hopping” techniques, not controlled in 5A001.b.4 and having any of the following:

b.3.a. User programmable spreading codes; or

b.3.b. A total transmitted bandwidth which is 100 or more times the bandwidth of any one information channel and in excess of 50 kHz;

**Note:** 5A001.b.3.b does not control radio equipment “specially designed” for use with any of the following:

- a. Civil cellular radio-communications systems; or
- b. Fixed or mobile satellite Earth stations for commercial civil telecommunications.

**Note:** 5A001.b.3 does not control equipment operating at an output power of 1 W or less.

b.4 Being radio equipment employing ultra-wideband modulation techniques, having user programmable channelizing codes, scrambling codes, or network identification codes and having any of the following:

- b.4.a. A bandwidth exceeding 500 MHz; or
- b.4.b. A “fractional bandwidth” of 20% or more;
- b.5. Being digitally controlled radio receivers having all of the following:
  - b.5.a. More than 1,000 channels;
  - b.5.b. A ‘channel switching time’ of less than 1 ms;
  - b.5.c. Automatic searching or scanning of a part of the electromagnetic spectrum; and
  - b.5.d. Identification of the received signals or the type of transmitter; or

**Note:** 5A001.b.5 does not control radio equipment “specially designed” for use with civil cellular radio-communications systems.

**Technical Note:** ‘Channel switching time’: the time (*i.e.*, delay) to change from one receiving frequency to another, to arrive at or within  $\pm 0.05\%$  of the final specified receiving frequency. Items having a specified frequency range of less than  $\pm 0.05\%$  around their center frequency are defined to be incapable of channel frequency switching.

b.6. Employing functions of digital “signal processing” to provide ‘voice coding’ output at rates of less than 700 bit/s.

**Technical Notes:**

1. For variable rate ‘voice coding’, 5A001.b.6 applies to the ‘voice coding’ output of continuous speech.
2. For the purpose of 5A001.b.6, ‘voice coding’ is defined as the technique to take samples of human voice and then convert these samples of human voice into a digital signal taking into account specific characteristics of human speech.
- c. Optical fibers of more than 500 m in length and specified by the manufacturer as being capable of withstanding a ‘proof test’ tensile stress of  $2 \times 10^9$  N/m<sup>2</sup> or more;
 

*N.B.: For underwater umbilical cables, see 8A002.a.3.*

**Technical Note:** ‘Proof Test’: On-line or off-line production screen testing that dynamically applies a prescribed tensile stress over a 0.5 to 3 m length of fiber at a running rate of 2 to 5 m/s while passing between capstans approximately 150 mm in diameter. The ambient temperature is a nominal 293 K (20 °C) and relative humidity 40%. Equivalent national standards may be used for executing the proof test.

d. “Electronically steerable phased array antennas” as follows:

- d.1. Rated for operation above 31.8 GHz, but not exceeding 57 GHz, and having an

Effective Radiated Power (ERP) equal to or greater than +20 dBm (22.15 dBm Effective Isotropic Radiated Power (EIRP));

d.2. Rated for operation above 57 GHz, but not exceeding 66 GHz, and having an ERP equal to or greater than +24 dBm (26.15 dBm EIRP);

d.3. Rated for operation above 66 GHz, but not exceeding 90 GHz, and having an ERP equal to or greater than +20 dBm (22.15 dBm EIRP);

d.4. Rated for operation above 90 GHz;

**Note:** 5A001.d does not control “electronically steerable phased array antennas” for landing systems with instruments meeting ICAO standards covering Microwave Landing Systems (MLS).

e. Radio direction finding equipment operating at frequencies above 30 MHz and having all of the following, and “specially designed” “components” therefor:

- e.1. “Instantaneous bandwidth” of 10 MHz or more; and
- e.2. Capable of finding a Line Of Bearing (LOB) to non-cooperating radio transmitters with a signal duration of less than 1 ms;
- f. Mobile telecommunications interception or jamming equipment, and monitoring equipment therefor, as follows, and “specially designed” “components” therefor:
  - f.1. Interception equipment designed for the extraction of voice or data, transmitted over the air interface;

f.2. Interception equipment not specified in 5A001.f.1, designed for the extraction of client device or subscriber identifiers (*e.g.*, IMSI, TIMSI or IMEI), signaling, or other metadata transmitted over the air interface;

f.3. Jamming equipment “specially designed” or modified to intentionally and selectively interfere with, deny, inhibit, degrade or seduce mobile telecommunication services and performing any of the following:

- f.3.a. Simulate the functions of Radio Access Network (RAN) equipment;
- f.3.b. Detect and exploit specific characteristics of the mobile telecommunications protocol employed (*e.g.*, GSM); or
- f.3.c. Exploit specific characteristics of the mobile telecommunications protocol employed (*e.g.*, GSM);

f.4. Radio Frequency (RF) monitoring equipment designed or modified to identify the operation of items specified in 5A001.f.1, 5A001.f.2 or 5A001.f.3.

**Note:** 5A001.f.1 and 5A001.f.2 do not apply to any of the following:

- a. Equipment “specially designed” for the interception of analog Private Mobile Radio (PMR), IEEE 802.11 WLAN;
- b. Equipment designed for mobile telecommunications network operators; or
- c. Equipment designed for the “development” or “production” of mobile telecommunications equipment or systems.

*N.B. 1: See also the International Traffic in Arms Regulations (ITAR) (22 CFR parts 120–130). For items specified by 5A001.f.1 (including as previously specified by 5A001.i), see also 5A980 and the U.S. Munitions List (22 CFR part 121).*

*N.B. 2: For radio receivers see 5A001.b.5.*  
g. Passive Coherent Location (PCL) systems or equipment, “specially designed” for

detecting and tracking moving objects by measuring reflections of ambient radio frequency emissions, supplied by non-radar transmitters.

**Technical Note:** Non-radar transmitters may include commercial radio, television or cellular telecommunications base stations.

**Note:** 5A001.g. does not control:

- a. Radio-astronomical equipment; or
- b. Systems or equipment, that require any radio transmission from the target.

h. Counter Improvised Explosive Device (IED) equipment and related equipment, as follows:

- h.1. Radio Frequency (RF) transmitting equipment, not specified by 5A001.f, designed or modified for prematurely activating or preventing the initiation of Improvised Explosive Devices (IEDs);
- h.2. Equipment using techniques designed to enable radio communications in the same frequency channels on which co-located equipment specified by 5A001.h.1 is transmitting.

*N.B.: See also Category XI of the International Traffic in Arms Regulations (ITAR) (22 CFR parts 120–130).*

i. [Reserved]

*N.B.: See 5A001.f.1 for items previously specified by 5A001.i.*

■ 35. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Part 1, ECCN 5B001 is revised to read as follows:

**5B001 Telecommunication test, inspection and production equipment, “components” and “accessories,” as follows (See List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$5000

*GBS:* Yes

*CIV:* Yes

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship 5B001.a equipment and “specially designed” “components” or “accessories” therefor, “specially designed” for the “development,” or “production” of equipment, functions or features specified by in ECCN 5A001.b.3, .b.5 or .h to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

List of Items Controlled

Related Controls: See also 5B991.

Related Definition: N/A

Items:

a. Equipment and "specially designed" components or "accessories" therefor, "specially designed" for the "development" or "production" of equipment, functions or features, controlled by 5A001;

Note: 5B001.a does not apply to 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. [Reserved]
b.2. Equipment employing a "laser" and having any of the following:

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

b.2.b. [Reserved]

b.2.c. [Reserved]

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

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

b.3. [Reserved]

b.4. Radio equipment employing Quadrature-Amplitude-Modulation (QAM) techniques above level 1,024.

36. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Part 1, ECCN 5E001 is revised to read as follows:

5E001 "Technology" as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, SL, AT

Country chart (see Supp. No. 1 to part 738)

Control(s)

NS applies to entire entry ..... NS Column 1

SL applies to "technology" for the "development" or "production" of equipment, functions or features controlled by 5A001.f.1, or for the "development" or "production" of "software" controlled by ECCN 5D001.a (for 5A001.f.1). A license is required for all destinations, as specified in §742.13 of the EAR. Accordingly, a column specific to this control does not appear on the Commerce Country Chart (Supplement No. 1 to Part 738 of the EAR)

Note to SL paragraph: This licensing requirement does not supersede, nor does it implement, construe or limit the scope of any criminal statute, including, but not limited to the Omnibus Safe Streets Act of 1968, as amended

AT applies to entire entry ..... AT Column 1

Reporting Requirements

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

List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

CIV: N/A

TSR: Yes, except for exports or reexports to destinations outside of those countries listed in Country Group A:5 (See Supplement No. 1 to part 740 of the EAR) of "technology" controlled by 5E001.a for the "development" or "production" of the following:

- (1) Items controlled by 5A001.b.5 or 5A001.h; or
(2) "Software" controlled by 5D001.a that is "specially designed" for the "development" or "production" of equipment, functions or features controlled by 5A001.b.5 or 5A001.h.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "technology" according to the General Technology Note for the "development" or "production" of equipment, functions or features specified by 5A001.b.3, .b.5 or .h; or for "software" in 5D001.a that is specified in the STA paragraph in the License Exception section of ECCN 5D001 to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: (1) See also 5E101, 5E980 and 5E991. (2) "Technology" for "development" or "production" of "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers that meet the control criteria given at 3A001.b.2 is controlled in 3E001; 5E001.d refers only to that

additional "technology" "required" for telecommunications.

Related Definitions: N/A

Items:

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

b. Specific "technology", as follows:
b.1. "Technology" "required" 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.

Note: 5E001.b.4 does not apply to "technology" for the "development" of any of the following:

a. Civil cellular radio-communications systems; or
b. Fixed or mobile satellite Earth stations for commercial civil telecommunications.

c. "Technology" according the General Technology Note for the "development" or "production" of any of the following:

c.1. [Reserved]

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

c.2.a. A transmission wavelength exceeding 1,750 nm;

c.2.b. [Reserved]

c.2.c. [Reserved]

c.2.d. Employing wavelength division multiplexing techniques of optical carriers at less than 100 GHz spacing; 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 commercial TV systems.

N.B.: For "technology" for the "development" or "production" of non-telecommunications equipment employing a "laser", see Product Group E of Category 6, e.g., 6E00x

c.3. Equipment employing "optical switching" and having a switching time less than 1 ms; or

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

c.4.a. Quadrature-Amplitude-Modulation (QAM) techniques above level 1,024; 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 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.4.c. Operating in the 1.5 MHz to 87.5 MHz band and incorporating adaptive techniques providing more than 15 dB suppression of an interfering signal; or

c.5. [Reserved]

c.6. Mobile equipment having all of the following:

c.6.a. Operating at an optical wavelength greater than or equal to 200nm and less than or equal to 400nm; and

c.6.b. Operating as a "local area network";

d. "Technology" according to the General Technology Note for the "development" or "production" of "Monolithic Microwave

Integrated Circuit” (“MMIC”) amplifiers “specially designed” for telecommunications and that are any of the following:

**Technical Note:** For purposes of 5E001.d, the parameter peak saturated power output may also be referred to on product data sheets as output power, saturated power output, maximum power output, peak power output, or peak envelope power output.

d.1. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz with a “fractional bandwidth” greater than 15%, and having any of the following:

d.1.a. A peak saturated power output greater than 75 W (48.75 dBm) at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;

d.1.b. A peak saturated power output greater than 55 W (47.4 dBm) at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;

d.1.c. A peak saturated power output greater than 40 W (46 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; or

d.1.d. A peak saturated power output greater than 20 W (43 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

d.2. Rated for operation at frequencies exceeding 6.8 GHz up to and including 16 GHz with a “fractional bandwidth” greater than 10%, and having any of the following:

d.2.a. A peak saturated power output greater than 10W (40 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz; or

d.2.b. A peak saturated power output greater than 5W (37 dBm) at any frequency exceeding 8.5 GHz up to and including 16 GHz;

d.3. Rated for operation with a peak saturated power output greater than 3 W (34.77 dBm) at any frequency exceeding 16 GHz up to and including 31.8 GHz, and with a “fractional bandwidth” of greater than 10%;

d.4. Rated for operation with a peak saturated power output greater than 0.1n W (–70 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;

d.5. Rated for operation with a peak saturated power output greater than 1 W (30 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz, and with a “fractional bandwidth” of greater than 10%;

d.6. Rated for operation with a peak saturated power output greater than 31.62 mW (15 dBm) at any frequency exceeding 43.5 GHz up to and including 75 GHz, and with a “fractional bandwidth” of greater than 10%;

d.7. Rated for operation with a peak saturated power output greater than 10 mW (10 dBm) at any frequency exceeding 75 GHz up to and including 90 GHz, and with a “fractional bandwidth” of greater than 5%;

d.8. Rated for operation with a peak saturated power output greater than 0.1 nW (–70 dBm) at any frequency exceeding 90 GHz;

e. “Technology” according to the General Technology Note for the “development” or “production” of electronic devices and circuits, “specially designed” for

telecommunications and containing “components” manufactured from “superconductive” materials, “specially designed” for operation at temperatures below the “critical temperature” of at least one of the “superconductive” constituents and having any of the following:

e.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

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

■ 37. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Part 2 is amended by revising the Notes at the beginning of Part 2 to read as follows:

#### Part 2—Information Security

**Note 1:** [Reserved]

**Note 2:** Category 5—Part 2, “information security” products, when accompanying their user for the user’s personal use or as tools of trade, are eligible for License Exceptions TMP or BAG, subject to the terms and conditions of these license exceptions.

**Note 3:** Cryptography Note: ECCNs 5A002, 5D002.a.1, .b, and .c.1, do not control items as follows:

a. Items meeting all of the following:

1. Generally available to the public by being sold, without restriction, from stock at retail selling points by means of any of the following:

- a. Over-the-counter transactions;
- b. Mail order transactions;
- c. Electronic transactions; or
- d. Telephone call transactions;

2. The cryptographic functionality cannot be easily changed by the user;

3. Designed for installation by the user without further substantial support by the supplier; and

4. When necessary, details of the items are accessible and will be provided, upon request, to the appropriate authority in the exporter’s country in order to ascertain compliance with conditions described in paragraphs a.1 through a.3 of this Note;

b. Hardware components or ‘executable software’, of existing items described in paragraph a. of this Note, that have been designed for these existing items, and meeting all of the following:

1. “Information security” is not the primary function or set of functions of the component or ‘executable software’;

2. The component or ‘executable software’ does not change any cryptographic functionality of the existing items, or add new cryptographic functionality to the existing items;

3. The feature set of the component or ‘executable software’ is fixed and is not designed or modified to customer specification; and

4. When necessary, as determined by the appropriate authority in the exporter’s country, details of the component or ‘executable software’, and details of relevant end-items are accessible and will be provided

to the authority upon request, in order to ascertain compliance with conditions described above.

**Technical Note:** For the purpose of the Cryptography Note, ‘executable software’ means “software” in executable form, from an existing hardware component excluded from 5A002, by the Cryptography Note.

**Note:** ‘Executable software’ does not include complete binary images of the “software” running on an end-item.

#### Note to the Cryptography Note:

1. To meet paragraph a. of Note 3, all of the following must apply:

a. The item is of potential interest to a wide range of individuals and businesses; and

b. The price and information about the main functionality of the item are available before purchase without the need to consult the vendor or supplier. A simple price inquiry is not considered to be a consultation.

2. In determining eligibility of paragraph a. of Note 3, BIS may take into account relevant factors such as quantity, price, required technical skill, existing sales channels, typical customers, typical use or any exclusionary practices of the supplier.

**N.B. to Note 3 (Cryptography Note):** You must submit a classification request or self-classification report to BIS for mass market encryption commodities and software eligible for the Cryptography Note employing a key length greater than 64 bits for the symmetric algorithm (or, for commodities and software not implementing any symmetric algorithms, employing a key length greater than 768 bits for asymmetric algorithms or greater than 128 bits for elliptic curve algorithms) in accordance with the requirements of § 740.17(b) of the EAR in order to be released from the “EI” and “NS” controls of ECCN 5A002 or 5D002.

■ 38. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Part 2, ECCN 5A002 is revised to read as follows:

**5A002 “Information security” systems, equipment and “components,” as follows (see List of Items Controlled).**

#### License Requirements

*Reason for Control:* NS, AT, EI

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 1
AT applies to entire entry.	AT Column 1
EI applies to entire entry	Refer to § 742.15 of the EAR

**License Requirements Note:** See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating “information security” functionality, and associated “software” and

“technology” for the “production” or “development” of such microprocessors.

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* Yes: \$500 for “components”. N/A for systems and equipment.

*GBS:* N/A

*CIV:* N/A

*ENC:* Yes for certain EI controlled commodities, see § 740.17 of the EAR for eligibility.

**List of Items Controlled**

*Related Controls:* (1) ECCN 5A002.a controls “components” providing the means or functions necessary for “information security.” All such “components” are presumptively “specially designed” and controlled by 5A002.a. (2) See USML Categories XI (including XI(b)) and XIII(b) (including XIII(b)(2)) for controls on systems, equipment, and components described in 5A002.d or .e that are subject to the ITAR. (3) For Global Navigation Satellite Systems (GNSS) receiving equipment containing or employing decryption see 7A005, and for related decryption “software” and “technology” see 7D005 and 7E001. (4) Noting that items may be controlled elsewhere on the CCL, examples of items not controlled by ECCN 5A002.a.4 include the following: (a) An automobile where the only ‘cryptography for data confidentiality’ ‘in excess of 56 bits of symmetric key length, or equivalent’ is performed by a Category 5—Part 2 Note 3 eligible mobile telephone that is built into the car. In this case, secure phone communications support a non-primary function of the automobile but the mobile telephone (equipment), as a standalone item, is not controlled by ECCN 5A002 because it is excluded by the Cryptography Note (Note 3) (See ECCN 5A992.c). (b) An exercise bike with an embedded Category 5—Part 2 Note 3 eligible web browser, where the only controlled cryptography is performed by the web browser. In this case, secure web browsing supports a non-primary function of the exercise bike but the web browser (“software”), as a standalone item, is not controlled by ECCN 5D002 because it is excluded by the Cryptography Note (Note 3) (See ECCN 5D992.c). (5) After classification or self-classification in accordance with § 740.17(b) of the EAR, mass market encryption commodities that meet eligibility requirements are released from “EI” and “NS” controls. These commodities are designated 5A992.c.

*Related Definitions:* N/A

*Items:*

a. Designed or modified to use ‘cryptography for data confidentiality’ having ‘in excess of 56 bits of symmetric key length, or equivalent’, where that cryptographic capability is usable without “cryptographic activation” or has been activated, as follows:

- a.1. Items having “information security” as a primary function;
- a.2. Digital communication or networking systems, equipment or components, not specified in paragraph 5A002.a.1;

a.3. Computers, other items having information storage or processing as a primary function, and components therefor, not specified in paragraphs 5A002.a.1 or .a.2;

*N.B.:* For operating systems see also 5D002.a.1 and .c.1.

a.4. Items, not specified in paragraphs 5A002.a.1 to a.3, where the ‘cryptography for data confidentiality’ having ‘in excess of 56 bits of symmetric key length, or equivalent’ meets all of the following:

a.4.a. It supports a non-primary function of the item; *and*

a.4.b. It is performed by incorporated equipment or “software” that would, as a standalone item, be specified by ECCNs 5A002, 5A003, 5A004, 5B002 or 5D002.

*N.B.:* To paragraph a.4: See *Related Control Paragraph (4) of this ECCN 5A002 for examples of items not controlled by 5A002.a.4.*

**Technical Notes:** 1. For the purposes of 5A002.a, ‘cryptography for data confidentiality’ means “cryptography” that employs digital techniques and performs any cryptographic function other than any of the following:

- 1.a. “Authentication;”
- 1.b. Digital signature;
- 1.c. Data integrity;
- 1.d. Non-repudiation;
- 1.e. Digital rights management, including the execution of copy-protected “software;”
- 1.f. Encryption or decryption in support of entertainment, mass commercial broadcasts or medical records management; *or*
- 1.g. Key management in support of any function described in paragraphs 1.a to 1.f of this Technical Note paragraph 1.

2. For the purposes of 5A002.a, ‘in excess of 56 bits of symmetric key length, or equivalent’ means any of the following:

- 2.a. A “symmetric algorithm” employing a key length in excess of 56 bits, not including parity bits; *or*
- 2.b. An “asymmetric algorithm” where the security of the algorithm is based on any of the following:
  - 2.b.1. Factorization of integers in excess of 512 bits (*e.g.*, RSA);
  - 2.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*
  - 2.b.3. Discrete logarithms in a group other than mentioned in paragraph 2.b.2 of this Technical Note in excess of 112 bits (*e.g.*, Diffie-Hellman over an elliptic curve).

**Note 1:** Details of items must be accessible and provided upon request, in order to establish any of the following:

- a. Whether the item meets the criteria of 5A002.a.1 to a.4; *or*
- b. Whether the cryptographic capability for data confidentiality specified by 5A002.a is usable without “cryptographic activation.”

**Note 2:** 5A002.a does not control any of the following items, or specially designed “information security” components therefor:

- a. Smart cards and smart card ‘readers/writers’ as follows:

- a.1. A smart card or an electronically readable personal document (*e.g.*, token coin, e-passport) that meets any of the following:
  - a.1.a. The cryptographic capability meets all of the following:

a.1.a.1. It is restricted for use in any of the following:

- a.1.a.1.a. Equipment or systems, not described by 5A002.a.1 to a.4;
- a.1.a.1.b. Equipment or systems, not using ‘cryptography for data confidentiality’ having ‘in excess of 56 bits of symmetric key length, or equivalent;’ *or*
- a.1.a.1.c. Equipment or systems, excluded from 5A002.a by entries b. to f. of this Note; *and*
- a.1.a.2. It cannot be reprogrammed for any other use; *or*
- a.1.b. Having all of the following:
  - a.1.b.1. It is specially designed and limited to allow protection of ‘personal data’ stored within;
  - a.1.b.2. Has been, or can only be, personalized for public or commercial transactions or individual identification; *and*
  - a.1.b.3. Where the cryptographic capability is not user-accessible;

**Technical Note to paragraph a.1.b of Note 2:** ‘Personal data’ includes any data specific to a particular person or entity, such as the amount of money stored and data necessary for “authentication.”

a.2. ‘Readers/writers’ specially designed or modified, and limited, for items specified by paragraph a.1 of this Note;

**Technical Note to paragraph a.2 of Note 2:** ‘Readers/writers’ include equipment that communicates with smart cards or electronically readable documents through a network.

b. Cryptographic equipment specially designed and limited for banking use or ‘money transactions’;

**Technical Note to paragraph b. of Note 2:** ‘Money transactions’ in 5A002 Note 2 paragraph b. includes the collection and settlement of fares or credit functions.

c. Portable or mobile radiotelephones for civil use (*e.g.*, for use with commercial civil cellular radio communication systems) that are not capable of transmitting encrypted data directly to another radiotelephone or equipment (other than Radio Access Network (RAN) equipment), nor of passing encrypted data through RAN equipment (*e.g.*, Radio Network Controller (RNC) or Base Station Controller (BSC));

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

e. Portable or mobile radiotelephones and similar client wireless devices for civil use, that implement only published or commercial cryptographic standards (except for anti-piracy functions, which may be non-published) and also meet the provisions of paragraphs a.2 to a.4 of the Cryptography Note (Note 3 in Category 5—Part 2), that have been customized for a specific civil industry application with features that do not affect the cryptographic functionality of these original non-customized devices;

f. Items, where the “information security” functionality is limited to wireless “personal area network” functionality, meeting all of the following:

f.1. Implement only published or commercial cryptographic standards; and

f.2. The cryptographic capability is limited to a nominal operating range not exceeding 30 meters according to the manufacturer's specifications, or not exceeding 100 meters according to the manufacturer's specifications for equipment that cannot interconnect with more than seven devices;

g. Mobile telecommunications Radio Access Network (RAN) equipment designed for civil use, which also meet the provisions of paragraphs a.2 to a.4 of the Cryptography Note (Note 3 in Category 5—Part 2), having an RF output power limited to 0.1W (20 dBm) or less, and supporting 16 or fewer concurrent users;

h. Routers, switches or relays, where the "information security" functionality is limited to the tasks of "Operations, Administration or Maintenance" ("OAM") implementing only published or commercial cryptographic standards; *or*

i. General purpose computing equipment or servers, where the "information security" functionality meets all of the following:

i.1. Uses only published or commercial cryptographic standards; *and*

i.2. Is any of the following:

i.2.a. Integral to a CPU that meets the provisions of Note 3 in Category 5—Part 2;

i.2.b. Integral to an operating system that is not specified by 5D002; *or*

i.2.c. Limited to "OAM" of the equipment.

b. Designed or modified to enable, by means of "cryptographic activation," an item to achieve or exceed the controlled performance levels for functionality specified by 5A002.a that would not otherwise be enabled;

*Control(s)*

NS applies to entire entry .....  
 AT applies to entire entry .....  
 EI applies to "software" in 5D002.a.1, a.3, .b, c.1 and c.3, for commodities or "software" controlled for EI reasons in ECCNs 5A002, 5A004 or 5D002.

**License Requirements Note:** See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating "information security" functionality, and associated "software" and "technology" for the "production" or "development" of such microprocessors.

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*CIV:* N/A  
*TSR:* N/A  
*ENC:* Yes for certain EI controlled software, see § 740.17 of the EAR for eligibility.

c. Designed or modified to use or perform "quantum cryptography;"

**Technical Note:** "Quantum cryptography" is also known as Quantum Key Distribution (QKD).

d. Designed or modified to use cryptographic techniques to generate channelizing codes, scrambling codes or network identification codes, for systems using ultra-wideband modulation techniques and having any of the following:

- d.1. A bandwidth exceeding 500 MHz; *or*
- d.2. A "fractional bandwidth" of 20% or more;
- e. Designed or modified to use cryptographic techniques to generate the spreading code for "spread spectrum" systems, not specified by 5A002.d, including the hopping code for "frequency hopping" systems.

■ 39. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Part 2, ECCN 5A003 is revised to read as follows:

**5A003 "Systems," "equipment" and "components," for non-cryptographic "information security," as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* Yes: \$500 for "components."  
*N/A* for systems and equipment.  
*GBS:* N/A  
*CIV:* N/A

**List of Items Controlled**

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

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

**Note:** 5A003.a applies only to physical layer security. For the purpose of 5A003.a, the physical layer includes Layer 1 of the Reference Model of Open Systems Interconnection (OSI) (ISO/IEC 7498–1).

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

■ 40. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Part 2, ECCN 5D002 is revised to read as follows:

**5D002 "Software" as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT, EI

*Country chart (see Supp. No. 1 to part 738)*

NS Column 1  
 AT Column 1  
 Refer to § 742.15 of the EAR

**Note:** Encryption software is controlled because of its functional capacity, and not because of any informational value of such software; such software is not accorded the same treatment under the EAR as other "software"; and for export licensing purposes, encryption software is treated under the EAR in the same manner as a commodity included in ECCN 5A002

**List of Items Controlled**

*Related Controls:* After classification or self-classification in accordance with § 740.17(b) of the EAR, mass market encryption software that meet eligibility requirements are released from "EI" and "NS" controls. This software is designated as 5D992.c.

*Related Definitions:* 5D002.a controls "software" designed or modified to use "cryptology" employing digital or analog techniques to ensure "information security."

*Items:*

a. "Software" "specially designed" or modified for the "development," "production" or "use" of any of the following:

- a.1. Equipment specified by 5A002 or "software" specified by 5D002.c.1;

a.2. Equipment specified by 5A003 or "software" specified by 5D002.c.2; *or*

a.3. Equipment specified by 5A004 or "software" specified by 5D002.c.3;

b. "Software" designed or modified to enable, by means of "cryptographic activation," an item to meet the criteria for functionality specified by 5A002.a, that would not otherwise be met;

c. "Software" having the characteristics of, or performing or simulating the functions of, any of the following:

- c.1. Equipment specified by 5A002.a, .c, .d *or* .e;

**Note:** 5D002.c.1 does not apply to "software" limited to the tasks of "OAM" implementing only published or commercial cryptographic standards.

- c.2. Equipment specified by 5A003; *or*

c.3. Equipment specified by 5A004.  
d. [Reserved]

*N.B.: See 5D002.b for items formerly specified in 5D002.d.*

■ 41. In Supplement No. 1 to part 774 (the Commerce Control List), Category 5—Part 2, ECCN 5E002 is revised to read as follows:

**5E002 “Technology” as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT, EI

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 1
AT applies to entire entry.	AT Column 1
EI applies to “technology” in 5E002.a for commodities or “software” controlled for EI reasons in ECCNs 5A002, 5A004 or 5D002, and to “technology” in 5E002.b.	Refer to § 742.15 of the EAR

**License Requirements Notes:**

(1) See § 744.17 of the EAR for additional license requirements for microprocessors having a processing speed of 5 GFLOPS or more and an arithmetic logic unit with an access width of 32 bit or more, including those incorporating “information security” functionality, and associated “software” and “technology” for the “production” or “development” of such microprocessors.

(2) When a person performs or provides technical assistance that incorporates, or otherwise draws upon, “technology” that was either obtained in the United States or is of US-origin, then a release of the “technology” takes place. Such technical assistance, when rendered with the intent to aid in the “development” or “production” of encryption commodities or software that would be controlled for “EI” reasons under ECCN 5A002, 5A004 or 5D002, may require authorization under the EAR even if the underlying encryption algorithm to be implemented is from the public domain or is not of U.S.-origin.

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*CIV:* N/A

*TSR:* N/A

*ENC:* Yes for certain EI controlled technology, see § 740.17 of the EAR for eligibility.

**List of Items Controlled**

*Related Controls:* See also 5E992. This entry does not control “technology” “required” for the “use” of equipment excluded from control under the Related Controls paragraph or the Technical Notes in ECCN 5A002 or “technology” related to equipment excluded from control under ECCN 5A002.

*Related Definitions:* N/A

*Items:*

a. “Technology” according to the General Technology Note for the “development,” “production” or “use” of equipment controlled by 5A002, 5A003, 5A004 or 5B002, or of “software” controlled by 5D002.a or 5D002.c.

b. “Technology” to enable, by means of “cryptographic activation,” an item to meet the criteria for functionality specified by 5A002.a, that would not otherwise be met.

**Note:** 5E002 includes “information security” technical data resulting from procedures carried out to evaluate or determine the implementation of functions, features or techniques specified in Category 5—Part 2.

■ 42. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6, ECCN 6A001 is revised to read as follows:

**6A001 Acoustic systems, equipment and “components,” as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$3000; N/A for 6A001.a.1.b.1 object detection and location systems having a transmitting frequency below 5 kHz or a sound pressure level exceeding 210 dB (reference 1 µPa at 1 m) for equipment with an operating frequency in the band from 30 kHz to 2 kHz inclusive; 6A001.a.1.e, 6A001.a.2.a.1, a.2.a.2, 6A001.a.2.a.3, a.2.a.5, a.2.a.6, 6A001.a.2.b; processing equipment controlled by 6A001.a.2.c, and “specially designed” for real-time application with towed acoustic hydrophone arrays; a.2.e.1, a.2.e.2; and bottom or bay cable systems controlled by 6A001.a.2.f and having processing equipment “specially designed” for real-time application with bottom or bay cable systems.

*GBS:* Yes for 6A001.a.1.b.4.

*CIV:* Yes for 6A001.a.1.b.4.

**Special Conditions for STA**

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

**List of Items Controlled**

*Related Controls:* See also 6A991

*Related Definitions:* N/A

*Items:*

a. Marine acoustic systems, equipment and “specially designed” “components” therefor, as follows:

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

**Note:** 6A001.a.1 does not control equipment as follows:

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.a. Acoustic seabed survey equipment as follows:

a.1.a.1. Surface vessel survey equipment designed for sea bed topographic mapping and having all of the following:

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

a.1.a.1.b. Designed to measure seabed topography at seabed depths exceeding 600 m;

a.1.a.1.c. ‘Sounding resolution’ less than 2; and

a.1.a.1.d. ‘Enhancement’ of the depth “accuracy” through compensation for all the following:

a.1.a.1.d.1. Motion of the acoustic sensor;

a.1.a.1.d.2. In-water propagation from sensor to the seabed and back; and

a.1.a.1.d.3. Sound speed at the sensor;

**Technical Notes:**

1. ‘Sounding resolution’ is the swath width (degrees) divided by the maximum number of soundings per swath.

2. ‘Enhancement’ includes the ability to compensate by external means.

a.1.a.2. Underwater survey equipment designed for seabed topographic mapping and having any of the following:

**Technical Note:** The acoustic sensor pressure rating determines the depth rating of the equipment specified by 6A001.a.1.a.2.

a.1.a.2.a. Having all of the following:

a.1.a.2.a.1. Designed or modified to operate at depths exceeding 300 m; and

a.1.a.2.a.2. ‘Sounding rate’ greater than 3,800 m/s; or

**Technical Note:** ‘Sounding rate’ is the product of the maximum speed (m/s) at which the sensor can operate and the maximum number of soundings per swath assuming 100% coverage. For systems that produce soundings in two directions (3D sonars), the maximum of the ‘sounding rate’ in either direction should be used.

a.1.a.2.b. Survey equipment, not specified by 6A001.a.1.a.2.a, having all of the following:

a.1.a.2.b.1. Designed or modified to operate at depths exceeding 100 m;

a.1.a.2.b.2. Designed to take measurements at an angle exceeding 20° from the vertical;

- a.1.a.2.b.3. Having any of the following:
- a.1.a.2.b.3.a. Operating frequency below 350 kHz; *or*
- a.1.a.2.b.3.b. Designed to measure seabed topography at a range exceeding 200 m from the acoustic sensor; *and*
- a.1.a.2.b.4. 'Enhancement' of the depth "accuracy" through compensation of all of the following:
- a.1.a.2.b.4.a. Motion of the acoustic sensor;
- a.1.a.2.b.4.b. In-water propagation from sensor to the seabed and back; *and*
- a.1.a.2.b.4.c. Sound speed at the sensor.
- a.1.a.3. Side Scan Sonar (SSS) or Synthetic Aperture Sonar (SAS), designed for seabed imaging and having all of the following, and specially designed transmitting and receiving acoustic arrays therefor:
- a.1.a.3.a. Designed or modified to operate at depths exceeding 500 m; *and*
- a.1.a.3.b. An 'area coverage rate' of greater than 570 m<sup>2</sup>/s while operating at the maximum range that it can operate with an 'along track resolution' of less than 15 cm; *and*
- a.1.a.3.c. An 'across track resolution' of less than 15 cm;

**Technical Notes:**

1. 'Area coverage rate' (m<sup>2</sup>/s) is twice the product of the sonar range (m) and the maximum speed (m/s) at which the sensor can operate at that range.
2. 'Along track resolution' (cm), for SSS only, is the product of azimuth (horizontal) beamwidth (degrees) and sonar range (m) and 0.873.
3. 'Across track resolution' (cm) is 75 divided by the signal bandwidth (kHz).
- a.1.b Systems or transmitting and receiving arrays, designed for object detection or location, 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 and 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.
3. Piezoelectric elements specified in 6A001.a.1.c include those made from lead-magnesium-niobate/lead-titanate (Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub>, or PMN-PT) single crystals grown from solid solution or lead-indium-niobate/lead-magnesium niobate/lead-titanate (Pb(In<sub>1/2</sub>Nb<sub>1/2</sub>)O<sub>3</sub>-Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub>, or PIN-PMN-PT) single crystals grown from solid solution.

- a.1.c.1. Operating at frequencies below 10 kHz and having any of the following:
- a.1.c.1.a. Not designed for continuous operation at 100% duty cycle and having a radiated 'free-field Source Level (SLRMS)' exceeding (10log(f) + 169.77)dB (reference 1 μPa at 1 m) where f is the frequency in Hertz of maximum Transmitting Voltage Response (TVR) below 10 kHz; *or*
- a.1.c.1.b. Designed for continuous operation at 100% duty cycle and having a continuously radiated 'free-field Source Level (SLRMS)' at 100% duty cycle exceeding (10log(f) + 159.77)dB (reference 1 μPa at 1 m) where f is the frequency in Hertz of maximum Transmitting Voltage Response (TVR) below 10 kHz; *or*

**Technical Note:** The 'free-field Source Level (SLRMS)' is defined along the maximum response axis and in the far field of the acoustic projector. It can be obtained from the Transmitting Voltage Response using the following equation:  $SLRMS = (TVR + 20log V_{RMS}) dB$  (ref 1μPa at 1 m), where  $SLRMS$  is the source level, TVR is the Transmitting Voltage Response and  $V_{RMS}$  is the Driving Voltage of the Projector.

- a.1.c.2. [Reserved]
- N.B. See 6A001.a.1.c.1 for items previously specified in 6A001.a.1.c.2.*
- a.1.c.3. Side-lobe suppression exceeding 22 dB;
- a.1.d. Acoustic systems and equipment, designed to determine the position of surface vessels or underwater vehicles and having all of the following, and "specially designed" "components" therefor:
- a.1.d.1. Detection range exceeding 1,000 m; *and*
- a.1.d.2. Determined position error 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.1.e. Active individual sonars, "specially designed" or modified to detect, locate and automatically classify swimmers or divers, having all of the following, and "specially designed" transmitting and receiving acoustic arrays therefor:

- a.1.e.1. Detection range exceeding 530 m;
- a.1.e.2. Determined position error of less than 15 m rms (root mean square) when measured at a range of 530 m; *and*

- a.1.e.3. Transmitted pulse signal bandwidth exceeding 3 kHz;
- N.B.: For diver detection systems "specially designed" or modified for military use, see the U.S. Munitions List in the International Traffic in Arms Regulations (ITAR) (22 CFR part 121).*

**Note:** For 6A001.a.1.e, where multiple detection ranges are specified for various environments, the greatest detection range is used.

- a.2. Passive systems, equipment and "specially designed" "components" therefor, as follows:
- a.2.a. Hydrophones having any of the following:

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

**Technical Note:** Hydrophones consist of one or more sensing elements producing a single acoustic output channel. Those that contain multiple elements can be referred to as a hydrophone group.

- a.2.a.1. Incorporating continuous flexible sensing elements;
- a.2.a.2. Incorporating flexible assemblies of discrete sensing 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.3. Having any of the following sensing elements:
- a.2.a.3.a. Optical fibers;
- a.2.a.3.b. 'Piezoelectric polymer films' other than polyvinylidene-fluoride (PVDF) and its co-polymers {P(VDF-TrFE) and P(VDF-TFE)};
- a.2.a.3.c. 'Flexible piezoelectric composites';
- a.2.a.3.d. Lead-magnesium-niobate/lead-titanate (i.e., Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub>, or PMN-PT) piezoelectric single crystals grown from solid solution; *or*
- a.2.a.3.e. Lead-indium-niobate/lead-magnesium niobate/lead-titanate (i.e., Pb(In<sub>1/2</sub>Nb<sub>1/2</sub>)O<sub>3</sub>-Pb(Mg<sub>1/3</sub>Nb<sub>2/3</sub>)O<sub>3</sub>-PbTiO<sub>3</sub>, or PIN-PMN-PT) piezoelectric single crystals grown from solid solution;
- a.2.a.4. A 'hydrophone sensitivity' better than -180dB at any depth with no acceleration compensation;
- a.2.a.5. Designed to operate at depths exceeding 35 m with acceleration compensation; *or*
- a.2.a.6. Designed for operation at depths exceeding 1,000 m;

**Technical Notes:**

1. 'Piezoelectric polymer film' sensing elements consist of polarized polymer film that is stretched over and attached to a supporting frame or spool (mandrel).
2. 'Flexible piezoelectric composite' sensing elements consist of piezoelectric ceramic particles or fibers combined with an electrically insulating, acoustically transparent rubber, polymer or epoxy compound, where the compound is an integral part of the sensing elements.
3. '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<sup>-8</sup> V in such a field, while one of -180 dB sensitivity would yield only 10<sup>-9</sup> V output. Thus, -160 dB is better than -180 dB.

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

**Technical Note:** Hydrophones arrays consist of a number of hydrophones providing multiple acoustic output channels.

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 35m;

**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. [Reserved];

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

a.2.b.8. Accelerometer-based hydro-acoustic sensors specified by 6A001.a.2.g;

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;

*N.B.: For inertial heading systems, see 7A003.c.*

a.2.e. Bottom or bay-cable hydrophone arrays having any of the following:

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

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; or

a.2.e.3. Incorporating accelerometer-based hydro-acoustic sensors specified by 6A001.a.2.g;

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;

a.2.g. Accelerometer-based hydro-acoustic sensors having all of the following:

a.2.g.1. Composed of three accelerometers arranged along three distinct axes;

a.2.g.2. Having an overall 'acceleration sensitivity' better than 48 dB (reference 1,000 mV rms per 1g);

a.2.g.3. Designed to operate at depths greater than 35 meters; and

a.2.g.4. Operating frequency below 20 kHz;

**Note:** 6A001.a.2.g does not apply to particle velocity sensors or geophones.

**Note:** 6A001.a.2 also applies to receiving equipment, whether or not related in normal application to separate active equipment, and "specially designed" "components" therefor.

**Technical Notes:**

1. Accelerometer-based hydro-acoustic sensors are also known as vector sensors.

2. 'Acceleration 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 hydro-acoustic sensor, without a preamplifier, is placed in a plane wave acoustic field with an rms acceleration of 1 g (i.e., 9.81 m/s<sup>2</sup>).

b. Correlation-velocity and Doppler-velocity sonar log equipment designed to measure the horizontal speed of the equipment carrier relative to the sea bed, as follows:

b.1. Correlation-velocity sonar log equipment having any of the following characteristics:

b.1.a. Designed to operate at distances between the carrier and the sea bed exceeding 500 m; or

b.1.b. Having speed "accuracy" better than 1% of speed;

b.2. Doppler-velocity sonar log equipment having speed "accuracy" better than 1% of speed;

**Note 1:** 6A001.b does not apply to depth sounders limited to any of the following:

- a. Measuring the depth of water;
- b. Measuring the distance of submerged or buried objects; or
- c. Fish finding.

**Note 2:** 6A001.b does not apply to equipment "specially designed" for installation on surface vessels.

c. [Reserved]

*N.B.: For diver deterrent acoustic systems, see 8A002.r.*

■ 43. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6, ECCN 6A003 is revised to read as follows:

**6A003 Cameras, systems or equipment, and "components" therefor, as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, NP, RS, AT, UN

*Country chart (See Supp. No. 1 to part 738)*

<i>Control(s)</i>	
NS applies to entire entry .....	NS Column 2
NP applies to cameras controlled by 6A003.a.2, a.3 or a.4 and to plug-ins in 6A003.a.6 for cameras controlled by 6A003.a.3 or a.4.	NP Column 1
RS applies to 6A003.b.3, 6A003.b.4.a, 6A003.b.4.c and to items controlled in 6A003.b.4.b that have a frame rate greater than 60 Hz or that incorporate a focal plane array with more than 111,000 elements, or to items in 6A003.b.4.b when being exported or reexported to be embedded in a civil product. (But see § 742.6(a)(2)(iii) and (v) for certain exemptions).	RS Column 1
RS applies to items controlled in 6A003.b.4.b that have a frame rate of 60 Hz or less and that incorporate a focal plane array with not more than 111,000 elements if not being exported or reexported to be embedded in a civil product.	RS Column 2
AT applies to entire entry .....	AT Column 1
UN applies to 6A003.b.3 and b.4 .....	See § 746.1(b) for UN controls.

**License Requirement Note:** Commodities that are not subject to the ITAR but are of the type described in USML Category XII(c) are

controlled as cameras in ECCN 6A003 when they incorporate a camera controlled in this ECCN.

**Reporting Requirements**

See § 743.3 of the EAR for thermal camera reporting for exports that are not

authorized by an individually validated license of thermal imaging cameras controlled by ECCN 6A003.b.4.b to destinations in Country Group A:1 (see Supplement No. 1 to part 740), must be reported to BIS.

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

*LVS*: \$1500, except N/A for 6A003.a.2

through a.6, b.1, b.3 and b.4

*GBS*: Yes for 6A003.a.1

*CIV*: Yes for 6A003.a.1

#### Special Conditions for STA

*STA*: License Exception STA may not be used to ship any commodity in 6A003.b.3 or b.4 to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

#### List of Items Controlled

*Related Controls*: (1) See ECCNs 6E001 (“development”), 6E002 (“production”), and 6E201 (“use”) for technology for items controlled under this entry. (2) Also see ECCN 6A203. (3) See ECCN 0A919 for foreign made military commodities that incorporate cameras described in 6A003. (4) Section 744.9 imposes a license requirement on cameras described in 6A003 if being exported, reexported, or transferred (in-country) for use by a military end-user or for incorporation into a commodity controlled by ECCN 0A919. (5) See USML Category XII(c) and (e) for cameras subject to the ITAR.

*Related Definitions*: N/A

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 as follows:

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

a.3.b. Electronic streak cameras having temporal resolution better than 50 ns;

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 1μs 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 by 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 10 nm, 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  $4 \times 10^6$  “active pixels” per solid state array for monochrome (black and white) cameras;

b.1.a.2. More than  $4 \times 10^6$  “active pixels” per solid state array for color cameras incorporating three solid state arrays; or

b.1.a.3. More than  $12 \times 10^6$  “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;

**Note**: 6A003.b.2 does not apply to scanning cameras and scanning camera systems, “specially designed” for any of the following:

a. Industrial or civilian photocopiers;

b. Image scanners “specially designed” for civil, stationary, close proximity scanning applications (e.g., reproduction of images or print contained in documents, artwork or photographs); or

c. Medical equipment.

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

b.4. Imaging cameras incorporating “focal plane arrays” having any of the following:

b.4.a. Incorporating “focal plane arrays” controlled by 6A002.a.3.a to 6A002.a.3.e;

b.4.b. Incorporating “focal plane arrays” controlled by 6A002.a.3.f; or

b.4.c. Incorporating “focal plane arrays” controlled by 6A002.a.3.g;

**Note 1**: Imaging cameras described in 6A003.b.4 include “focal plane arrays” combined with sufficient “signal processing” electronics, beyond the read out integrated circuit, to enable as a minimum the output of an analog or digital signal once power is supplied.

**Note 2**: 6A003.b.4.a does not control imaging cameras incorporating linear “focal plane arrays” with 12 elements or fewer, not employing time-delay-and-integration within the element and 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.

**Note 3**: 6A003.b.4.b does not control imaging cameras having any of the following:

a. A maximum frame rate equal to or less than 9 Hz;

b. Having all of the following:

1. Having a minimum horizontal or vertical ‘Instantaneous-Field-of-View (IFOV)’ of at least 10 mrad (milliradians);

2. Incorporating a fixed focal-length lens that is not designed to be removed;

3. Not incorporating a ‘direct view’ display; and

**Technical Note**: ‘Direct view’ refers to an imaging camera operating in the infrared spectrum that presents a visual image to a human observer using a near-to-eye micro display incorporating any light-security mechanism.

4. Having any of the following:

a. No facility to obtain a viewable image of the detected field-of-view; or

b. The camera is designed for a single kind of application and designed not to be user modified; or

#### Technical Note:

‘Instantaneous Field of View (IFOV)’ specified in Note 3.b is the lesser figure of the ‘Horizontal FOV’ or the ‘Vertical FOV’.

‘Horizontal IFOV’ = horizontal Field of View (FOV)/number of horizontal detector elements

‘Vertical IFOV’ = vertical Field of View (FOV)/number of vertical detector elements.

c. The camera is “specially designed” for installation into a civilian passenger land vehicle and having all of the following:

1. The placement and configuration of the camera within the vehicle are solely to assist the driver in the safe operation of the vehicle;

2. Is operable only when installed in any of the following:

a. The civilian passenger land vehicle for which it was intended and the vehicle weighs less than 4,500 kg (gross vehicle weight); *or*

b. A "specially designed", authorized maintenance test facility; *and*

3. Incorporates an active mechanism that forces the camera not to function when it is removed from the vehicle for which it was intended.

**Note:** When necessary, details of the items will be provided, upon request, to the Bureau of Industry and Security in order to ascertain compliance with the conditions described in Note 3.b.4 and Note 3.c in this Note to 6A003.b.4.b.

**Note 4:** 6A003.b.4.c does not apply to 'imaging cameras' having any of the following characteristics:

a. Having all of the following:

1. Where the camera is "specially designed" for installation as an integrated component into indoor and wall-plug-operated systems or equipment, limited by design for a single kind of application, as follows:

a. Industrial process monitoring, quality control, or analysis of the properties of materials;

b. Laboratory equipment "specially designed" for scientific research;

c. Medical equipment;

d. Financial fraud detection equipment; *and*

2. Is only operable when installed in any of the following:

a. The system(s) or equipment for which it was intended; *or*

b. A "specially designed," authorized maintenance facility; *and*

3. Incorporates an active mechanism that forces the camera not to function when it is removed from the system(s) or equipment for which it was intended;

b. Where the camera is "specially designed" for installation into a civilian passenger land vehicle or passenger and vehicle ferries and having all of the following:

1. The placement and configuration of the camera within the vehicle or ferry are solely to assist the driver or operator in the safe operation of the vehicle or ferry;

2. Is only operable when installed in any of the following:

a. The civilian passenger land vehicle for which it was intended and the vehicle weighs less than 4,500 kg (gross vehicle weight);

b. The passenger and vehicle ferry for which it was intended and having a length overall (LOA) 65 m or greater; *or*

c. A "specially designed", authorized maintenance test facility; *and*

3. Incorporates an active mechanism that forces the camera not to function when it is removed from the vehicle for which it was intended;

c. Limited by design to have a maximum "radiant sensitivity" of 10 mA/W or less for

wavelengths exceeding 760 nm, having all of the following:

1. Incorporating a response limiting mechanism designed not to be removed or modified; *and*

2. Incorporates an active mechanism that forces the camera not to function when the response limiting mechanism is removed; *and*

3. Not "specially designed" or modified for underwater use; *or*

d. Having all of the following:

1. Not incorporating a 'direct view' or electronic image display;

2. Has no facility to output a viewable image of the detected field of view;

3. The "focal plane array" is only operable when installed in the camera for which it was intended; *and*

4. The "focal plane array" incorporates an active mechanism that forces it to be permanently inoperable when removed from the camera for which it was intended.

**Note:** When necessary, details of the item will be provided, upon request, to the Bureau of Industry and Security in order to ascertain compliance with the conditions described in Note 4 above.

b.5. Imaging cameras incorporating solid-state detectors specified by 6A002.a.1.

■ 44. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6, ECCN 6A005 is revised to read as follows:

**6A005 "Lasers," "components" and optical equipment, as follows (see List of Items Controlled), excluding items that are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).**

**License Requirements**

*Reason for Control:* NS, NP, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 2
NP applies to lasers controlled by 6A005.a.2, a.3, a.4, b.2.b, b.3, b.4, b.6.c, c.1.b, c.2.b, d.2, d.3.c, or d.4.c that meet or exceed the technical parameters described in 6A205.	NP Column 1
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* N/A for NP items; \$3,000 for all other item

*GBS:* Neodymium-doped (other than glass) "lasers" controlled by 6A005.b.6.d.2 (except 6A005.b.6.d.2.b) that have an output wavelength exceeding 1,000 nm, but not exceeding 1,100 nm, and an average or CW output power not exceeding 2kW, and operate in a pulse-excited, non-

"Q-switched" multiple-transverse mode, or in a continuously excited, multiple-transverse mode; Dye and Liquid Lasers controlled by 6A005.c.1, c.2 and c.3, except for 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; CO "lasers" controlled by 6A005.d.2 having a CW maximum rated single or multimode output power not exceeding 10 kW; CO<sub>2</sub> or CO/CO<sub>2</sub> "lasers" controlled by 6A005.d.3 having an output wavelength in the range from 9,000 to 11,000 nm and having a pulsed output not exceeding 2 J per pulse and a maximum rated average single or multimode output power not exceeding 5 kW; CO<sub>2</sub> "lasers" controlled by 6A005.d.3 that operate in CW multiple-transverse mode, and having a CW output power not exceeding 15kW; and 6A005.f.1.

*CIV:* Neodymium-doped (other than glass) "lasers" controlled by 6A005.b.6.d.2 (except 6A005.b.6.d.2.b) that have an output wavelength exceeding 1,000 nm, but not exceeding 1,100 nm, and an average or CW output power not exceeding 2kW, and operate in a pulse-excited, non-"Q-switched" multiple-transverse mode, or in a continuously excited, multiple-transverse mode; Dye and Liquid Lasers controlled by 6A005.c.1, c.2 and c.3, except for 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; CO "lasers" controlled by 6A005.d.2 having a CW maximum rated single or multimode output power not exceeding 10 kW; CO<sub>2</sub> or CO/CO<sub>2</sub> "lasers" controlled by 6A005.d.3 having an output wavelength in the range from 9,000 to 11,000 nm and having a pulsed output not exceeding 2 J per pulse and a maximum rated average single or multimode output power not exceeding 5 kW; CO<sub>2</sub> "lasers" controlled by 6A005.d.3 that operate in CW multiple-transverse mode, and having a CW output power not exceeding 15kW; and 6A005.f.1.

**List of Items Controlled**

*Related Controls:* (1) See ECCN 6D001 for "software" for items controlled under this entry. (2) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (3) Also see ECCNs 6A205 and 6A995. (4) See ECCN 3B001 for excimer "lasers" "specially designed" for lithography equipment. (5) "Lasers" "specially designed" or prepared for use in isotope separation are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110). (6) See USML Category XII(b) and (e) for laser systems or lasers subject to the ITAR. (7) See USML Category XVIII for certain laser-based directed energy weapon systems, equipment, and components subject to the ITAR.

*Related Definitions:* (1) 'Wall-plug efficiency' is defined as the ratio of "laser" output power (or "average output power") to total electrical input power required to operate

the “laser”, including the power supply/conditioning and thermal conditioning/heat exchanger, see 6A005.a.6.b.1 and 6A005.b.6; (2) ‘Non-repetitive pulsed’ refers to “lasers” that produce either a single output pulse or that have a time interval between pulses exceeding one minute, see Note 2 of 6A005 and 6A005.d.6.

Items:

**Note:**

1. Pulsed “lasers” include those that run in a continuous wave (CW) mode with pulses superimposed.

2. Excimer, semiconductor, chemical, CO, CO<sub>2</sub>, and ‘non-repetitive pulsed’ Nd:glass “lasers” are only specified by 6A005.d.

**Technical Note:** ‘Non-repetitive pulsed’ refers to “lasers” that produce either a single output pulse or that have a time interval between pulses exceeding one minute.

3. 6A005 includes fiber “lasers”.

4. The control status of “lasers” incorporating frequency conversion (*i.e.*, wavelength change) by means other than one “laser” pumping another “laser” is determined by applying the control parameters for both the output of the source “laser” and the frequency-converted optical output.

5. 6A005 does not control “lasers” as follows:

- a. Ruby with output energy below 20 J;
- b. Nitrogen;
- c. Krypton.

a. Non-“tunable” continuous wave (“CW”) lasers” having any of the following:

- a.1. Output wavelength less than 150 nm and output power exceeding 1W;
- a.2. Output wavelength of 150 nm or more but not exceeding 510 nm and output power exceeding 30 W;

**Note:** 6A005.a.2 does not control Argon “lasers” having an output power equal to or less than 50 W.

a.3. Output wavelength exceeding 510 nm but not exceeding 540 nm and any of the following:

- a.3.a. Single transverse mode output and output power exceeding 50 W; *or*
- a.3.b. Multiple transverse mode output and output power exceeding 150 W;

a.4. Output wavelength exceeding 540 nm but not exceeding 800 nm and output power exceeding 30 W;

a.5. Output wavelength exceeding 800 nm but not exceeding 975 nm and any of the following:

- a.5.a. Single transverse mode output and output power exceeding 50 W; *or*
- a.5.b. Multiple transverse mode output and output power exceeding 80 W;

a.6. Output wavelength exceeding 975 nm but not exceeding 1,150 nm and any of the following:

- a.6.a. Single transverse mode output and output power exceeding 500 W; *or*
- a.6.b. Multiple transverse mode output and any of the following:

- a.6.b.1. ‘Wall-plug efficiency’ exceeding 18% and output power exceeding 500 W; *or*
- a.6.b.2. Output power exceeding 2 kW;

**Note 1:** 6A005.a.6.b does not control multiple transverse mode, industrial “lasers”

with output power exceeding 2kW and not exceeding 6 kW with a total mass greater than 1,200 kg. For the purpose of this note, total mass includes all “components” required to operate the “laser,” *e.g.*, “laser,” power supply, heat exchanger, but excludes external optics for beam conditioning and/or delivery.

**Note 2:** 6A005.a.6.b does not apply to multiple transverse mode, industrial “lasers” having any of the following:

a. Output power exceeding 500 W but not exceeding 1 kW and having all of the following:

- 1. Beam Parameter Product (BPP) exceeding 0.7 mm•mrad; *and*
- 2. ‘Brightness’ not exceeding 1024 W/(mm•mrad)<sup>2</sup>;

b. Output power exceeding 1 kW but not exceeding 1.6 kW and having a BPP exceeding 1.25 mm•mrad;

c. Output power exceeding 1.6 kW but not exceeding 2.5 kW and having a BPP exceeding 1.7 mm•mrad;

d. Output power exceeding 2.5 kW but not exceeding 3.3 kW and having a BPP exceeding 2.5 mm•mrad;

e. Output power exceeding 3.3 kW but not exceeding 4 kW and having a BPP exceeding 3.5 mm•mrad;

f. Output power exceeding 4 kW but not exceeding 5 kW and having a BPP exceeding 5 mm•mrad;

g. Output power exceeding 5 kW but not exceeding 6 kW and having a BPP exceeding 7.2 mm•mrad;

h. Output power exceeding 6 kW but not exceeding 8 kW and having a BPP exceeding 12 mm•mrad; *or*

i. Output power exceeding 8 kW but not exceeding 10 kW and having a BPP exceeding 24 mm•mrad;

**Technical Note:** For the purpose of 6A005.a.6.b, Note 2 (a)(2), ‘brightness’ is defined as the output power of the “laser” divided by the squared Beam Parameter Product (BPP), *i.e.*, (output power)/BPP<sup>2</sup>.

a.7. Output wavelength exceeding 1,150 nm but not exceeding 1,555 nm and any of the following:

- a.7.a. Single transverse mode and output power exceeding 50 W; *or*
- a.7.b. Multiple transverse mode and output power exceeding 80 W;

a.8. Output wavelength exceeding 1,555 nm but not exceeding 1,850 nm and output power exceeding 1 W;

a.9. Output wavelength exceeding 1,850 nm but not exceeding 2,100 nm, and any of the following:

- a.9.a. Single transverse mode and output power exceeding 1 W; *or*
- a.9.b. Multiple transverse mode output and output power exceeding 120 W; *or*

a.10. Output wavelength exceeding 2,100 nm and output power exceeding 1 W;

b. Non-“tunable” “pulsed lasers” having any of the following:

b.1. Output wavelength less than 150 nm and any of the following:

- b.1.a. Output energy exceeding 50 mJ per pulse and “peak power” exceeding 1 W; *or*
- b.1.b. “Average output power” exceeding 1 W;

b.2. Output wavelength of 150 nm or more but not exceeding 510 nm and any of the following:

- b.2.a. Output energy exceeding 1.5 J per pulse and “peak power” exceeding 30 W; *or*
- b.2.b. “Average output power” exceeding 30 W;

**Note:** 6A005.b.2.b does not control Argon “lasers” having an “average output power” equal to or less than 50 W.

b.3. Output wavelength exceeding 510 nm, but not exceeding 540 nm and any of the following:

- b.3.a. Single transverse mode output and any of the following:
  - b.3.a.1. Output energy exceeding 1.5 J per pulse and “peak power” exceeding 50 W; *or*
  - b.3.a.2. “Average output power” exceeding 50 W; *or*
- b.3.b. Multiple transverse mode output and any of the following:

- b.3.b.1. Output energy exceeding 1.5 J per pulse and “peak power” exceeding 150 W; *or*
- b.3.b.2. “Average output power” exceeding 150 W;

b.4. Output wavelength exceeding 540 nm but not exceeding 800 nm and any of the following:

- b.4.a. “Pulse duration” less than 1 ps and any of the following:
  - b.4.a.1. Output energy exceeding 0.005 J per pulse and “peak power” exceeding 5 GW; *or*

- b.4.a.2. “Average output power” exceeding 20 W; *or*

- b.4.b. “Pulse duration” equal to or exceeding 1 ps and any of the following:

- b.4.b.1. Output energy exceeding 1.5 J per pulse and “peak power” exceeding 30 W; *or*
- b.4.b.2. “Average output power” exceeding 30 W;

b.5. Output wavelength exceeding 800 nm but not exceeding 975 nm and any of the following:

- b.5.a. “Pulse duration” less than 1 ps and any of the following:

- b.5.a.1. Output energy exceeding 0.005 J per pulse and “peak power” exceeding 5 GW; *or*

- b.5.a.2. Single transverse mode output and “average output power” exceeding 20 W;

- b.5.b. “Pulse duration” equal to or exceeding 1 ps and not exceeding 1 μs and any of the following:

- b.5.b.1. Output energy exceeding 0.5 J per pulse and “peak power” exceeding 50 W;
- b.5.b.2. Single transverse mode output and “average output power” exceeding 20 W; *or*
- b.5.b.3. Multiple transverse mode output and “average output power” exceeding 50 W; *or*

- b.5.c. “Pulse duration” exceeding 1 μs and any of the following:

- b.5.c.1. Output energy exceeding 2 J per pulse and “peak power” exceeding 50 W;
- b.5.c.2. Single transverse mode output and “average output power” exceeding 50 W; *or*
- b.5.c.3. Multiple transverse mode output and “average output power” exceeding 80 W.

b.6. Output wavelength exceeding 975 nm but not exceeding 1,150 nm and any of the following:

- b.6.a. “Pulse duration” of less than 1 ps, and any of the following:

- b.6.a.1. Output “peak power” exceeding 2 GW per pulse;

b.6.a.2. "Average output power" exceeding 30 W; *or*

b.6.a.3. Output energy exceeding 0.002 J per pulse;

b.6.b. "Pulse duration" equal to or exceeding 1 ps and less than 1 ns, and any of the following:

b.6.b.1. Output "peak power" exceeding 5 GW per pulse;

b.6.b.2. "Average output power" exceeding 50 W; *or*

b.6.b.3. Output energy exceeding 0.1 J per pulse;

b.6.c. "Pulse duration" equal to or exceeding 1 ns but not exceeding 1  $\mu$ s and any of the following:

b.6.c.1. Single transverse mode output and any of the following:

b.6.c.1.a. "Peak power" exceeding 100 MW;

b.6.c.1.b. "Average output power" exceeding 20 W limited by design to a maximum pulse repetition frequency less than or equal to 1 kHz;

b.6.c.1.c. 'Wall-plug efficiency' exceeding 12%, "average output power" exceeding 100 W and capable of operating at a pulse repetition frequency greater than 1 kHz;

b.6.c.1.d. "Average output power" exceeding 150 W and capable of operating at a pulse repetition frequency greater than 1 kHz; *or*

b.6.c.1.e. Output energy exceeding 2 J per pulse; *or*

b.6.c.2. Multiple transverse mode output and any of the following:

b.6.c.2.a. "Peak power" exceeding 400 MW;

b.6.c.2.b. 'Wall-plug efficiency' exceeding 18% and "average output power" exceeding 500 W;

b.6.c.2.c. "Average output power" exceeding 2 kW; *or*

b.6.c.2.d. Output energy exceeding 4 J per pulse; *or*

b.6.d. "Pulse duration" exceeding 1  $\mu$ s and any of the following:

b.6.d.1. Single transverse mode output and any of the following:

b.6.d.1.a. "Peak power" exceeding 500 kW;

b.6.d.1.b. 'Wall-plug efficiency' exceeding 12% and "average output power" exceeding 100 W; *or*

b.6.d.1.c. "Average output power" exceeding 150 W; *or*

b.6.d.2. Multiple transverse mode output and any of the following:

b.6.d.2.a. "Peak power" exceeding 1 MW;

b.6.d.2.b. 'Wall-plug efficiency' exceeding 18% and "average output power" exceeding 500 W; *or*

b.6.d.2.c. "Average output power" exceeding 2 kW;

b.7. Output wavelength exceeding 1,150 nm but not exceeding 1,555 nm and any of the following:

b.7.a. "Pulse duration" not exceeding 1  $\mu$ s and any of the following:

b.7.a.1. Output energy exceeding 0.5 J per pulse and "peak power" exceeding 50 W;

b.7.a.2. Single transverse mode output and "average output power" exceeding 20 W; *or*

b.7.a.3. Multiple transverse mode output and "average output power" exceeding 50 W; *or*

b.7.b. "Pulse duration" exceeding 1  $\mu$ s and any of the following:

b.7.b.1. Output energy exceeding 2 J per pulse and "peak power" exceeding 50 W;

b.7.b.2. Single transverse mode output and "average output power" exceeding 50 W; *or*

b.7.b.3. Multiple transverse mode output and "average output power" exceeding 80 W;

b.8. Output wavelength exceeding 1,555 nm but not exceeding 1,850 nm, and any of the following:

b.8.a. Output energy exceeding 100 mJ per pulse and "peak power" exceeding 1 W; *or*

b.8.b. "Average output power" exceeding 1 W;

b.9. Output wavelength exceeding 1,850 nm but not exceeding 2,100 nm, and any of the following:

b.9.a. Single transverse mode and any of the following:

b.9.a.1. Output energy exceeding 100 mJ per pulse and "peak power" exceeding 1 W; *or*

b.9.a.2. "Average output power" exceeding 1 W;

b.9.b. Multiple transverse mode and any of the following:

b.9.b.1. Output energy exceeding 100 mJ per pulse and "peak power" exceeding 10 kW; *or*

b.9.b.2. "Average output power" exceeding 120 W; *or*

b.10. Output wavelength exceeding 2,100 nm and any of the following:

b.10.a. Output energy exceeding 100 mJ per pulse and "peak power" exceeding 1 W; *or*

b.10.b. "Average output power" exceeding 1 W;

c. "Tunable" lasers having any of the following:

c.1. Output wavelength less than 600 nm and any of the following:

c.1.a. Output energy exceeding 50 mJ per pulse and "peak power" exceeding 1 W; *or*

c.1.b. Average or CW output power exceeding 1 W;

**Note:** 6A005.c.1 does not apply to dye "lasers" or other liquid "lasers," having a multimode output and a wavelength of 150 nm or more but not exceeding 600 nm and all of the following:

1. Output energy less than 1.5 J per pulse or a "peak power" less than 20 W; *and*

2. Average or CW output power less than 20 W.

c.2. Output wavelength of 600 nm or more but not exceeding 1,400 nm, and any of the following:

c.2.a. Output energy exceeding 1 J per pulse and "peak power" exceeding 20 W; *or*

c.2.b. Average or CW output power exceeding 20 W; *or*

c.3. Output wavelength exceeding 1,400 nm and any of the following:

c.3.a. Output energy exceeding 50 mJ per pulse and "peak power" exceeding 1 W; *or*

c.3.b. Average or CW output power exceeding 1 W;

d. Other "lasers", not controlled by 6A005.a, 6A005.b, or 6A005.c as follows:

d.1. Semiconductor "lasers" as follows:

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

2. The control status of semiconductor "lasers" "specially designed" for other

equipment is determined by the control status of the other equipment.

d.1.a. Individual single transverse mode semiconductor "lasers" having any of the following:

d.1.a.1. Wavelength equal to or less than 1,510 nm and average or CW output power, exceeding 1.5 W; *or*

d.1.a.2. Wavelength greater than 1,510 nm and average or CW output power, exceeding 500 mW;

d.1.b. Individual, multiple-transverse mode semiconductor "lasers" having any of the following:

d.1.b.1. Wavelength of less than 1,400 nm and average or CW output power, exceeding 15 W;

d.1.b.2. Wavelength equal to or greater than 1,400 nm and less than 1,900 nm and average or CW output power, exceeding 2.5 W; *or*

d.1.b.3. Wavelength equal to or greater than 1,900 nm and average or CW output power, exceeding 1 W;

d.1.c. Individual semiconductor "laser" 'bars' having any of the following:

d.1.c.1. Wavelength of less than 1,400 nm and average or CW output power, exceeding 100 W;

d.1.c.2. Wavelength equal to or greater than 1,400 nm and less than 1,900 nm and average or CW output power, exceeding 25 W; *or*

d.1.c.3. Wavelength equal to or greater than 1,900 nm and average or CW output power, exceeding 10 W;

d.1.d. Semiconductor "laser" 'stacked arrays' (two dimensional arrays) having any of the following:

d.1.d.1. Wavelength less than 1,400 nm and having any of the following:

d.1.d.1.a. Average or CW total output power less than 3 kW and having average or CW output 'power density' greater than 500 W/cm<sup>2</sup>;

d.1.d.1.b. Average or CW total output power equal to or exceeding 3 kW but less than or equal to 5 kW, and having average or CW output 'power density' greater than 350W/cm<sup>2</sup>;

d.1.d.1.c. Average or CW total output power exceeding 5 kW;

d.1.d.1.d. Peak pulsed 'power density' exceeding 2,500 W/cm<sup>2</sup>; *or*

**Note:** 6A005.d.1.d.1.d does not apply to epitaxially-fabricated monolithic devices.

d.1.d.1.e. Spatially coherent average or CW total output power, greater than 150 W;

d.1.d.2. Wavelength greater than or equal to 1,400 nm but less than 1,900 nm, and having any of the following:

d.1.d.2.a. Average or CW total output power less than 250 W and average or CW output 'power density' greater than 150 W/cm<sup>2</sup>;

d.1.d.2.b. Average or CW total output power equal to or exceeding 250 W but less than or equal to 500 W, and having average or CW output 'power density' greater than 50W/cm<sup>2</sup>;

d.1.d.2.c. Average or CW total output power exceeding 500 W;

d.1.d.2.d. Peak pulsed 'power density' exceeding 500 W/cm<sup>2</sup>; *or*

**Note:** 6A005.d.1.d.2.d does not apply to epitaxially-fabricated monolithic devices.

d.1.d.2.e. Spatially coherent average or CW total output power, exceeding 15 W;  
 d.1.d.3. Wavelength greater than or equal to 1,900 nm and having any of the following:  
 d.1.d.3.a. Average or CW output 'power density' greater than 50 W/cm<sup>2</sup>;  
 d.1.d.3.b. Average or CW output power greater than 10 W; *or*  
 d.1.d.3.c. Spatially coherent average or CW total output power, exceeding 1.5 W; *or*  
 d.1.d.4. At least one "laser" 'bar' specified by 6A005.d.1.c;

**Technical Note:** For the purposes of 6A005.d.1.d, 'power density' means the total "laser" output power divided by the emitter surface area of the 'stacked array'.

d.1.e. Semiconductor "laser" 'stacked arrays', other than those specified by 6.A005.d.1.d., having all of the following:  
 d.1.e.1. "Specially designed" or modified to be combined with other 'stacked arrays' to form a larger 'stacked array'; *and*  
 d.1.e.2. Integrated connections, common for both electronics and cooling;

**Note 1:** 'Stacked arrays', formed by combining semiconductor "laser" 'stacked arrays' specified by 6A005.d.1.e, that are not designed to be further combined or modified are specified by 6A005.d.1.d.

**Note 2:** 'Stacked arrays', formed by combining semiconductor "laser" 'stacked arrays' specified by 6A005.d.1.e, that are designed to be further combined or modified are specified by 6A005.d.1.e.

**Note 3:** 6A005.d.1.e does not apply to modular assemblies of single 'bars' designed to be fabricated into end to end stacked linear arrays.

**Technical Notes:**

1. Semiconductor "lasers" are commonly called "laser" diodes.
2. A 'bar' (also called a semiconductor "laser" 'bar', a "laser" diode 'bar' or diode 'bar') consists of multiple semiconductor "lasers" in a one dimensional array.
3. A 'stacked array' consists of multiple 'bars' forming a two dimensional array of semiconductor "lasers".

d.2. Carbon monoxide (CO) "lasers" having any of the following:

d.2.a. Output energy exceeding 2 J per pulse and "peak power" exceeding 5 kW; *or*  
 d.2.b. Average or CW output power, exceeding 5 kW;

d.3. Carbon dioxide (CO<sub>2</sub>) "lasers" having any of the following:

d.3.a. CW output power exceeding 15 kW;  
 d.3.b. Pulsed output with "pulse duration" exceeding 10 μs and any of the following:  
 d.3.b.1. "Average output power" exceeding 10 kW; *or*  
 d.3.b.2. "Peak power" exceeding 100 kW; *or*

d.3.c. Pulsed output with a "pulse duration" equal to or less than 10 μs and any of the following:

d.3.c.1. Pulse energy exceeding 5 J per pulse; *or*  
 d.3.c.2. "Average output power" exceeding 2.5 kW;

d.4. Excimer "lasers" having any of the following:

d.4.a. Output wavelength not exceeding 150 nm and any of the following:

d.4.a.1. Output energy exceeding 50 mJ per pulse; *or*

d.4.a.2. "Average output power" exceeding 1 W;

d.4.b. Output wavelength exceeding 150 nm but not exceeding 190 nm and any of the following:

d.4.b.1. Output energy exceeding 1.5 J per pulse; *or*

d.4.b.2. "Average output power" exceeding 120 W;

d.4.c. Output wavelength exceeding 190 nm but not exceeding 360 nm and any of the following:

d.4.c.1. Output energy exceeding 10 J per pulse; *or*

d.4.c.2. "Average output power" exceeding 500 W; *or*

d.4.d. Output wavelength exceeding 360 nm and any of the following:

d.4.d.1. Output energy exceeding 1.5 J per pulse; *or*

d.4.d.2. "Average output power" exceeding 30 W;

**Note:** For excimer "lasers" "specially designed" for lithography equipment, see 3B001.

d.5. "Chemical lasers" as follows:

d.5.a. Hydrogen Fluoride (HF) "lasers";  
 d.5.b. Deuterium Fluoride (DF) "lasers";

d.5.c. "Transfer lasers" as follows:

d.5.c.1. Oxygen Iodine (O<sub>2</sub>-I) "lasers";

d.5.c.2. Deuterium Fluoride-Carbon dioxide (DF-CO<sub>2</sub>) "lasers";

d.6. 'Non-repetitive pulsed' Neodymium (Nd) glass "lasers" having any of the following:

d.6.a. A "pulse duration" not exceeding 1 μs and output energy exceeding 50 J per pulse; *or*

d.6.b. A "pulse duration" exceeding 1 μs and output energy exceeding 100 J per pulse;

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," other than fused tapered fiber combiners and Multi-Layer Dielectric gratings (MLDs), "specially designed" for use with controlled "lasers";

**Note to 6A005.e.2:** Fiber combiners and MLDs are specified by 6A005.e.3.

e.3. Fiber "laser" "components" as follows:

e.3.a. Multimode to multimode fused tapered fiber combiners having all of the following:

e.3.a.1. An insertion loss better (less) than or equal to 0.3 dB maintained at a rated total average or CW output power (excluding output power transmitted through the single mode core if present) exceeding 1,000 W; *and*

e.3.a.2. Number of input fibers equal to or greater than 3;

e.3.b. Single mode to multimode fused tapered fiber combiners having all of the following:

e.3.b.1. An insertion loss better (less) than 0.5 dB maintained at a rated total average or CW output power exceeding 4,600 W;

e.3.b.2. Number of input fibers equal to or greater than 3; *and*

e.3.b.3. Having any of the following:

e.3.b.3.a. A Beam Parameter Product (BPP) measured at the output not exceeding 1.5 mm mrad for a number of input fibers less than or equal to 5; *or*

e.3.b.3.b. A BPP measured at the output not exceeding 2.5 mm mrad for a number of input fibers greater than 5;

e.3.c. MLDs having all of the following:

e.3.c.1. Designed for spectral or coherent beam combination of 5 or more fiber "lasers;" *and*

e.3.c.2. CW "Laser" Induced Damage Threshold (LIDT) greater than or equal to 10 kW/cm<sup>2</sup>;

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 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 λ/10 at the designed wavelength, or 0.1 μm, whichever is the smaller;

f.4. Projection telescopes "specially designed" for use with "SHPL" systems;

g. 'Laser acoustic detection equipment' having all of the following:

g.1. CW "laser" output power greater than or equal to 20 mW;

g.2. "Laser" frequency stability equal to or better (less) than 10 MHz;

g.3. "Laser" wavelengths equal to or exceeding 1,000 nm but not exceeding 2,000 nm;

g.4. Optical system resolution better (less) than 1 nm; *and*

g.5. Optical Signal to Noise ratio equal or exceeding to 10<sup>3</sup>.

**Technical Note:** 'Laser acoustic detection equipment' is sometimes referred to as a "Laser" Microphone or Particle Flow Detection Microphone.

■ 45. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6, ECCN 6A008 is revised to read as follows:

**6A008 Radar systems, equipment and assemblies, having any of the following (see List of Items Controlled), and "specially designed" "components" thereof.**

**License Requirements**

*Reason for Control:* NS, MT, RS, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 2
MT applies to items that are designed for airborne applications and that are usable in systems controlled for MT reasons.	MT Column 1
RS applies to 6A008.j.1	RS Column 1
AT applies to entire entry.	AT Column 1

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$5000; N/A for MT and for 6A008.j.1.  
*GBS:* Yes, for 6A008.b, .c, and l.1 only  
*CIV:* Yes, for 6A008.b, .c, and l.1 only

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship any commodity in 6A008.d, 6A008.h or 6A008.k to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* (1) See also ECCNs 6A108 and 6A998. ECCN 6A998 controls, inter alia, the Light Detection and Ranging (LIDAR) equipment excluded by the note to paragraph j of this ECCN (6A008). (2) See USML Category XII(b) for certain LIDAR, Laser Detection and Ranging (LADAR), or range-gated systems subject to the ITR.

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

**Note:** 6A008 does not control:  
—Secondary surveillance radar (SSR);  
—Civil Automotive Radar;  
—Displays or monitors used for air traffic control (ATC);  
—Meteorological (weather) radar;  
—Precision Approach Radar (PAR) equipment conforming to ICAO standards and employing electronically steerable linear (1-dimensional) arrays or mechanically positioned passive antennas.

- a. Operating at frequencies from 40 GHz to 230 GHz and having any of the following:
  - a.1. An “average output power” exceeding 100 mW; or
  - a.2. Locating “accuracy” of 1 m or less (better) in range and 0.2 degree or less (better) in azimuth;
- b. A tunable bandwidth exceeding ±6.25% of the ‘center operating frequency’;

**Technical Note:** The ‘center operating frequency’ equals one half of the sum of the highest plus the lowest specified operating frequencies.

- c. Capable of operating simultaneously on more than two carrier frequencies;
- d. Capable of operating in synthetic aperture (SAR), inverse synthetic aperture (ISAR) radar mode, or sidelooking airborne (SLAR) radar mode;
- e. Incorporating electronically steerable array antennas;
- f. Capable of heightfinding non-cooperative targets;
- g. “Specially designed” for airborne (balloon or airframe mounted) operation and having Doppler “signal processing” for the detection of moving targets;
- h. Employing processing of radar signals and using any of the following:
  - h.1. “Radar spread spectrum” techniques; or
  - h.2. “Radar frequency agility” techniques;
- i. Providing ground-based operation with a maximum “instrumented range” exceeding 185 km;

**Note:** 6A008.i does not control:  
a. Fishing ground surveillance radar;  
b. Ground radar equipment “specially designed” for en route air traffic control, and having all of the following:
 

- 1. A maximum “instrumented range” of 500 km or less;
- 2. Configured so that radar target data can be transmitted only one way from the radar site to one or more civil ATC centers;
- 3. Contains no provisions for remote control of the radar scan rate from the en route ATC center; and
- 4. Permanently installed;

c. Weather balloon tracking radars.

- j. Being “laser” radar or Light Detection and Ranging (LIDAR) equipment and having any of the following:
  - j.1. “Space-qualified”;
  - j.2. Employing coherent heterodyne or homodyne detection techniques and having an angular resolution of less (better) than 20 µrad (microradians); or
  - j.3. Designed for carrying out airborne bathymetric littoral surveys to International Hydrographic Organization (IHO) Order 1a Standard (5th Edition February 2008) for Hydrographic Surveys or better, and using one or more “lasers” with a wavelength exceeding 400 nm but not exceeding 600 nm;

**Note 1:** LIDAR equipment “specially designed” for surveying is only specified by 6A008.j.3.

**Note 2:** 6A008.j does not apply to LIDAR equipment “specially designed” for meteorological observation.

**Note 3:** Parameters in the IHO Order 1a Standard 5th Edition February 2008 are summarized as follows:  
Horizontal Accuracy (95% Confidence Level) = 5 m + 5% of depth.  
Depth Accuracy for Reduced Depths (95% confidence level) = ±√(a²+(b\*d)²) where:  
a = 0.5 m = constant depth error, i.e. the sum of all constant depth errors  
b = 0.013 = factor of depth dependant error  
b\*d = depth dependant error, i.e. the sum of all depth dependant errors  
d = depth  
Feature Detection = Cubic features > 2 m in depths up to 40 m; 10% of depth beyond 40 m.

- k. Having “signal processing” sub-systems using “pulse compression” and having any of the following:
  - k.1. A “pulse compression” ratio exceeding 150; or
  - k.2. A compressed pulse width of less than 200 ns; or

**Note:** 6A008.k.2 does not apply to two dimensional ‘marine radar’ or ‘vessel traffic service’ radar, having all of the following:
 

- a. “Pulse compression” ratio not exceeding 150;
- b. Compressed pulse width of greater than 30 ns;
- c. Single and rotating mechanically scanned antenna;
- d. Peak output power not exceeding 250 W; and
- e. Not capable of “frequency hopping”.

- l. Having data processing sub-systems and having any of the following:
  - l.1. “Automatic target tracking” providing, at any antenna rotation, the predicted target position beyond the time of the next antenna beam passage; or

**Note:** 6A008.l.1 does not control conflict alert capability in ATC systems, or ‘marine radar’.

- l.2. [Reserved]
- l.3. [Reserved]
- l.4. Configured to provide superposition and correlation, or fusion, of target data within six seconds from two or more “geographically dispersed” radar sensors to improve the aggregate performance beyond that of any single sensor specified by 6A008.f, or 6A008.i.

*N.B.:* See also the U.S. Munitions List (22 CFR part 121).

**Note:** 6A008.l does not apply to systems, equipment and assemblies designed for ‘vessel traffic services’.

**Technical Notes:**

- 1. For the purposes of 6A008, ‘marine radar’ is a radar that is used to navigate safely at sea, inland waterways or near-shore environments.
- 2. For the purposes of 6A008, ‘vessel traffic service’ is a vessel traffic monitoring and control service similar to air traffic control for “aircraft.”

■ 46. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6, ECCN 6D003 is revised to read as follows:

**6D003 Other “software” as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, RS, AT

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

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*CIV:* Yes for 6D003.h.1

*TSR:* Yes, except for 6D003.c and exports or reexports to destinations outside of those countries listed in Country Group A:5 (See Supplement No. 1 to part 740 of the EAR) of “software” for items controlled by 6D003.a.

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship or transmit software in 6D003.a to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* See also ECCNs 6D103, 6D991, and 6D993.

*Related Definitions:* N/A

*Items:*

*Acoustics*

- a. “Software” as follows:
  - a.1. “Software” “specially designed” for acoustic beam forming for the “real-time processing” of acoustic data for passive reception using towed hydrophone arrays;
  - a.2. “Source code” for the “real-time processing” of acoustic data for passive reception using towed hydrophone arrays;
  - a.3. “Software” “specially designed” for acoustic beam forming for the “real-time processing” of acoustic data for passive reception using bottom or bay cable systems;
  - a.4. “Source code” for the “real-time processing” of acoustic data for passive reception using bottom or bay cable systems;
  - a.5. “Software” or “source code”, “specially designed” for all of the following:
    - a.5.a. “Real-time processing” of acoustic data from sonar systems controlled by 6A001.a.1.e; and
    - a.5.b. Automatically detecting, classifying and determining the location of divers or swimmers;

*N.B.:* For diver detection “software” or “source code”, “specially designed” or modified for military use, see the U.S. Munitions List of the International Traffic in Arms Regulations (ITAR) (22 CFR part 121).

- b. Optical sensors. None.

*Cameras*

- c. “Software” designed or modified for cameras incorporating “focal plane arrays” specified by 6A002.a.3.f and designed or modified to remove a frame rate restriction and allow the camera to exceed the frame rate specified in 6A003.b.4 Note 3.a;

*Optics*

- d. “Software” specially designed to maintain the alignment and phasing of segmented mirror systems consisting of mirror segments having a diameter or major axis length equal to or larger than 1 m;
- e. Lasers. None.

*Magnetic and Electric Field Sensors*

- f. “Software” as follows:
  - f.1. “Software” “specially designed” for magnetic and electric field “compensation systems” for magnetic sensors designed to operate on mobile platforms;
  - f.2. “Software” “specially designed” for magnetic and electric field anomaly detection on mobile platforms;
  - f.3. “Software” “specially designed” for “real-time processing” of electromagnetic data using underwater electromagnetic receivers specified by 6A006.e;
  - f.4. “Source code” for “real-time processing” of electromagnetic data using underwater electromagnetic receivers specified by 6A006.e;

*Gravimeters*

- g. “Software” “specially designed” to correct motional influences of gravity meters or gravity gradiometers;

*Radar*

- h. “Software” as follows:
  - h.1. Air Traffic Control (ATC) “software” application “programs” designed to be hosted on general purpose computers located at Air Traffic Control centers and capable of accepting radar target data from more than four primary radars;
  - h.2. “Software” for the design or “production” of radomes and having all of the following:
    - h.2.a. “Specially designed” to protect the “electronically steerable phased array antennae” controlled by 6A008.e.; and
    - h.2.b. Resulting in an antenna pattern having an ‘average side lobe level’ more than 40 dB below the peak of the main beam level.

**Technical Note:** ‘Average side lobe level’ in 6D003.h.2.b is measured over the entire array excluding the angular extent of the main beam and the first two side lobes on either side of the main beam.

■ 47. In Supplement No. 1 to part 774 (the Commerce Control List), Category 6, ECCN 6E003 is revised to read as follows:

**6E003 Other “technology” as follows (see List of Items Controlled).**

**License Requirements**

Reason for Control: NS, AT

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*CIV:* N/A

*TSR:* Yes

**List of Items Controlled**

*Related Controls:* See also 6E993

*Related Definitions:* N/A

*Items:*

*Acoustics*

- a. [Reserved]

*Optical Sensors*

- b. [Reserved]

*Cameras*

- c. [Reserved]

*Optics*

- d. “Technology” as follows:
    - d.1. “Technology” “required” for the coating and treatment of optical surfaces to achieve an ‘optical thickness’ 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  $5 \times 10^{-3}$ ;
- N.B.:* See also 2E003.f.

**Technical Note:** ‘Optical thickness’ is the mathematical product of the index of refraction and the physical thickness of the coating.

- d.2. “Technology” for the fabrication of optics 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<sup>2</sup>;

*Lasers*

- e. “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;

*Magnetic and Electric Field Sensors*

- f. [Reserved]

*Gravimeters*

- g. [Reserved]

*Radar*

- h. [Reserved]

■ 48. In Supplement No. 1 to part 774 (the Commerce Control List), Category 7, ECCN 7D003 is revised to read as follows:

**7D003 Other “software” as follows (see List of Items Controlled).**

**License Requirements**

Reason for Control: NS, MT, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No.1 to part 738)</i>
NS applies to entire entry.	NS Column 1
MT applies to “software” for equipment controlled for MT reasons. MT does not apply to “software” for equipment controlled by 7A008.	MT Column 1
AT applies to entire entry.	AT Column 1

**Reporting Requirements**

See § 743.1 of the EAR for reporting requirements for exports under License

Exceptions, and Validated End-User authorizations.

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

CIV: N/A  
TSR: N/A

**Special Conditions for STA**

STA: License Exception STA may not be used to ship or transmit software in 7D003.a or .b to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* See also 7D103 and 7D994.

*Related Definitions:* ‘Data-Based Referenced Navigation’ (‘DBRN’) systems are systems which use various sources of previously measured geo-mapping data integrated to provide accurate navigation information under dynamic conditions. Data sources include bathymetric maps, stellar maps, gravity maps, magnetic maps or 3-D digital terrain maps.

*Items:*

a. ‘‘Software’’ ‘‘specially designed’’ or modified to improve the operational performance or reduce the navigational error of systems to the levels controlled by 7A003, 7A004 or 7A008;

b. ‘‘Source code’’ for hybrid integrated systems which improves the operational performance or reduces the navigational error of systems to the level controlled by 7A003 or 7A008 by continuously combining heading data with any of the following:

b.1. Doppler radar or sonar velocity data;

b.2. Global Navigation Satellite Systems (GNSS) reference data; or

b.3. Data from ‘Data-Based Referenced Navigation’ (‘DBRN’) systems;

c. [Reserved]

d. [Reserved]

*N.B. For flight control ‘‘source code,’’ see 7D004.*

e. Computer-Aided-Design (CAD) ‘‘software’’ ‘‘specially designed’’ for the ‘‘development’’ of ‘‘active flight control systems’’, helicopter multi-axis fly-by-wire or fly-by-light controllers or helicopter ‘‘circulation controlled anti-torque or circulation-controlled direction control systems’’, whose ‘‘technology’’ is controlled by 7E004.b.1, 7E004.b.3 to b.5, 7E004.b.7 to b.8, 7E004.c.1 or 7E004.c.2.

■ 49. In Supplement No. 1 to part 774 (the Commerce Control List), Category 7, ECCN 7D004 is revised to read as follows:

**7D004 ‘‘Source code’’ incorporating ‘‘development’’ ‘‘technology’’ specified by 7E004.a.2, a.3, a.5, a.6 or 7E004.b, for any of the following: (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

CIV: N/A  
TSR: N/A

**Special Conditions for STA**

STA: License Exception STA may not be used to ship or transmit ‘‘software’’ in 7D004.a to .d and .g to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* See 7D103 and 7D994

*Related Definitions:* N/A

*Items:*

a. Digital flight management systems for ‘‘total control of flight’’;

b. Integrated propulsion and flight control systems;

c. ‘‘Fly-by-wire systems’’ or ‘‘fly-by-light systems’’;

d. Fault-tolerant or self-reconfiguring ‘‘active flight control systems’’;

e. [Reserved];

f. Air data systems based on surface static data; or

g. Three dimensional displays.

**Note:** 7D004 does not apply to ‘‘source code’’ associated with common computer elements and utilities (e.g., input signal acquisition, output signal transmission, computer program and data loading, built-in test, task scheduling mechanisms) not providing a specific flight control system function.

■ 50. In Supplement No. 1 to part 774 (the Commerce Control List), Category 7, ECCN 7E001 is revised to read as follows:

**7E001 ‘‘Technology’’ according to the General Technology Note for the ‘‘development’’ of equipment or ‘‘software,’’ specified by 7A. (except 7A994), 7B. (except 7B994), 7D001, 7D002, 7D003 or 7D005.**

**License Requirements**

*Reason for Control:* NS, MT, RS, AT

<i>Control(s)</i>	<i>Country chart (See Supp. No.1 to part 738)</i>
NS applies to ‘‘technology’’ for items controlled by 7A001 to 7A004, 7A006, 7A008, 7B001 to 7B003, 7D001 to 7D005.	NS Column 1

<i>Control(s)</i>	<i>Country chart (See Supp. No.1 to part 738)</i>
MT applies to technology for equipment controlled for MT reasons. MT does not apply to ‘‘technology’’ for equipment controlled by 7A008. MT does apply to ‘‘technology’’ for equipment specified in 7A001, 7A002 or 7A003.d that meets or exceeds parameters of 7A101, 7A102 or 7A103.	MT Column 1

RS applies to ‘‘technology’’ for inertial navigation systems or inertial equipment, and ‘‘components’’ therefor, for 9A991.b aircraft.

RS Column 1

AT applies to entire entry.

AT Column 1

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

CIV: N/A  
TSR: N/A

**Special Conditions for STA**

STA: License Exception STA may not be used to ship or transmit any technology in this entry to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* (1) See also 7E101 and 7E994. (2) The ‘‘technology’’ related to 7A003.b, 7A005, 7A103.b, 7A105, 7A106, 7A115, 7A116, 7A117, 7B103, software in 7D101 specified in the Related Controls paragraph of ECCN 7D101, 7D102.a, or 7D103 is ‘‘subject to the ITAR’’ (see 22 CFR parts 120 through 130).

*Related Definitions:* N/A

*Items:*

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

**Note:** 7E001 includes key management ‘‘technology’’ exclusively for equipment specified in 7A005.a.

■ 51. In Supplement No. 1 to part 774 (the Commerce Control List), Category 7, ECCN 7E003 is revised to read as follows:

**7E003 ‘‘Technology’’ according to the General Technology Note for the repair, refurbishing or overhaul of equipment controlled by 7A001 to 7A004.**

**License Requirements**

*Reason for Control:* NS, MT, AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
NS applies to entire entry.	NS Column 1
MT applies to entire entry.	MT Column 1
AT applies to entire entry.	AT Column 1

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

CIV: N/A  
TSR: N/A

#### List of Items Controlled

**Related Controls:** See also 7E994. This entry does not control “technology” for maintenance directly associated with calibration, removal or replacement of damaged or unserviceable LRUs and SRAs of a “civil aircraft” as described in ‘Maintenance Level I’ or ‘Maintenance Level II’.

**Related Definition:** Refer to the Related Definitions for 7B001 for ‘Maintenance Level I’ or ‘Maintenance Level II’.

#### Items:

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

■ 52. In Supplement No. 1 to part 774 (the Commerce Control List), Category 7, ECCN 7E004 is revised to read as follows:

#### 7E004 Other “technology” as follows (see List of Items Controlled).

#### License Requirements

**Reason for Control:** NS, MT, AT

Control(s)	Country chart (See Supp. No. 1 to part 738)
NS applies to entire entry.	NS Column 1
MT applies to “technology” for equipment or systems controlled for MT reasons.	MT Column 1
AT applies to entire entry.	AT Column 1

#### List Based License Exceptions (See Part 740 for a Description of All License Exceptions)

CIV: N/A  
TSR: N/A

#### Special Conditions for STA

**STA:** (1) Paragraph (c)(1) of License Exception STA (§ 740.20(c)(1) of the EAR) may not be used for 7E004, except for 7E004.a.7. (2) Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2) of the EAR) may not be used for 7E004, except for 7E004.a.7.

#### List of Items Controlled

**Related Controls:** (1) See also 7E001, 7E002, 7E101, and 7E994. (2) In addition to the Related Controls in 7E001, 7E002, and 7E101 that include MT controls, also see the MT controls in 7E104 for design “technology” for the integration of the flight control, guidance, and propulsion

data into a flight management system, designed or modified for rockets or missiles capable of achieving a “range” equal to or greater than 300 km, for optimization of rocket system trajectory; and also see 9E101 for design “technology” for integration of air vehicle fuselage, propulsion system and lifting control surfaces, designed or modified for unmanned aerial vehicles capable of achieving a “range” equal to or greater than 300 km, to optimize aerodynamic performance throughout the flight regime of an unmanned aerial vehicle.

**Related Definitions:** “Primary flight control” means an “aircraft” stability or maneuvering control using force/moment generators, *i.e.*, aerodynamic control surfaces or propulsive thrust vectoring.

#### Items:

a. “Technology” for the “development” or “production” of any of the following:

- a.1. [Reserved]
- a.2. Air data systems based on surface static data only, *i.e.*, which dispense with conventional air data probes;
- a.3. Three dimensional displays for “aircraft”;
- a.4. [Reserved]
- a.5. Electric actuators (*i.e.*, electromechanical, electrohydrostatic and integrated actuator package) “specially designed” for “primary flight control”;
- a.6. “Flight control optical sensor array” “specially designed” for implementing “active flight control systems”;
- a.7. “DBRN” systems designed to navigate underwater, using sonar or gravity databases, that provide a positioning “accuracy” equal to or less (better) than 0.4 nautical miles;

b. “Development” “technology”, as follows, for “active flight control systems” (including “fly-by-wire systems” or “fly-by-light systems”):

- b.1. Photonic-based “technology” for sensing “aircraft” or flight control component state, transferring flight control data, or commanding actuator movement, “required” for “fly-by-light systems” “active flight control systems”;
- b.2. [Reserved]
- b.3. Real-time algorithms to analyze component sensor information to predict and preemptively mitigate impending degradation and failures of components within an “active flight control system”;

**Note:** 7E004.b.3 does not include algorithms for purpose of off-line maintenance.

b.4. Real-time algorithms to identify component failures and reconfigure force and moment controls to mitigate “active flight control system” degradations and failures;

**Note:** 7E004.b.4 does not include algorithms for the elimination of fault effects through comparison of redundant data sources, or off-line pre-planned responses to anticipated failures.

b.5. Integration of digital flight control, navigation and propulsion control data, into a digital flight management system for “total control of flight”;

**Note:** 7E004.b.5 does not apply to:

1. “Technology” for integration of digital flight control, navigation and propulsion control data, into a digital flight management system for “flight path optimization”;

2. “Technology” for “aircraft” flight instrument systems integrated solely for VOR, DME, ILS or MLS navigation or approaches.

b.6. [Reserved]

b.7. “Technology” “required” for deriving the functional requirements for “fly-by-wire systems” having all of the following:

b.7.a. ‘Inner-loop’ airframe stability controls requiring loop closure rates of 40 Hz or greater; and

**Technical Note:** ‘Inner-loop’ refers to functions of “active flight control systems” that automate airframe stability controls.

b.7.b. Having any of the following:

b.7.b.1. Corrects an aerodynamically unstable airframe, measured at any point in the design flight envelope, that would lose recoverable control if not corrected within 0.5 seconds;

b.7.b.2. Couples controls in two or more axes while compensating for ‘abnormal changes in aircraft state’;

**Technical Note:** ‘Abnormal changes in aircraft state’ include in-flight structural damage, loss of engine thrust, disabled control surface, or destabilizing shifts in cargo load.

b.7.b.3. Performs the functions specified in 7E004.b.5; or

**Note:** 7E004.b.7.b.3 does not apply to autopilots.

b.7.b.4. Enables “aircraft” to have stable controlled flight, other than during take-off or landing, at greater than 18 degrees angle of attack, 15 degrees side slip, 15 degrees/second pitch or yaw rate, or 90 degrees/second roll rate;

b.8. “Technology” “required” for deriving the functional requirements of “fly-by-wire systems” to achieve all of the following:

b.8.a. No loss of control of the “aircraft” in the event of a consecutive sequence of any two individual faults within the “fly-by-wire system”; and

b.8.b. Probability of loss of control of the “aircraft” being less (better) than  $1 \times 10^{-9}$  failures per flight hour;

**Note:** 7E004.b does not apply to “technology” associated with common computer elements and utilities (*e.g.*, input signal acquisition, output signal transmission, computer program and data loading, built-in test, task scheduling mechanisms) not providing a specific flight control system function.

c. “Technology” for the “development” of helicopter systems, as follows:

c.1. Multi-axis fly-by-wire or fly-by-light controllers, which combine the functions of at least two of the following into one controlling element:

c.1.a. Collective controls;

c.1.b. Cyclic controls;

c.1.c. Yaw controls;

c.2. “Circulation-controlled anti-torque or circulation-controlled direction control systems”;

c.3. Rotor blades incorporating “variable geometry airfoils”, for use in systems using individual blade control.

■ 53. In Supplement No. 1 to part 774 (the Commerce Control List), Category 8, ECCN 8A002 is revised to read as follows:

**8A002 Marine systems, equipment, “parts” and “components,” as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$5000; N/A for 8A002.o.3.b

*GBS:* Yes for manipulators for civil end uses (e.g., underwater oil, gas or mining operations) controlled by 8A002.i.2 and having 5 degrees of freedom of movement; and 8A002.r.

*CIV:* Yes for manipulators for civil end uses (e.g., underwater oil, gas or mining operations) controlled by 8A002.i.2 and having 5 degrees of freedom of movement; and 8A002.r.

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship any commodity in 8A002.b, h, j, o.3, or p to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* (1) See also 8A992 and for underwater communications systems, see Category 5, Part I—Telecommunications. (2) See also 8A992 for self-contained underwater breathing apparatus that is not controlled by 8A002 or released for control by the 8A002.q Note. (3) For electronic imaging systems “specially designed” or modified for underwater use incorporating image intensifier tubes specified by 6A002.a.2.a or 6A002.a.2.b, see 6A003.b.3. (4) For electronic imaging systems “specially designed” or modified for underwater use incorporating “focal plane arrays” specified by 6A002.a.3.g, see 6A003.b.4.c. (5) Section 744.9 imposes a license requirement on commodities described in 8A002.d if being exported, reexported, or transferred (in-country) for use by a military end-user or for incorporation into an item controlled by ECCN 0A919.

*Related Definitions:* N/A

*Items:*

a. Systems, equipment, “parts” and “components,” “specially designed” or modified for submersible vehicles and designed to operate at depths exceeding 1,000 m, as follows:

a.1. Pressure housings or pressure hulls with a maximum inside chamber diameter exceeding 1.5 m;

a.2. Direct current propulsion motors or thrusters;

a.3. Umbilical cables, and connectors therefor, using optical fiber and having synthetic strength members;

a.4. “Parts” and “components” manufactured from material specified by ECCN 8C001;

**Technical Note:** The objective of 8A002.a.4 should not be defeated by the export of ‘syntactic foam’ controlled by 8C001 when an intermediate stage of manufacture has been performed and it is not yet in its final component form.

b. Systems “specially designed” or modified for the automated control of the motion of submersible vehicles controlled by 8A001, using navigation data, having closed loop servo-controls and having any of the following:

b.1. Enabling a vehicle to move within 10 m of a predetermined point in the water column;

b.2. Maintaining the position of the vehicle within 10 m of a predetermined point in the water column; *or*

b.3. Maintaining the position of the vehicle within 10 m while following a cable on or under the seabed;

c. Fiber optic pressure hull penetrators;

d. Underwater vision systems “specially designed” or modified for remote operation with an underwater vehicle, employing techniques to minimize the effects of back scatter and including range-gated illuminators or “laser” systems;

e. [Reserved]

f. [Reserved]

g. Light systems “specially designed” or modified for underwater use, as follows:

g.1. Stroboscopic light systems capable of a light output energy of more than 300 J per flash and a flash rate of more than 5 flashes per second;

g.2. Argon arc light systems “specially designed” for use below 1,000 m;

h. “Robots” “specially designed” for underwater use, controlled by using a dedicated computer and having any of the following:

h.1. Systems that control the “robot” using information from sensors which measure force or torque applied to an external object, distance to an external object, or tactile sense between the “robot” and an external object; *or*

h.2. The ability to exert a force of 250 N or more or a torque of 250 Nm or more and using titanium based alloys or “composite” “fibrous or filamentary materials” in their structural members;

i. Remotely controlled articulated manipulators “specially designed” or modified for use with submersible vehicles and having any of the following:

i.1. Systems which control the manipulator using information from sensors which measure any of the following:

i.1.a. Torque or force applied to an external object; *or*

i.1.b. Tactile sense between the manipulator and an external object; *or*

i.2. Controlled by proportional master-slave techniques and having 5 degrees of ‘freedom of movement’ or more;

**Technical Note:** Only functions having proportionally related motion control using positional feedback are counted when determining the number of degrees of ‘freedom of movement’.

j. Air independent power systems “specially designed” for underwater use, as follows:

j.1. Brayton or Rankine cycle engine air independent power systems having any of the following:

j.1.a. Chemical scrubber or absorber systems, “specially designed” to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;

j.1.b. Systems “specially designed” to use a monoatomic gas;

j.1.c. Devices or enclosures, “specially designed” for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *or*

j.1.d. Systems having all of the following:

j.1.d.1. “Specially designed” to pressurize the products of reaction or for fuel reformation;

j.1.d.2. “Specially designed” to store the products of the reaction; *and*

j.1.d.3. “Specially designed” to discharge the products of the reaction against a pressure of 100 kPa or more;

j.2. Diesel cycle engine air independent systems having all of the following:

j.2.a. Chemical scrubber or absorber systems, “specially designed” to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;

j.2.b. Systems “specially designed” to use a monoatomic gas;

j.2.c. Devices or enclosures, “specially designed” for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *and*

j.2.d. “Specially designed” exhaust systems that do not exhaust continuously the products of combustion;

j.3. “Fuel cell” air independent power systems with an output exceeding 2 kW and having any of the following:

j.3.a. Devices or enclosures, “specially designed” for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *or*

j.3.b. Systems having all of the following:

j.3.b.1. “Specially designed” to pressurize the products of reaction or for fuel reformation;

j.3.b.2. “Specially designed” to store the products of the reaction; *and*

j.3.b.3. “Specially designed” to discharge the products of the reaction against a pressure of 100 kPa or more;

j.4. Stirling cycle engine air independent power systems having all of the following:

j.4.a. Devices or enclosures, “specially designed” for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *and*

j.4.b. "Specially designed" exhaust systems which discharge the products of combustion against a pressure of 100 kPa or more;

k. through n. [Reserved]

o. Propellers, power transmission systems, power generation systems and noise reduction systems, as follows:

o.1. [Reserved]

o.2. Water-screw propeller, power generation systems or transmission systems, designed for use on vessels, as follows:

o.2.a. Controllable-pitch propellers and hub assemblies, rated at more than 30 MW;

o.2.b. Internally liquid-cooled electric propulsion engines with a power output exceeding 2.5 MW;

o.2.c. "Superconductive" propulsion engines or permanent magnet electric propulsion engines, with a power output exceeding 0.1 MW;

o.2.d. Power transmission shaft systems incorporating "composite" material "parts" or "components" and capable of transmitting more than 2 MW;

o.2.e. Ventilated or base-ventilated propeller systems, rated at more than 2.5 MW;

o.3. Noise reduction systems designed for use on vessels of 1,000 tonnes displacement or more, as follows:

o.3.a. Systems that attenuate underwater noise at frequencies below 500 Hz and consist of compound acoustic mounts for the acoustic isolation of diesel engines, diesel generator sets, gas turbines, gas turbine generator sets, propulsion motors or propulsion reduction gears, "specially designed" for sound or vibration isolation and having an intermediate mass exceeding 30% of the equipment to be mounted;

o.3.b. 'Active noise reduction or cancellation systems' or magnetic bearings, "specially designed" for power transmission systems;

**Technical Note:** 'Active noise reduction or cancellation systems' incorporate electronic control systems capable of actively reducing equipment vibration by the generation of anti-noise or anti-vibration signals directly to the source.

p. Pumpjet propulsion systems having all of the following:

p.1. Power output exceeding 2.5 MW; and

p.2. Using divergent nozzle and flow conditioning vane techniques to improve propulsive efficiency or reduce propulsion-generated underwater-radiated noise;

q. Underwater swimming and diving equipment as follows:

q.1. Closed circuit rebreathers;

q.2. Semi-closed circuit rebreathers;

**Note:** 8A002.q does not control individual rebreathers for personal use when accompanying their users.

*N.B. For equipment and devices "specially designed" for military use see ECCN 8A620.f.*

r. Diver deterrent acoustic systems "specially designed" or modified to disrupt divers and having a sound pressure level equal to or exceeding 190 dB (reference 1 µPa at 1 m) at frequencies of 200 Hz and below.

**Note 1:** 8A002.r does not apply to diver deterrent systems based on under-water-explosive devices, air guns or combustible sources.

**Note 2:** 8A002.r includes diver deterrent acoustic systems that use spark gap sources, also known as plasma sound sources.

■ 54. In Supplement No. 1 to part 774 (the Commerce Control List), Category 8, ECCN 8C001 is revised to read as follows:

**8C001 'Syntactic foam' designed for underwater use and having all of the following (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

**List Based License Exceptions (see Part 740 for a Description of All License Exceptions)**

*LVS:* N/A

*GBS:* N/A

*CIV:* N/A

**List of Items Controlled**

*Related Controls:* See also 8A002.a.4.

*Related Definition:* 'Syntactic foam' consists of hollow spheres of plastic or glass embedded in a resin "matrix."

*Items:*

a. Designed for marine depths exceeding 1,000 m; and

b. A density less than 561 kg/m<sup>3</sup>.

■ 55. In Supplement No. 1 to part 774 (the Commerce Control List), Category 9, ECCN 9A001 is revised to read as follows:

**9A001 Aero gas turbine engines having any of the following (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, MT, AT

<i>Control(s)</i>	<i>Country Chart (See Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 1
MT applies to only to those engines that meet the characteristics listed in 9A101.	MT Column 1
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* N/A

*GBS:* N/A

*CIV:* N/A

**List of Items Controlled**

*Related Controls:* See also 9A101 and 9A991

*Related Definitions:* N/A

*Items:*

a. Incorporating any of the "technologies" controlled by 9E003.a, 9E003.h, or 9E003.i; or

**Note 1:** 9A001.a. does not control aero gas turbine engines which meet all of the following:

a. Certified by the civil aviation authority in a country listed in Supplement No. 1 to Part 743; and

b. Intended to power non-military manned "aircraft" for which any of the following has been issued by a Wassenaar Arrangement Participating State listed in Supplement No. 1 to Part 743 for the "aircraft" with this specific engine type:

b.1. A civil type certificate; or

b.2. An equivalent document recognized by the International Civil Aviation Organization (ICAO).

**Note 2:** 9A001.a does not apply to aero gas turbine engines for Auxiliary Power Units (APUs) approved by the civil aviation authority in a Wassenaar Arrangement Participating State (see Supplement No. 1 to part 743 of the EAR).

b. Designed to power an "aircraft" designed to cruise at Mach 1 or higher, for more than 30 minutes.

■ 56. In Supplement No. 1 to part 774 (the Commerce Control List), Category 9, ECCN 9A004 is revised to read as follows:

**9A004 Space launch vehicles and "spacecraft," "spacecraft buses," "spacecraft payloads," "spacecraft" on-board systems or equipment, and terrestrial equipment, as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS and AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to 9A004.u, .v, .w and .x.	NS Column 1
AT applies to 9A004.u, .v, .w, .x and .y.	AT Column 1

**License Requirements Note:** 9A004.b through .f are controlled under ECCN 9A515.

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* N/A

*GBS:* N/A

*CIV:* N/A

**List of Items Controlled**

*Related Controls:* (1) See also 9A104, 9A515, and 9B515. (2) See ECCNs 9E001 ("development") and 9E002 ("production") for technology for items controlled by this entry. (3) See USML Categories IV for the space launch vehicles and XV for other spacecraft that are "subject to the ITAR" (see 22 CFR parts 120 through 130).

*Related Definition:* N/A

*Items:*

a. Space launch vehicles;

b. "Spacecraft";

c. "Spacecraft buses";

d. "Spacecraft payloads" incorporating items specified by 3A001.b.1.a.4, 3A002.g, 5A001.a.1, 5A001.b.3, 5A002.c, 5A002.e,

6A002.a.1, 6A002.a.2, 6A002.b, 6A002.d, 6A003.b, 6A004.c, 6A004.e, 6A008.d, 6A008.e, 6A008.k, 6A008.l or 9A010.c; e. On-board systems or equipment, specially designed for "spacecraft" and having any of the following functions:

e.1. 'Command and telemetry data handling';

**Note:** For the purpose of 9A004.e.1, 'command and telemetry data handling' includes bus data management, storage, and processing.

e.2. 'Payload data handling'; or

**Note:** For the purpose of 9A004.e.2, 'payload data handling' includes payload data management, storage, and processing.

e.3. 'Attitude and orbit control';

**Note:** For the purpose of 9A004.e.3, 'attitude and orbit control' includes sensing and actuation to determine and control the position and orientation of a "spacecraft".

*N.B.: Equipment specially designed for military use is "subject to the ITAR". See 22 CFR parts 120 through 130.*

f. Terrestrial equipment specially designed for "spacecraft," as follows:

f.1. Telemetry and telecommand equipment;

f.2. Simulators.

g. through t. [Reserved]

u. The James Webb Space Telescope (JWST) being developed, launched, and operated under the supervision of the U.S. National Aeronautics and Space Administration (NASA).

v. "Parts," "components," "accessories" and "attachments" that are "specially designed" for the James Webb Space Telescope and that are *not*:

v.1. Enumerated or controlled in the USML;

v.2. Microelectronic circuits;

v.3. Described in ECCNs 7A004 or 7A104;

or

v.4. Described in an ECCN containing "space-qualified" as a control criterion (See ECCN 9A515.x.4).

w. The International Space Station being developed, launched, and operated under the supervision of the U.S. National Aeronautics and Space Administration.

x. "Parts," "components," "accessories" and "attachments" that are "specially designed" for the International Space Station.

y. Items that would otherwise be within the scope of ECCN 9A004.v or .x but that have been identified in an interagency-cleared commodity classification (CCATS) pursuant to § 748.3(e) as warranting control in 9A004.y.

■ 57. In Supplement No. 1 to part 774 (the Commerce Control List), Category 9, ECCN 9A515 is revised to read as follows:

**9A515 "Spacecraft" and related commodities, as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, RS, MT, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry, except .e and .y.	NS Column 1
RS applies to entire entry, except .e and .y.	RS Column 1
RS applies to 9A515.e ..	RS Column 2
MT applies to microcircuits in 9A515.d and 9A515.e.2 when "usable in" "missiles" for protecting "missiles" against nuclear effects (e.g. Electro-magnetic Pulse (EMP), X-rays, combined blast and thermal effects).	MT Column 1
AT applies to entire entry.	AT Column 1

**License Requirement Note:** The Commerce Country Chart is not used for determining license requirements for commodities classified in ECCN 9A515.a.1, .a.2., .a.3., .a.4, and .g. See § 742.6(a)(8), which specifies that such commodities are subject to a worldwide license requirement.

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$1500

*GBS:* N/A

*CIV:* N/A

**Special Conditions for STA**

STA: (1) Paragraph (c)(1) of License Exception STA (§ 740.20(c)(1) of the EAR) may not be used for "spacecraft" in ECCN 9A515.a.1, .a.2, .a.3, or .a.4, or items in 9A515.g, unless determined by BIS to be eligible for License Exception STA in accordance with § 740.20(g) (License Exception STA eligibility requests for certain 9x515 and "600 series" items). (2) License Exception STA may not be used if the "spacecraft" controlled in ECCN 9A515.a.1, .a.2, .a.3, or .a.4 contains a separable or removable propulsion system enumerated in USML Category IV(d)(2) or USML Category XV(e)(12) and designated MT. (3) Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2) of the EAR) may not be used for any item in 9A515.

**List of Items Controlled**

*Related Controls:* Spacecraft, launch vehicles and related articles that are enumerated in the USML, and technical data (including "software") directly related thereto, and all services (including training) directly related to the integration of any satellite or spacecraft to a launch vehicle, including both planning and onsite support, or furnishing any assistance (including training) in the launch failure analysis or investigation for items in ECCN 9A515.a, are "subject to the ITAR." All other "spacecraft," as enumerated below and defined in § 772.1, are subject to the controls of this ECCN. See also ECCNs 3A001, 3A002, 3A991, 3A992, 6A002, 6A004, 6A008, and 6A998 for specific "space-qualified" items, 7A004 and 7A104 for star trackers, and 9A004 for the

International Space Station (ISS), the James Webb Space Telescope (JWST), and "specially designed" "parts" and "components" therefor. See USML Category XI(c) for controls on "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers that are "specially designed" for defense articles. See ECCN 9A610.g for pressure suits used for high altitude aircraft.

*Related Definitions:* 'Microcircuit' means a device in which a number of passive or active elements are considered as indivisibly associated on or within a continuous structure to perform the function of a circuit.

*Items:*

"Spacecraft" and other items described in ECCN 9A515 remain subject to the EAR even if exported, reexported, or transferred (in-country) with defense articles "subject to the ITAR" integrated into and included therein as integral parts of the item. In all other cases, such defense articles are subject to the ITAR. For example, a 9A515.a "spacecraft" remains "subject to the EAR" even when it is exported, reexported, or transferred (in-country) with a "hosted payload" described in USML Category XV(e)(17) incorporated therein. In all other cases, a "hosted payload" performing a function described in USML Category XV(a) always remains a USML item. The removal of the defense article subject to the ITAR from the spacecraft is a retransfer under the ITAR and would require an ITAR authorization, regardless of the CCL authorization the spacecraft is exported under. Additionally, transfer of technical data regarding the defense article subject to the ITAR integrated into the spacecraft would require an ITAR authorization.

a. "Spacecraft," including satellites, and space vehicles, whether designated developmental, experimental, research or scientific, not enumerated in USML Category XV or described in ECCN 9A004.u or .w, that:

a.1. Have electro-optical remote sensing capabilities and having a clear aperture greater than 0.35 meters, but less than or equal to 0.50 meters;

a.2. Have remote sensing capabilities beyond NIR (*i.e.*, SWIR, MWIR, or LWIR);

a.3. Have radar remote sensing capabilities (*e.g.*, AESA, SAR, or ISAR) having a center frequency equal to or greater than 1.0 GHz, but less than 10.0 GHz and having a bandwidth equal to or greater than 100 MHz, but less than 300 MHz;

a.4. Provide space-based logistics, assembly, or servicing of another "spacecraft"; or

a.5. Are not described in ECCN 9A515.a.1, .a.2, .a.3 or .a.4.

**Note:** ECCN 9A515.a includes commercial communications satellites, remote sensing satellites, planetary rovers, planetary and interplanetary probes, and in-space habitats, not identified in ECCN 9A004 or USML Category XV(a).

b. Ground control systems and training simulators "specially designed" for telemetry, tracking, and control of the "spacecraft" controlled in paragraphs 9A004.u or 9A515.a.

c. [Reserved]

d. Microelectronic circuits (*e.g.*, integrated circuits, microcircuits, or MOSFETs) and discrete electronic components rated, certified, or otherwise specified or described as meeting or exceeding all the following characteristics and that are “specially designed” for defense articles, “600 series” items, or items controlled by ECCNs 9A004.v or 9A515:

d.1. A total dose of  $5 \times 10^5$  Rads (Si) ( $5 \times 10^3$  Gy (Si));

d.2. A dose rate upset threshold of  $5 \times 10^8$  Rads (Si)/sec ( $5 \times 10^6$  Gy (Si)/sec);

d.3. A neutron dose of  $1 \times 10^{14}$  n/cm<sup>2</sup> (1 MeV equivalent);

d.4. An uncorrected single event upset sensitivity of  $1 \times 10^{-10}$  errors/bit/day or less, for the CREME-MC geosynchronous orbit, Solar Minimum Environment for heavy ion flux; and

d.5. An uncorrected single event upset sensitivity of  $1 \times 10^{-3}$  errors/part or less for a fluence of  $1 \times 10^7$  protons/cm<sup>2</sup> for proton energy greater than 50 MeV.

e. Microelectronic circuits (*e.g.*, integrated circuits, microcircuits, or MOSFETs) and discrete electronic components that are rated, certified, or otherwise specified or described as meeting or exceeding the characteristics in either paragraph e.1 or e.2, AND “specially designed” for defense articles controlled by USML Category XV or items controlled by ECCNs 9A004.u or 9A515:

e.1. A total dose  $\geq 1 \times 10^5$  Rads (Si) ( $1 \times 10^3$  Gy(Si)) and  $< 5 \times 10^5$  Rads (Si) ( $5 \times 10^3$  Gy(Si)); and a single event effect (SEE) (*i.e.*, single event latchup (SEL), single event burnout (SEB), or single event gate rupture (SEGR)) immunity to a linear energy transfer (LET)  $\geq 80$  MeV-cm<sup>2</sup>/mg; or

e.2. A total dose  $\geq 5 \times 10^5$  Rads (Si) ( $5 \times 10^3$  Gy (Si)) and not described in 9A515.d.

**Note 1 to 9A515.d and .e:** Application specific integrated circuits (ASICs), integrated circuits developed and produced for a specific application or function, specifically designed or modified for defense articles and not in normal commercial use are controlled by Category XI(c) of the USML regardless of characteristics.

**Note 2 to 9A515.d and .e:** See 3A001.a for controls on radiation-hardened microelectronic circuits “subject to the EAR” that are not controlled by 9A515.d or 9A515.e.

f. Pressure suits (*i.e.*, space suits) capable of operating at altitudes 55,000 feet above sea level.

g. Remote sensing components “specially designed” for “spacecraft” described in ECCNs 9A515.a.1 through 9A515.a.4 as follows:

g.1. Space-qualified optics (*i.e.*, lens, mirror, membrane having active properties (*e.g.*, adaptive, deformable)) with the largest lateral clear aperture dimension equal to or less than 0.35 meters; or with the largest clear aperture dimension greater than 0.35 meters but less than or equal to 0.50 meters;

g.2. Optical bench assemblies “specially designed” for ECCN 9A515.a.1, 9A515.a.2, 9A515.a.3, or 9A515.a.4 “spacecraft;” or

g.3. Primary, secondary, or hosted payloads that perform a function of ECCN 9A515.a.1, 9A515.a.2, 9A515.a.3, or 9A515.a.4 “spacecraft.”

h. through w. [Reserved]

x. “Parts,” “components,” “accessories” and “attachments” that are “specially designed” for defense articles controlled by USML Category XV or items controlled by 9A515, and that are NOT:

x.1. Enumerated or controlled in the USML or elsewhere within ECCNs 9A515 or 9A004;

x.2. Microelectronic circuits and discrete electronic components;

x.3. Described in ECCNs 7A004 or 7A104;

x.4. Described in an ECCN containing “space-qualified” as a control criterion (*i.e.*, 3A001.b.1, 3A001.e.4, 3A002.g.1, 3A991.o, 3A992.b.3, 6A002.a.1, 6A002.b.2, 6A002.d.1, 6A004.c and .d, 6A008.j.1, 6A998.b, or 7A003.d.2);

x.5. Microwave solid state amplifiers and microwave assemblies (refer to ECCN 3A001.b.4 for controls on these items);

x.6. Travelling wave tube amplifiers (refer to ECCN 3A001.b.8 for controls on these items); or

x.7. Elsewhere specified in ECCN 9A515.y.

**Note to 9A515.x:** “Parts,” “components,” “accessories,” and “attachments” specified in USML subcategory XV(e) or enumerated in other USML categories are subject to the controls of that paragraph or category.

y. Items that would otherwise be within the scope of ECCN 9A515.x but that have been identified in an interagency-cleared commodity classification (CCATS) pursuant to § 748.3(e) as warranting control in 9A515.y.

y.1. Discrete electronic components not specified in 9A515.e; and

y.2. Space grade or for spacecraft applications thermistors;

y.3. Space grade or for spacecraft applications RF microwave bandpass ceramic filters (Dielectric Resonator Bandpass Filters);

y.4. Space grade or for spacecraft applications hall effect sensors;

y.5. Space grade or for spacecraft applications subminiature (SMA and SMP) plugs and connectors, TNC plugs and cable and connector assemblies with SMA plugs and connectors; and

y.6. Space grade or for spacecraft applications flight cable assemblies.

■ 58. In Supplement No. 1 to part 774 (the Commerce Control List), Category 9, ECCN 9B002 is revised to read as follows:

**9B002 On-line (real time) control systems, instrumentation (including sensors) or automated data acquisition and processing equipment, having all of the following (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, MT, AT

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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
MT applies to equipment for engines controlled under 9A001 for MT reasons and for engines controlled under 9A101.	MT Column 1
AT applies to entire entry.	AT Column 1

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$3,000, except N/A for MT

*GBS:* Yes, except N/A for MT

*CIV:* Yes, except N/A for MT

**List of Items Controlled**

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

- a. “Specially designed” for the “development” of gas turbine engines, assemblies, “parts” or “components”; and
- b. Incorporating any of the “technologies” controlled by 9E003.h or 9E003.i.

■ 59. In Supplement No. 1 to part 774 (the Commerce Control List), Category 9, ECCN 9B009 is revised to read as follows:

**9B009 Tooling “specially designed” for producing gas turbine engine powder metallurgy rotor “parts” or “components” having all of the following (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, AT

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

*LVS:* \$5,000

*GBS:* N/A

*CIV:* N/A

**List of Items Controlled**

*Related Controls:* See 9B002.

*Related Definitions:* N/A

*Items:*

- a. Designed to operate at stress levels of 60% of Ultimate Tensile Strength (UTS) or more measured at a temperature of 873 K (600 °C); and
- b. Designed to operate at a temperature of 873 K (600 °C) or more.

**Note:** 9B009 does not specify tooling for the production of powder.

■ 60. In Supplement No. 1 to part 774 (the Commerce Control List), Category 9, ECCN 9E003 is revised to read as follows:

**9E003 Other "technology" as follows (see List of Items Controlled).****License Requirements**

Reason for Control: NS, SI, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry.	NS Column 1
SI applies to 9E003.a.1 through a.8, .h, .i, and .k.	See § 742.14 of the EAR for additional information
AT applies to entire entry.	AT Column 1

**Reporting Requirements**

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

**List Based License Exceptions (See Part 740 for a Description of All License Exceptions)**

CIV: N/A

TSR: N/A

**Special Conditions for STA**

STA: License Exception STA may not be used to ship or transmit any technology in 9E003.a.1, 9E003.a.2 to a.5, 9E003.a.8, or 9E003.h to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

**List of Items Controlled**

Related Controls: (1) Hot section "technology" specifically designed, modified, or equipped for military uses or purposes, or developed principally with U.S. Department of Defense funding, is "subject to the ITAR" (see 22 CFR parts 120 through 130). (2) "Technology" is subject to the EAR when actually applied to a commercial "aircraft" engine program. Exporters may seek to establish commercial application either on a case-by-case basis through submission of documentation demonstrating application to a commercial program in requesting an export license from the Department of Commerce in respect to a specific export, or in the case of use for broad categories of "aircraft," engines, "parts" or "components," a commodity jurisdiction determination from the Department of State.

Related Definitions: N/A

**Items:**

a. "Technology" "required" for the "development" or "production" of any of the following gas turbine engine "parts," "components" or systems:

a.1. Gas turbine blades, vanes or "tip shrouds", made from directionally solidified (DS) or single crystal (SC) alloys and having (in the 001 Miller Index Direction) a stress-rupture life exceeding 400 hours at 1,273 K (1,000 °C) at a stress of 200 MPa, based on the average property values;

**Technical Note:** For the purposes of 9E003.a.1, stress-rupture life testing is typically conducted on a test specimen.

a.2. Combustors having any of the following:

a.2.a. "Thermally decoupled liners" designed to operate at 'combustor exit temperature' exceeding 1,883K (1,610 °C);

a.2.b. Non-metallic liners;

a.2.c. Non-metallic shells; or

a.2.d. Liners designed to operate at 'combustor exit temperature' exceeding 1,883K (1,610 °C) and having holes that meet the parameters specified by 9E003.c;

**Note:** The "required" "technology" for holes in 9E003.a.2 is limited to the derivation of the geometry and location of the holes.

**Technical Notes:**

1. 'Thermally decoupled liners' are liners that feature at least a support structure designed to carry mechanical loads and a combustion facing structure designed to protect the support structure from the heat of combustion. The combustion facing structure and support structure have independent thermal displacement (mechanical displacement due to thermal load) with respect to one another, *i.e.* they are thermally decoupled.

2. 'Combustor exit temperature' is the bulk average gas path total (stagnation) temperature between the combustor exit plane and the leading edge of the turbine inlet guide vane (*i.e.*, measured at engine station T40 as defined in SAE ARP 755A) when the engine is running in a 'steady state mode' of operation at the certificated maximum continuous operating temperature.

*N.B.:* See 9E003.c for "technology" "required" for manufacturing cooling holes.

a.3. "Parts" or "components," that are any of the following:

a.3.a. Manufactured from organic "composite" materials designed to operate above 588 K (315 °C);

a.3.b. Manufactured from any of the following:

a.3.b.1. Metal "matrix" "composites" reinforced by any of the following:

a.3.b.1.a. Materials controlled by 1C007;

a.3.b.1.b. "Fibrous or filamentary materials" specified by 1C010; or

a.3.b.1.c. Aluminides specified by 1C002.a; or

a.3.b.2. Ceramic "matrix" "composites" specified by 1C007; or

a.3.c. Stators, vanes, blades, tip seals (shrouds), rotating blings, rotating blisks or 'splitter ducts', that are all of the following:

a.3.c.1. Not specified in 9E003.a.3.a;

a.3.c.2. Designed for compressors or fans; and

a.3.c.3. Manufactured from material controlled by 1C010.e with resins controlled by 1C008;

**Technical Note:** A 'splitter duct' performs the initial separation of the air-mass flow between the bypass and core sections of the engine.

a.4. Uncooled turbine blades, vanes or "tip shrouds" designed to operate at a 'gas path temperature' of 1,373 K (1,100 °C) or more;

a.5. Cooled turbine blades, vanes or "tip-shrouds", other than those described in 9E003.a.1, designed to operate at a 'gas path temperature' of 1,693 K (1,420 °C) or more;

**Technical Notes:**

1. 'Gas path temperature' is the bulk average gas path total (stagnation)

temperature at the leading edge plane of the turbine component when the engine is running in a 'steady state mode' of operation at the certificated or specified maximum continuous operating temperature.

2. The term 'steady state mode' defines engine operation conditions, where the engine parameters, such as thrust/power, rpm and others, have no appreciable fluctuations, when the ambient air temperature and pressure at the engine inlet are constant.

a.6. Airfoil-to-disk blade combinations using solid state joining;

a.7. Gas turbine engine "parts" or "components" using "diffusion bonding" "technology" controlled by 2E003.b;

a.8. 'Damage tolerant' gas turbine engine rotor "parts" or "components" using powder metallurgy materials controlled by 1C002.b; or

**Technical Note:** 'Damage tolerant' "parts" and "components" are designed using methodology and substantiation to predict and limit crack growth.

a.9. [Reserved]

*N.B.:* For "FADEC systems", see 9E003.h.

a.10. [Reserved]

*N.B.:* For adjustable flow path geometry, see 9E003.i.

a.11. Hollow fan blades;

b. "Technology" "required" for the "development" or "production" of any of the following:

b.1. Wind tunnel aero-models equipped with non-intrusive sensors capable of transmitting data from the sensors to the data acquisition system; or

b.2. "Composite" propeller blades or propfans, capable of absorbing more than 2,000 kW at flight speeds exceeding Mach 0.55;

c. "Technology" "required" for manufacturing cooling holes, in gas turbine engine "parts" or "components" incorporating any of the "technologies" specified by 9E003.a.1, 9E003.a.2 or 9E003.a.5, and having any of the following:

c.1. Having all of the following:

c.1.a. Minimum 'cross-sectional area' less than 0.45 mm<sup>2</sup>;

c.1.b. 'Hole shape ratio' greater than 4.52; and

c.1.c. 'Incidence angle' equal to or less than 25°; or

c.2. Having all of the following:

c.2.a. Minimum 'cross-sectional area' less than 0.12 mm<sup>2</sup>;

c.2.b. 'Hole shape ratio' greater than 5.65; and

c.2.c. 'Incidence angle' more than 25°;

**Note:** 9E003.c does not apply to "technology" for manufacturing constant radius cylindrical holes that are straight through and enter and exit on the external surfaces of the component.

**Technical Notes:**

1. For the purposes of 9E003.c, the 'cross-sectional area' is the area of the hole in the plane perpendicular to the hole axis.

2. For the purposes of 9E003.c, 'hole shape ratio' is the nominal length of the axis of the hole divided by the square root of its minimum 'cross-sectional area'.

3. For the purposes of 9E003.c, 'incidence angle' is the acute angle measured between the plane tangential to the airfoil surface and the hole axis at the point where the hole axis enters the airfoil surface.

4. Techniques for manufacturing holes in 9E003.c include "laser", water jet, Electro-Chemical Machining (ECM) or Electrical Discharge Machining (EDM) methods.

d. "Technology" "required" for the "development" or "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems;

e. "Technology" for the "development" or "production" of reciprocating diesel engine ground vehicle propulsion systems having all of the following:

- e.1. 'Box volume' of 1.2 m<sup>3</sup> or less;
- e.2. An overall power output of more than 750 kW based on 80/1269/EEC, ISO 2534 or national equivalents; *and*
- e.3. Power density of more than 700 kW/m<sup>3</sup> of 'box volume';

**Technical Note:** 'Box volume' is the product of three perpendicular dimensions measured in the following way:

Length: The length of the crankshaft from front flange to flywheel face;

Width: The widest of any of the following:

a. The outside dimension from valve cover to valve cover;

b. The dimensions of the outside edges of the cylinder heads; or

c. The diameter of the flywheel housing;

Height: The largest of any of the following:

a. The dimension of the crankshaft centerline to the top plane of the valve cover (or cylinder head) plus twice the stroke; or

b. The diameter of the flywheel housing.

f. "Technology" "required" for the "production" of "specially designed" "parts" or "components" for high output diesel engines, as follows:

f.1. "Technology" "required" for the "production" of engine systems having all of the following "parts" and "components" employing ceramics materials controlled by 1C007:

f.1.a. Cylinder liners;

f.1.b. Pistons;

f.1.c. Cylinder heads; *and*

f.1.d. One or more other "part" or "component" (including exhaust ports, turbochargers, valve guides, valve assemblies or insulated fuel injectors);

f.2. "Technology" "required" for the "production" of turbocharger systems with single-stage compressors and having all of the following:

f.2.a. Operating at pressure ratios of 4:1 or higher;

f.2.b. Mass flow in the range from 30 to 130 kg per minute; *and*

f.2.c. Variable flow area capability within the compressor or turbine sections;

f.3. "Technology" "required" for the "production" of fuel injection systems with a "specially designed" multifuel (*e.g.*, diesel or jet fuel) capability covering a viscosity range from diesel fuel (2.5 cSt at 310.8 K

(37.8 °C)) down to gasoline fuel (0.5 cSt at 310.8 K (37.8 °C)) and having all of the following:

f.3.a. Injection amount in excess of 230 mm<sup>3</sup> per injection per cylinder; *and*

f.3.b. Electronic control features "specially designed" for switching governor characteristics automatically depending on fuel property to provide the same torque characteristics by using the appropriate sensors;

g. "Technology" "required" for the "development" or "production" of 'high output diesel engines' for solid, gas phase or liquid film (or combinations thereof) cylinder wall lubrication and permitting operation to temperatures exceeding 723 K (450 °C), measured on the cylinder wall at the top limit of travel of the top ring of the piston;

**Technical Note:** 'High output diesel engines' are diesel engines with a specified brake mean effective pressure of 1.8 MPa or more at a speed of 2,300 r.p.m., provided the rated speed is 2,300 r.p.m. or more.

h. "Technology" for gas turbine engine "FADEC systems" as follows:

h.1. "Development" "technology" for deriving the functional requirements for the "parts" or "components" necessary for the "FADEC system" to regulate engine thrust or shaft power (*e.g.*, feedback sensor time constants and accuracies, fuel valve slew rate);

h.2. "Development" or "production" "technology" for control and diagnostic "parts" or "components" unique to the "FADEC system" and used to regulate engine thrust or shaft power;

h.3. "Development" "technology" for the control law algorithms, including "source code", unique to the "FADEC system" and used to regulate engine thrust or shaft power;

**Note:** 9E003.h does not apply to technical data related to engine-"aircraft" integration required by civil aviation authorities of one or more Wassenaar Arrangement Participating States (See Supplement No. 1 to part 743 of the EAR) to be published for general airline use (*e.g.*, installation manuals, operating instructions, instructions for continued airworthiness) or interface functions (*e.g.*, input/output processing, airframe thrust or shaft power demand).

i. "Technology" for adjustable flow path systems designed to maintain engine stability for gas generator turbines, fan or power turbines, or propelling nozzles, as follows:

i.1. "Development" "technology" for deriving the functional requirements for the "parts" or "components" that maintain engine stability;

i.2. "Development" or "production" "technology" for "parts" or "components" unique to the adjustable flow path system and that maintain engine stability;

i.3. "Development" "technology" for the control law algorithms, including "source code", unique to the adjustable flow path system and that maintain engine stability;

**Note:** 9E003.i does not apply to "technology" for any of the following:

- a. Inlet guide vanes;
- b. Variable pitch fans or prop-fans;
- c. Variable compressor vanes;
- d. Compressor bleed valves; or
- e. Adjustable flow path geometry for reverse thrust.

j. "Technology" "required" for the "development" of wing-folding systems designed for fixed-wing "aircraft" powered by gas turbine engines.

N.B.: For "technology" "required" for the "development" of wing-folding systems designed for fixed-wing "aircraft" specified in USML Category VIII (a), see USML Category VIII (i).

k. "Technology" not otherwise controlled in 9E003.a.1 through a.8, a.10, and .h and used in the "development", "production", or overhaul of hot section "parts" or "components" of civil derivatives of military engines controlled on the U.S. Munitions List.

#### Supplement No. 6 to Part 774 [Amended]

■ 61. Supplement No. 6 to part 774 "Sensitive List" is amended by:

■ a. Removing the reference to "and .d" in paragraph (1)(iii) and "1C007.d" in paragraphs (1)(vi) and (1)(vii);

■ b. Removing the phrase "exceeding 12.5" and adding in its place "exceeding 16" in paragraphs (4)(ii) and (4)(iii);

■ c. Removing the term "user accessible programmability" and adding in its place "user-accessible programmability" in paragraphs (6)(v) and (6)(viii);

■ d. Adding double quotes around the term "Magnetic gradiometers" in paragraph (6)(xxiv)(C);

■ e. Adding double quotes around the word "magnetometers" in paragraph (6)(xxv);

■ f. Removing and reserving paragraph (9)(viii);

■ g. Revising paragraph (9)(ix); and

■ h. Adding paragraph (9)(x).

The additions and revisions read as follows:

#### Supplement No. 6 to Part 774— Sensitive List

\* \* \* \* \*

(9) Category 9

\* \* \* \* \*

(ix) 9E003.a.1 to a.5, a.8.

(x) 9E003.h.

**Matthew S. Borman,**

*Deputy Assistant Secretary for Export Administration.*

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