

**DEPARTMENT OF COMMERCE****Bureau of Industry and Security****15 CFR Parts 740, 742, 744, 772, and 774****[Docket No. 170831854–7854–01]****RIN 0694–AH44****Wassenaar Arrangement 2017 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 2017 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 2017 Plenary meeting by revising Export Control Classification Numbers (ECCNs) controlled for national security reasons in each category of the CCL. This rule also makes other associated changes to the EAR and makes a correction.

**DATES:** This rule is effective October 24, 2018.**FOR FURTHER INFORMATION CONTACT:** For general questions, contact Sharron Cook, Office of Exporter Services, Bureau of Industry and Security, U.S. Department of Commerce at 202–482–2440 or by email: [Sharron.Cook@bis.doc.gov](mailto:Sharron.Cook@bis.doc.gov).*For technical questions contact:*

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Categories 7 &amp; 9: Michael Rithmire 202–482–6105 or Michael Tu 202–482–6462.

Category 9x515 (Satellites): Michael Tu 202–482–6462.

Category “600 Series” (Munitions Items): Christopher Williams at 202–482–6023 or Heather Moore at 202–482–4786.

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

The Wassenaar Arrangement (Wassenaar or WA) (<http://www.wassenaar.org>) on Export Controls for Conventional Arms and Dual-Use Goods and Technologies is a group of 42 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 2017 WA Plenary meeting, update the corresponding items listed in the EAR, and reflect the most recent changes in technologies and conditions. Unless explicitly discussed below, the revisions made by this rule will not impact the number of license applications submitted to BIS.

**Revisions to the Commerce Control List Related to WA 2017 Plenary Agreements**

*Revises (50) ECCNs:* 0A617, 0A919, 1A002, 1C001, 1C002, 1C007, 1C010, 1C608, 2A001, 2B001, 2B006, 2B007, 2B008, 2E003, 3A001, 3A002, 3B001, 3B002, 3C002, 3C005, 3C006, 3C992, 3E001, 4A003, 4A004, 4D001, 4E001, 5A001, 5A002, 5D002, 5E002, 6A002, 6A003, 6A004, 6A005, 6A008, 6A203, 6D003, 6D991, 6E001, 6E002, 6E201, 7A006, 7E004, 9A002, 9A004, 9D001, 9D002, 9D004, and 9E003.

*License Exception eligibility additions:* 3A001.i (GBS).

*ECCN Removals:* 6A990 and 6E990.

*ECCN Correction:* 3A991.

*ECCN change to maintain NP controls:* 2B206.

**Category 0—Nuclear Materials, Facilities, and Equipment [and Miscellaneous Items]**

*0A617 Miscellaneous “Equipment”, Materials, and Related Commodities*

ECCN 0A617, paragraph y.3, containers for shipping or packing defense articles or items controlled by “600 series” ECCNs, is amended by narrowing the scope to International Organization for Standardization (ISO) intermodal containers or demountable vehicle bodies (*i.e.*, swap bodies), but also expands the scope beyond “specially designed” by adding “or modified”. As the term ‘modified’ is in single quotes, BIS is also adding the technical note that defines ‘modified,’ which was already existing text in Wassenaar Arrangement Military List of 2017 (WAML 17).

*0A919 “Military Commodities” Located and Produced Outside the United States*

ECCN 0A919 is revised to remove reference to 6A990, because this rule removes 6A990 from the CCL and Read Out Integrated Circuits (ROICs) are now controlled under 6A002.f.

**Category 1—Special Materials and Related Equipment, Chemicals, “Microorganisms”, and “Toxins”**

*1A002 “Composite” Structures or Laminates*

The heading of ECCN 1A002 is amended by replacing “having any of the following” with “as follows”. An “as follows” phrase is usually followed by items, but in this case it is followed by parameters. The phrase “consisting of” is replaced by “made from” in both sub-paragraph .a and .b. Also, more descriptive text is added for clarity and the scope of the control is not changed. The superfluous word “purely” is removed from Note 2, which does not change the effect of the Note.

*1C001 Materials “Specially Designed” for Use as Absorbing of Electromagnetic Radiation, or Intrinsically Conductive Polymers*

The heading of ECCN 1C001 is amended by replacing “absorbers” with “absorbing” and replacing “waves” with “radiation”. Subparagraph .b is amended by moving the phrase “not transparent to visible light” to the beginning and adding more descriptive text “near-infrared radiation having a wavelength” to clarify the scope of the control. Also the parameters are changed from “ $1.5 \times 10^{14}$  Hz” to “810

nm” and “ $3.7 \times 10^{14}$  Hz” to “2,000 nm (frequencies exceeding 150 THz but less than 370 THz)”. The frequency band is changed to the equivalent wavelength band to make the parameter easier to understand and not to change the scope of control. Therefore, these revisions will not affect the number of license applications submitted to BIS.

**1C002 Metal Alloys, Metal Alloy Powder and Alloyed Materials**

Item paragraphs c.2 and d.3 are amended by replacing the double quotes with single quotes around the terms in c.2.a through c.2.h and d.3.a through d.3.c. Double quotes indicate the term is used multiple times in the Commerce Control List (CCL) or separated by a large amount of space within a single ECCN and the definition for the term is found in part 772. Single quotes indicate the term is used only in a single ECCN and the definition for the term is found within the ECCN where the term is used. These and many other terms in this rule were found to only be used in a single ECCN and should not be defined in part 772, but in the ECCN. The definitions for the terms, in c.2.a through c.2.h and d.3.a through d.3.c, are moved from part 772 to a new Technical Note after Items paragraph d.3.c. These amendments do not change the number of license applications submitted to BIS.

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

In the Nota Bene (N.B.) to Item paragraphs c.2, .d and .f, the phrase “listed under” is replaced by “specified by” to be consistent with the terms used to reference new locations for controlled items. This does not change the number of license applications submitted to BIS.

**1C010 “Fibrous or Filamentary Materials”**

Item paragraphs d.2 and .e, and Note 1 below Item paragraph e.2.c are amended by replacing the double quotes with single quotes around defined terms, because the terms are only used in this ECCN. The definition for ‘commingled’ is moved from part 772 to the Technical Note below Items paragraph d.2. The definition for ‘carbon fiber preforms’ is moved from part 772 to the Technical Note at the end of the List of Items Controlled. These amendments do not change the number of license applications submitted to BIS.

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

WA agreed to add a Note specifying that WAML 8.c.1 does not apply to aircraft fuels—JP-4, JP-5 and JP-8. This rule adds this Note below 1C608.n “Any explosives, ‘propellants,’ oxidizers, ‘pyrotechnics’, fuels, binders, or additives . . .” as well as bringing forth another Note from WAML 8.c.1 that specifies that aircraft fuels specified by WAML 8.c.1 are finished products, not their constituents.

**Category 2—Materials Processing**

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

Note 2 at the beginning of the Items paragraph is amended by adding “(or national equivalents)”, in order to help efficiently classify bearings using national standards that are equivalent to ISO 3290 as grade 5.

**2B001 Machine Tools**

An editorial change is made to Note 2 to 2B001.a by replacing “and/or” with “or”. Items paragraph c.1.b is revised from specifying “three or more axes” to “three or four axes” to remove the overlap between c.2 “five or more axes” and c.1.b for machine tools for grinding. This will not affect license submissions to BIS.

**2B006 Dimensional Inspection or Measuring Systems, Equipment, Position Feedback Units and “Electronic Assemblies”**

The Heading is revised to add “position feedback units” and “electronic assemblies” to more accurately describe the scope of controls in Items paragraph .b. Angular displacement measuring systems formerly in 2B006.b.2 are moved to 2B006.c. Linear Variable Differential Transformer (LVDT) systems formerly in 2B006.b.1.b are moved to 2B206.d and no longer have a national security control. The License Requirements section is amended by revising the Nuclear Proliferation (NP) controls from “2B006.a and .b” to “2B006.a, .b.1, b.3, and .c (angular displacement measuring instruments)” to account for moving the LVDT systems to 2B206 and moving the angular displacement measuring instruments from 2B006.b.2 to .c. Item paragraphs 2B008.a (linear position feedback units) and .b.2 (rotary position feedback units) are moved to 2B006.b.2 and .c, respectively, so that all the measuring systems for machine tools are in one place. Equipment for measuring surface roughness is moved from Items paragraph 2B006.c to .d.

**2B007 “Robots”**

Item paragraph .a “[Robots] capable in real-time of full three-dimensional image processing or full three-dimensional “scene analysis” to generate or modify “programs” or to generate or modify numerical program data” is removed and reserved because of insufficient connection to military capabilities. Robots of national security concern are controlled under 2B007.b, .c and .d. This change will have a minimal effect on license application submissions to BIS.

**2B008 “Compound Rotary Tables” and “Tilting Spindles”, “Specially Designed” for Machine Tools**

The Heading is amended by replacing “assemblies or units” with ‘compound rotary tables’ and “tilting spindles”, as well as removing “or dimensional inspection or measuring systems and equipment” to align with revisions made to the List of Items Controlled in this ECCN. Item paragraphs .a (linear position feedback units) and .b (rotary position feedback units) are removed and reserved, because this rule moves these items to 2B006.b.2 and .c, respectively. Item paragraph .c is amended by replacing and cascading the parameter paragraphs, as well as moving the definition for ‘compound rotary table’ from part 772 to a Technical Note under this Item paragraph. “Tilting spindles” are moved from Item paragraph .c to new Item paragraph .d to separate it from the compound rotary table control. The parameters have been revised in both paragraphs .c and .d to remove ambiguity, which will not affect license application submissions.

**2B206 Dimensional Inspection Machines, Instruments or Systems, Other Than Those Described in 2B006**

2B206 is amended by adding Linear Variable Differential Transformer (LVDT) systems to Item paragraph .d, because this item is removed from 2B006.b.1.b. While LVDT systems are no longer controlled for national security reasons, they are still on the Nuclear Supplier’s Group (NSG) list under 1.B.3.b.2 and remain controlled for nuclear nonproliferation reasons on the CCL.

**2E003 Other “Technology”**

Item paragraph .a (“technology” for the “development” of interactive graphics as an integrated part in “numerical control” units for preparation or modification of part programs) is removed and reserved because of the advancement of technology. Therefore, Item paragraph .a is removed from License Exception TSR.

The double quotes are replaced with single quotes around the term ‘direct-acting hydraulic pressing’ in Item paragraphs b.1.c and b.1.d and ‘hot isostatic densification’ in Item paragraph b.2.d. Additionally, the definition for these terms is moved from part 772 to the Technical Notes below Item paragraph b.2.d.3, because these terms are only used in this ECCN. Item paragraph .d (“technology” for the “development” of generators of machine tool instructions . . . from design data residing inside “numerical control” units) is removed and reserved because of the advancement of technology. When items are removed because of technological advancement, it does not affect the annual number of license application submissions to BIS.

### Category 3—Electronics

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

Note 1 at the beginning of Category 3 is amended by making an editorial correction by moving an “or” and adding “to” in order to correctly specify which ECCN 3A001 subparagraphs are excluded from the scope statement for Category 3.

Note 2 at the beginning of Category 3 is amended by making an editorial correction by moving an “or”, adding “to”, adding a comma and replacing “that” with “which”. These revisions are made to correctly specify which ECCN 3A001 subparagraphs are included in the scope statement for Category 3.

The Nota Bene after Note 2 is amended to make an editorial correction by moving an “and” and adding “to” in order to correctly specify the scope of this N.B.

#### 3A001 Electronic Items

Item paragraph a.2 is amended by replacing “Electrical Erasable Programmable Read-Only Memories (EEPROMS), flash memories, and MRAMs” with ‘non-volatile memories’ and adding a Technical Note to define ‘non-volatile memories,’ to provide a more generic term for these types of memory integrated circuits.

Item paragraph a.5.a “ADCs” and the Technical Note below a.5.a are amended by replacing the term “output rate” with the “sample rate” as measured points at the input, except for oversampling (defined as output sample rate), and the Technical Note identifies common ways manufacturers specify ‘sample rate.’ The definition for “sample rate” is added to part 772 “Definition of Terms. . . .”

Also the superfluous term “Mega Samples Per Second”, is removed from several subparagraphs in a.5.a, but leaves its acronym “MSPS”. The Technical Notes below Items paragraph a.5.a are amended by adding an explanation for the resolution of the ADC, removing the explanation for output rate, replacing single quotes with double quotes around the term “interleaved ADCs” and “multiple channel ADCs”, and removing Technical Notes 6 through 9. The definitions for the terms “interleaved ADCs” and “multiple channel ADCs” are added to part 772 “Definition of Terms. . . .”. These revisions will not change the number of submissions of license applications.

Item paragraph a.5.b.2.a, “settling time” parameter, is amended by adding “arrive at or within” to clarify the potentially ambiguous parameter with common usage and understanding of DAC specifications, so that it will not be misinterpreted to mean the time to deviate by the specific amount from the original level.

The inclusion Note to 3A001.a.7 is amended by removing “Simple Programmable Logic Devices (SPLDs)” because of technological advancements, which will not affect the number of license application submissions.

Item paragraph a.14 is amended by replacing “Integrated circuits that perform all of the following:” with “Integrated circuits that perform or are programmed to perform all of the following:”. The term “input sample rate” is replaced with “sample rate” that is defined in part 772. The superfluous “Giga Samples Per Second” is removed, but the acronym GSPS remains, as “Mega Samples Per Second” is removed and MSPS remains. Technical Notes are added below Items paragraph a.14.b.2 to provide more explanation of the parameters in Item paragraph .a, especially, resolution of ADC and the “sample rate” for integrated circuits with interleaving or non-interleaving “multiple channel ADCs”. These changes will have little effect on the number of licenses submitted to BIS.

Nota Bene 3 is added after Item paragraph b.4.f to reference 3A001.b.7 for converters and harmonic mixers, designed to extend the operating or frequency range of signal analyzers, signal generators, network analyzers or microwave test receivers.

In Item paragraph b.11 double quotes are replaced with single quotes around the term ‘frequency synthesizer’ and the definition is moved from part 772 to a Technical Note below Item paragraph b.11.g, because the term is only used in this ECCN.

The Technical Notes after Item paragraph b.12.d are amended by correcting the reference “3A001.b.4.12.c” to read “3A001.b.12.c” in Technical Note 5.

The parameters for ‘primary cells’ in Item paragraph e.1.a are amended by cascading the parameters and adding a ‘continuous power density’ parameter and the definition for it in Technical Note 5 below Item paragraph e.1.b, because military uses for these items have requirements in both energy and power density. This revision should lower the annual number of license applications submitted to BIS by 5.

Intensity, amplitude, or phase electro-optic modulators, designed for analog signals, including electro-optic modulators having optical input and output connectors are added to new paragraph 3A001.i to address photonic components for analog Radio Frequency (RF) over fiber antenna remoting, and analog RF distribution of signals. One of the parameters for these items is ‘half-wave voltage’ ( $V\pi$ ), which is defined in a Technical Note below the new paragraph. These items will be eligible for License Exception GBS; therefore, the GBS paragraph is revised to add Item paragraph .i. This new entry is estimated to add 10 new license application submissions to BIS annually.

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

On September 20, 2016, BIS published a WA rule (81 FR 64682) that increased the energy density in 3A001.e.1.b from 300 to 350 Wh/kg, but did not make the corresponding change to ECCN 3A991.j.2, which left a gap in control. This rule corrects 3A991.j.2 by increasing the energy density from 300 to 350 Wh/kg or less in order to close a gap of control between 3A001.e.1.b and 3A991.j.2 for secondary cells.

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

The frequency parameter is raised from “exceeding 10 MHz” to “exceeding 40 MHz” for signal analyzers having a 3 dB resolution bandwidth (RBW) in Item paragraph c.1, which is estimated to reduce annual license application submissions to BIS by 5.

Double quotes are replaced with single quotes for the term ‘real-time bandwidth’ in Item paragraph c.4.a and for ‘frequency mask trigger’ in Item paragraph c.4.b.2, because these terms are only used in this ECCN. The definitions for these terms are moved from part 772 to the Technical Notes after Item paragraph c.4.b.2.

The scientific unit “billion samples per second” is replaced with “Giga Samples Per Second (GSPS)” in Item paragraph h.1.a. The scientific unit “billion samples per second” is replaced with the acronym GSPS in Item paragraphs h.1.b and h.1.c. The scientific unit “million samples per second” is replaced with “Mega Samples Per Second (MSPS)” in Item paragraph h.1.d. The scientific unit “million samples per second” is replaced with the acronym “MSPS” in Item paragraph h.1.e. These revisions are made for simplification purposes.

The Technical Note below Item paragraph h.2.c is replaced by the same Technical Notes that are added below 3A001.a.5.a, explaining resolution and “sample rate” for interleaved and non-interleaved multiple-channel “electronic assemblies”, modules, or equipment.

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

Mask “substrate blanks” with multilayer reflector structure consisting of molybdenum and silicon being “specially designed” for ‘Extreme Ultraviolet (EUV)’ lithography and being compliant with SEMI Standard P37 are added to new paragraph 3B001.j, because mask “substrate blanks” and the subsequent substrate blank with multilayer reflector structure are critical materials for EUV lithography. This addition is estimated to increase annual license application submissions to BIS by 7. EUV lithography opens up integrated circuit fabrication at the most advanced state-of-the-art technology node. The definition for ‘Extreme Ultraviolet (EUV)’ is added to a Technical Note below Item paragraph j.2.

### *3B002 Test Equipment “Specially Designed” for Testing Finished or Unfinished Semiconductor Devices*

Item paragraph .a is revised from “For testing S-parameters of transistor device at frequencies exceeding 31.8 GHz” to read “For testing S-parameters of items specified by 3A001.b.3” to remove potential overlapping controls for network analyzers (which measure S-parameters) described in 3A002.e, to harmonize the control text of equipment for testing S-parameters of transistors specified in paragraphs 3A001.b.3.a and 3A001.b.3.b (*i.e.*, transistors that are below 31.8 GHz), and to remove ambiguity regarding the meaning of the phrase “transistor devices” by substituting the unambiguous reference to transistors specified by 3A001.b.3.

### *3C002 Resist Materials*

The wavelength for positive resists in Item paragraph a.1 is revised from “wavelengths less than 245 nm . . . .” to “wavelengths less than 193 nm . . . .” in order to match the material control with the lithography equipment parameters in 3B001.f.1.a, which is estimated to reduce by 3 the annual number of license application submissions to BIS.

### *3C005 High Resistivity Materials*

The Heading of ECCN 3C005 is revised to move the items that were in the Heading to Items paragraph .a. Polycrystalline “substrates” or polycrystalline ceramic “substrates” are added to Item paragraph .b, because there are both military and commercial applications for microwave transistors fabricated on the engineered substrates. These newly added substrates will be controlled for NS:2 and AT:1 and have License Exception LVS (\$3,000), GBS and CIV eligibility. It is anticipated that this new control will result in an increase of 15 new license application submissions to BIS annually.

### *3C006 Materials, Not Specified by 3C001, Consisting of a “Substrate” Specified in 3C005 With at Least One Epitaxial Layer of Silicon Carbide, Gallium Nitride, Aluminum Nitride or Aluminum Gallium Nitride*

The Heading is amended by adding “Materials, not specified by 3C001, consisting of a” at the beginning of the Heading in order to clarify the scope of the control. The former language of 3C001, 3C005 and 3C006 has common elements that have led to some confusion around the control of silicon carbide wafers.

### *3C992 Positive Resists Designed for Semiconductor Lithography*

The Heading of 3C992 is amended by replacing the wavelength range from “370 and 245 nm” to “370 and 193 nm.” This is to harmonize this ECCN with the amendment to ECCN 3C002.a.1.

### *3E001 “Technology”*

License Exception CIV eligibility paragraph is corrected by removing the eligibility for 3B001.c, because that paragraph was removed and reserved on September 20, 2016 (81 FR 64658).

Note 2 is amended by harmonizing the scope of the paragraph to be “technology” for integrated circuits controlled by 3A001.a.3 to a.14.

Note 3 is added to exclude from 3E001 ‘Process Design Kits’ (‘PDKs’) unless they include libraries implementing functions or technologies

for items specified by 3A001. A Technical Note is added below Note 3 to define ‘Process Design Kit’ (‘PDK’). PDKs do not provide knowledge about production tools. This will not result in a change to license application submissions, because no license submissions have been submitted to BIS for PDK under 3E001.

### **Category 4—Computers**

In Note 2 at the top of Category 4, the double quotes are replaced with single quotes around the term ‘main storage’ because the term is only used in these Category 4 Notes. The definition is moved from part 772 to a Technical Note at the end of the Category 4 Notes section.

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

The Adjusted Peak Performance (APP) is raised from “exceeding 16 WT” to “exceeding 29 WT” in Item paragraph .b and in accordance with this revision the APP is raised to 29 in the AT control text in the License Requirements table and in two places in the Note to the table. This change will not immediately affect the annual number of license application submissions to BIS because this is keeping up with technological advancement. However, absent additional increases next year, BIS estimates that this level would result in an increase of 600 license applications per year.

### *4A004 Computers*

The double quotes are replaced with single quotes around the terms ‘systolic array computers,’ ‘neural computers’ and ‘optical computers,’ because these terms are only used in this ECCN. The definitions for these terms are moved from part 772 to Technical Notes at the end of the Items paragraph of 4A004.

### *4D001 “Software” & 4E001 “Technology”*

The Adjusted Peak Performance (APP) is raised from 16 Weighted TeraFLOPs (WT) to 29 WT in License Exceptions TSR and STA in accordance with the new APP level in 4A003.b. The APP control level is raised from “exceeding 8 WT” to “exceeding 15 WT” in Item paragraph b.1. These revisions continue to address the need to track incremental (*e.g.*, “Moore’s Law”) improvements in microprocessor technology. This change will not affect the annual number of license application submissions to BIS because this is keeping up with technological advancement.

*Technical Note on “Adjusted Peak Performance” (“APP”)*

In the Outline of “APP” calculation method, the Note to paragraph 1, an “and/or” is replaced with “or,” which does not change the meaning at all.

**Category 5—Part 1—“Telecommunications”***5A001 Telecommunications Systems, Equipment, “Components” and “Accessories”*

In the NS Column 1 paragraph of the License Requirements table, the order of the referenced Item paragraphs is corrected.

For telecommunications equipment specially designed to withstand transitory electronic effects or electromagnetic pulse effects, the temperature range parameters is changed from “to operate outside the temperature range from 218K (-55 °C) to 397 K (124 °C)” to “below 218K (-55°C)” in Item paragraph a.3 or “above 397 K (124 °C)” in new Item paragraph a.4, which does not change the scope of control, but seeks to make the text easier to understand. The Note to 5A001.a.3 is modified to add 5A001.a.4, so that it reads “5A001.a.3 and 5A001.a.4 apply only to electronic equipment”.

Double quotes are replaced by single quotes around the term ‘electronically steerable phased array antennae’ in Item paragraph .d. The word ‘antennas’ is replaced with ‘antennae’ in this paragraph and in Note 1 to this paragraph. The quotes are revised because the term is only used in this ECCN. The definition for the term is moved from part 772 to a Technical Note above Item paragraph .e. Because of technology advances, phased array antennae are increasingly being developed for civil telecommunications applications, including cellular, WLAN, 802.15, and wireless HDMI. Exclusion Note 2 is added in order to remove from control phased array antennae specially designed for those purposes.

**Category 5—Part 2—“Information Security”***5A002 “Information Security” Systems, Equipment and “Components”*

5A002 is amended to clarify controls on products with dormant encryption. These changes do not affect the scope of items controlled. Items paragraph .a is amended by replacing the phrase “where that cryptographic capability is usable without “cryptographic activation” or has been activated” with the phrase “where that cryptographic capability is usable, has been activated, or can be activated by means of

“cryptographic activation” not employing a secure mechanism”. The revision clarified that an item is controlled if (1) the ‘cryptography for data confidentiality’ is usable from the beginning regardless of “cryptographic activation” (*i.e.*, not dormant), (2) the cryptographic capability was previously dormant but is now usable (whether by “cryptographic activation” or by other means; or (3) the “cryptographic activation” mechanism is not secure (*i.e.*, the cryptographic capability is not securely kept dormant).

Items paragraph .b is amended by replacing “to enable” an item with “for converting” an item and replacing “to achieve or exceed the controlled performance levels for functionality specified by 5A002.a that would not otherwise be enabled” with “not specified by Category 5 —Part 2 into an item specified by 5A002.a or 5D002.c.1, and not released by the Cryptography Note (Note 3 in Category 5—Part 2), or for enabling, by means of “cryptographic activation”, additional functionality specified by 5A002.a of an item already specified by Category 5—Part 2”. This clarifies that a “cryptographic activation” mechanism is controlled by 5A002.b in two situations: (1) It converts an item classified outside of Category 5—Part 2 into a 5A002.a item (*e.g.*, by activating ‘cryptography for data confidentiality’ capability in an item that was previously limited to performing “authentication,” or by activating encryption capability which disqualifies a product from the Cryptography Note exclusion (Note 3 in Category 5—Part 2)); or (2) it enables additional functionality specified in 5A002.a in an item that was already classified in Category 5—Part 2 (*e.g.*, making additional encryption algorithms usable by the item, or that would change the item from being eligible or described under § 740.17(b)(1) into an item described under § 740.17(b)(2) or (3)).

*5D002 “Software” and 5E002 “Technology”*

Item paragraph .b of ECCNs 5D002 and 5E002 is amended by replacing “enable” with “for converting” and replacing “to meet the criteria for functionality specified by 5A002.a, that would not otherwise be met” with “not specified by Category 5—Part 2 into an item specified by 5A002.a or 5D002.c.1, and not released by the Cryptography Note (Note 3 in Category 5—Part 2), or for enabling, by means of “cryptographic activation”, additional functionality specified by 5A002.a of an item already specified by Category 5—Part 2”. These revisions are made to

create mirroring entries consistent with the changes being made to 5A002.b.

**Category 6—Sensors and Lasers***6A002 Optical Sensors and Equipment, and “Components”*

Item paragraph .f is added to establish a control for Read-Out Integrated Circuits (ROICs) to ensure that certain ROICs not controlled on the Munitions List, but that provide night vision capability, are controlled. In order to maintain consistent paragraph placement with the WA List this rule adds and reserves Items paragraph .e, so that ROICs can be added to Item paragraph .f. For consistency, Items paragraph .f is added to the Regional Stability controls (RS Column 1) in the License Requirements section, because 6A990, where ROICs were formerly controlled, was controlled for RS Column 1.

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

Item paragraphs a.1 (high-speed cinema recording cameras) and a.2 (mechanical high speed cameras) are removed and reserved because of the advancement of technology. Item paragraph a.3.a (mechanical streak cameras) is also removed because of the advancement of technology. As a result of this change, electronic streak cameras are moved from Item paragraph a.3.b to a.3. BIS anticipates that there will be a negligible impact on the annual number of license applications submitted to BIS as a result of these removals and revisions.

*6A004 Optical Equipment and “Components”*

The double quotes are replaced with single quotes around the term ‘deformable mirrors’ in Item paragraph a.1 because the term is only used in this ECCN. The definition for ‘deformable mirrors’ is moved from part 772 to the Technical Note below Item paragraph a.1.b.2. At the end of Item paragraph e.3 the period is changed to a semicolon, because a new Item paragraph is added. Dynamic wavefront measuring equipment is added to Item paragraph .f, with parameters in subparagraphs and a Technical Note at the end to define “frame rate”. The purpose of wavefront sensing is to measure the level of the wavefront aberration as it is transferred through an optical system, regardless if the source of that aberration is the optical system itself or something external to that system. Wavefront sensors are principally used as one of the main components of adaptive optics

systems where they serve to close the control loop and feed the information about the required correction to deformable mirrors and beam steering mirrors in real-time, which are also controlled in this ECCN.

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

An editorial amendment is made to Note 1, below Item paragraph a.6.b.2, by replacing “and/or” with “or”, which does not change the scope of the Note. The double quotes are replaced with single quotes around the term ‘transfer lasers’ in Item paragraph d.5.c. The definition for ‘transfer lasers’ is moved from part 772 to the Technical Note below Item paragraph d.5.c.2, because this term is only found in this ECCN.

Item paragraph f.1 (dynamic wavefront (phase) measuring equipment) is removed and reserved, because this item is moved to ECCN 6A004.f, because of its close association to the mirrors controlled in 6A004. A Nota Bene is added to point to the new Item paragraph where this item is controlled.

Item paragraph f.2 (“Laser” diagnostic equipment) is amended by replacing “capable of measuring” with “specially designed for dynamic measurement of” and replacing “equal to or less than” with “and having an angular “accuracy” of” to refine the scope of the entry. The phrase “(microradians) or less (better)” is added after “10  $\mu$ rad” to clarify the unit. BIS does not anticipate and change to the annual number of license application submissions as a result of these changes.

Item paragraph f.3 (Optical equipment and components) is amended by moving the phrase “coherent beam combination” for better readability. The “accuracy” parameter is cascaded down to Item paragraph f.3.b and a new “accuracy” parameter is added to f.3.a, so that the equipment is controlled if it meets either of the “accuracy” parameters.

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

Item paragraph a.1 is amended by removing the double quotes around the term “average output power” in order to be consistent with the WA List.

Item paragraph .e is amended by replacing “steerable array antennas” with “scanned array antennae” as well as adding a Technical Note to make people aware that electronically scanned array antennae are also known as electronically steerable array antennae. This revision uses more current, and standard, language to describe E-scan radar.

Double quotes are replaced by single quotes around the term ‘automatic target tracking’ in Item paragraph l.1 and the definition is moved from part 772 to a Technical Note under the Note to 6A008.l.1, because this term only appears in this ECCN.

Double quotes are replaced by single quotes around ‘geographically dispersed’ in Item paragraph l.4 and the definition is moved from part 772 to the Technical Note below Item paragraph l.4, because this term only appears in this ECCN.

#### 6A203 High-Speed Cameras, Imaging Devices and “Components” Therefor

The Related Controls paragraph is revised to remove a reference to ECCN 6A003.a.2, which is removed and reserved by this rule.

#### 6A990 Read-Out Integrated Circuits and 6E990 Technology for ROICs

ECCNs 6A990 and 6E990 are removed because this rule adds ROICs to ECCN 6A002.f.

#### 6D003 Other “Software”

ECCN 6D003 is amended by removing the unnecessary word “and” in Item paragraph h.2 and replacing “steerable phased array antennae” with “scanned array antennae” in Item paragraph h.2.a in order to use a more standard term. Item paragraph h.2.a is also amended by replacing “controlled” with “specified” in order to be more precise, because an item may or may not be controlled depending on the reasons for control and destination of the export.

#### 6D991, 6E001 and 6E002

Each of these ECCNs are amended to remove references to 6A990 or 6E990, because this rule adds ROICs to ECCN 6A002.f. For consistency, the License Requirements sections of 6E001 and 6E002 are amended to add a reference to 6A002.f to the Regional Stability Column 1 controls, because this technology was controlled for Regional Stability Column 1 under ECCN 6E990, where it was formerly controlled.

#### 6E201 “Technology” According to the General Technology Note for the “USE” of Equipment

The Heading of ECCN 6E201 is revised to remove reference to 6A003.a.2, which is removed and reserved by this rule.

#### Category 7—Navigation and Avionics

##### 7A006 Airborne Altimeters

Double quotes are replaced by single quotes around the term ‘power management’ and the definition for the term is moved from part 772 to a

Technical Note below Item paragraph .a because the term is only used in this ECCN.

##### 7E004 Other “Technology”

Double quotes are replaced by single quotes around the term ‘primary flight control’ in Item paragraph a.5 and the definition for the term is moved from part 772 to a Technical Note below Item paragraph .a.5 because the term is only used in this ECCN.

Double quotes are replaced by single quotes around the term ‘flight control optical sensor array’ in Item paragraph a.6 and the definition for the term is moved from part 772 to a Technical Note below Item paragraph a.6 because the term is only used in the ECCN.

Double quotes are replaced by single quotes around the term ‘flight path optimization’ in paragraph 1. of the Note to 7E004.b.5 and the definition is moved from part 772 to a Technical Note below the Note to 7E004.b.5 because the term is only used in this ECCN.

Double quotes are replaced by single quotes around the term ‘variable geometry airfoils’ in Item paragraph c.3 and the definition for the term is moved from part 772 to a Technical Note below Item paragraph c.3 because the term only appears in this ECCN.

#### Category 9—Aerospace and Propulsion

##### 9A002 “Marine Gas Turbine Engines”

The Heading is amended by revising and moving the parameter “with an ISO standard continuous power rating of 24,245 kW or more and a specific fuel consumption not exceeding 0.219 kg/kWh in the power range from 35 to 100%” to the Items paragraph and adding “designed to use liquid fuel and having all of the following (see List of Items Controlled),” to the Heading. The definition for ‘marine gas turbine engines’ is moved from the Related Definition paragraph of the ECCN to a Note below Item paragraph .b in order to be more consistent with the WA list. Two parameters are added for this ECCN: Maximum continuous power and ‘corrected specific fuel consumption’. The definition for ‘corrected specific fuel consumption’ is added to a Technical Note below the Note that is below Item paragraph .b. This change removes the ambiguity in this ECCN by removing the reference to power range. These revisions therefore do not change the scope of the existing control text, but rather clarify it by making it clear that the specific fuel consumption of concern applies at the “turndown performance” of 35%.

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

The scope of Item paragraph f.1 (Telemetry and telecommand equipment) is clarified by adding “specially designed” and two specific end uses in order to eliminate data processing equipment for mission data, such as GPS, science data, communication and broadcasting, since this data is not meant to be controlled under 9A004.f.1. The scope of Item paragraph f.2 (Simulators) is narrowed by adding “specially designed for ‘verification of operational procedures’ of ‘spacecraft’”. A Technical Note is added below Item paragraph f.2 to define ‘verification of operational procedures.’ These clarifications will not result in a change to the number of annual license application submissions to BIS.

*9D001 and 9D002 “Software”*

The Heading of 9D001 and 9D002 are amended by adding “not specified in 9D003 or 9D004” to clarify the scope of these entries and eliminate any possible overlap of control.

*9D004 Other “Software”*

Item paragraph .b (“Software” for testing aero gas turbine engines, assemblies, “parts” or “components”) is amended by removing the parameter and cascading subparagraphs with specific features or functions, such as “specially designed” for testing aero gas turbine engines . . . , to clarify and focus (narrow) the scope of control. A Note is added above Item paragraph .c to exclude software for operation of the test facility or operator safety, or production, repair or maintenance acceptance-testing . . . . It is estimated that these changes will not affect the annual number of license application submissions to BIS.

*9E003 Other “Technology”*

In Technical Note 2 below Item paragraph a.2.d and in the Technical Note below Item paragraph a.5, the single quotes are replaced with double quotes around the term “steady state mode” because this term is also used in another ECCN 9A002.a. The definition for “steady state mode” is moved from the Technical Note 2 below a.5 to part 772 “Definitions and Terms”.

Technical Note 4 below the Note to 9E003.c is amended by removing “techniques” and moving “methods” from the end of the Technical Note 4 to the top of Technical Note 4. Also revising the phrase “include “laser”,”

water jet . . . .” to read ““include “laser” beam machining, water jet machining . . . .” to be consistent with the other types of machining specified in Technical Note 4.

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

This rule removes 37 definitions from § 772.1 and adds them to the ECCNs where they are used. According to the WA drafting guidelines, if a term is only used in a single ECCN, then the definition must be located in a Technical Note close to where that term is used. However, if the term is separated by many subparagraphs, then the definition may be located in the Definitions section of the WA List. The following 37 definitions are removed from part 772, because they are only used within a single ECCN: Automatic target tracking, carbon fiber preforms, commingled, comminution, compound rotary table, deformable mirrors, direct acting hydraulic pressing, effective gram, electronically steerable phased array antenna, flight control optical sensor array, flight path optimization, frequency mask trigger, frequency synthesizer, gas atomization, geographically dispersed, hot isostatic densification, linearity, main storage, mechanical alloying, melt extraction, melt spinning, neural computers, optical computer, plasma atomization, power management, previously separated, primary flight control, real-time bandwidth, resolution, rotary atomization, settling time, splat quenching, systolic array computer, transfer laser, vacuum atomization and variable geometry airfoils. The following definitions are revised for reasons stated either in the **Federal Register**

instruction or under an ECCN where the term is used: Compensation systems, cryptographic activation, and user-accessible programmability. Two terms used in ECCNs 3A001 and 3A002 related to Analog-to-Digital Converters (ADC) are added to § 772.1. The term “sample rate”, which is used in both ECCN 3A001 and 3A002, is added to § 772.1. The definition “steady state mode” is moved from Technical Note 2 to 9E003.a.5 to § 772.1 because it is now also used in a new parameter for ‘marine gas turbine engines’ in ECCN 9A002, as well as in Technical Notes in 9E003.a.2.d and 9E003.a.5. The Category 5—Part 2 definition “cryptographic activation” is amended by adding the word “specifically” before “activates or enables”, and taking the word “secure” out of the definition, to fit with the changes being made in the control list

entries that refer to this definition (ECCNs 5A002.b, 5D002.b and 5E002.b).

**Supplement No. 6 to Part 774—Sensitive List**

Paragraph (1)(i), ECCN 1A002, is amended by narrowing the scope from all of ECCN 1A002 to only subparagraph a.1 ““Composite” structures or laminates made from an organic “matrix” and “fibrous or filamentary materials” specified by 1C010.c or 1C010.d”, because the rest of the items in ECCN 1A002 do not warrant control on the Sensitive List as they are not key technologies. This revision will minimally affect the annual number of Wassenaar reports to BIS.

Paragraph (2)(i)—ECCN 2D001, (ii)—ECCN 2E001, and (iii)—ECCN 2E002 are simplified and restructured for easier understanding and compliance. The revisions also focus the Sensitive List entries for software and technology for machine tools having a unidirectional repeatability at 0.9 microns. For machine tools having no variations specified at 0.9 microns, there is no change to the thresholds.

**Supplement No. 7 to Part 774—Very Sensitive List**

Paragraph (1)(i), ECCN 1A002, is amended by narrowing the scope from subparagraph .a to subparagraph a.1 (“Composite” structures or laminates made from an organic “matrix” and “fibrous or filamentary materials” specified by 1C010.c or 1C0010.d), because the rest of the items in ECCN 1A002.a do not warrant control on the Sensitive List as they are not key technologies. It is estimated that this will minimally affect the annual number of Wassenaar reports to BIS.

Paragraphs (3)(iv), ECCN 6A001.a.2.c, and (3)(vi), ECCN 6A002.a.2.f, are amended by replacing the phrase “user accessible programmability” with “user-accessible programmability” to add a hyphen for correctness.

**Section 740.16 Additional Permissive Reexports (APR)**

License Exception APR is amended to remove a reference to ECCN 6A990 in paragraphs (a)(2) and (b)(2)(v), because ECCN 6A990 is removed from the CCL by this rule. ROICs are now specified in 6A002.f.

**Section 740.17 Encryption Commodities, Software and Technology (ENC)**

License Exception ENC is corrected to replace a reference to 5D002.d with a reference to 5D002.b in the Note to paragraph (b)(2) and in paragraph (b)(3)(iv).



### Section 740.20 License Exception Strategic Trade Authorization (STA)

License Exception STA is amended to remove reference to ECCNs 6A990 and 6E990 from paragraph (b)(2)(x), because these ECCNs are removed from the CCL. ROICs are now specified in 6A002.f and ROIC technology is specified in ECCNs 6E001 and 6E002.

### Section 742.6 Regional Stability

Paragraph (b)(1)(ii) is amended by removing reference to ECCN 6E990, because this ECCN is removed by this rule. ROIC technology is now controlled under ECCNs 6E001 and 6E002.

### Section 744.9 Restrictions on Exports, Reexports, and Transfers (In-Country) of Certain Cameras, Systems, or Related Components

Section 744.9 is amended by removing reference to ECCN 6A990 from paragraphs (a) and (b), because this ECCN is removed from the CCL. ROICs are now controlled under ECCN 6A002.f.

### Export Control Reform Act of 2018

On August 13, 2018, the President signed into law the John S. McCain National Defense Authorization Act for Fiscal Year 2019, which included the Export Control Reform Act of 2018 (ECRA) (Title XVII, Subtitle B of Pub. L. 115–232) that provides the legal basis for BIS's principal authorities and serves as the authority under which BIS issues this rule. As set forth in Section 1768 of ECRA, all delegations, rules, regulations, orders, determinations, licenses, or other forms of administrative action that have been made, issued, conducted, or allowed to become effective under the Export Administration Act of 1979 (50 U.S.C. 4601 *et seq.*) (as in effect prior to August 13, 2018 and as continued in effect pursuant to the International Emergency Economic Powers Act (50 U.S.C. 1701 *et seq.*) and 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 8, 2018, 83 FR 39871 (August 13, 2018)), or the Export Administration Regulations, and are in effect as of August 13, 2018, shall continue in effect according to their terms until modified, superseded, set aside, or revoked under the authority of ECRA.

### 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 October 24, 2018, 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 exported, reexported or transferred (in-country) before December 24, 2018. Any such items not actually exported, reexported or transferred (in-country) before midnight, on December 24, 2018, 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 42 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. 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.

Any comments regarding 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. Seehra, Office of Management and Budget (OMB), by email to [Jasmeet\\_K\\_Seehra@omb.eop.gov](mailto:Jasmeet_K_Seehra@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 42 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 October 24, 2018.

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 742*

Exports, Terrorism.

*15 CFR Part 744*

Exports, Reporting and recordkeeping requirements, Terrorism.

*15 CFR Part 772*

Exports.

*15 CFR Part 774*

Exports, Reporting and recordkeeping requirements.

Accordingly, parts 740, 742, 744, 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 is revised to read as follows:

**Authority:** Pub. L. 115–232, Title XVII, Subtitle B. 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 8, 2018, 83 FR 39871 (August 13, 2018).

■ 2. Section 740.16 is amended by revising paragraphs (a)(2) and (b)(2)(v) to read as follows:

**§ 740.16 Additional permissive reexports (APR).**

\* \* \* \* \*

(a) \* \* \*

(2) The commodities being reexported are not controlled for NP, CB, MT, SI or CC reasons or described in ECCN 0A919, 3A001.b.2 or b.3 (except those that are being reexported for use in civil telecommunications applications), 6A002, or 6A003; and

\* \* \* \* \*

(b) \* \* \*

(2) \* \* \*

(v) Commodities described in ECCN 6A002.

\* \* \* \* \*

**§ 740.17 [Amended]**

■ 3. Section 740.17 is amended by removing the reference to “5D002.d” and adding in its place “5D002.b” in the Note to paragraph (b)(2) and in paragraph (b)(3)(iv).

■ 4. Section 740.20 is amended by revising paragraph (b)(2)(x) to read as follows:

**§ 740.20 License Exception Strategic Trade Authorization (STA).**

\* \* \* \* \*

(b) \* \* \*

(2) \* \* \*

(x) License Exception STA may not be used for items controlled by ECCN 6A002; 6D002 (software “specially designed” for the “use” of commodities controlled under 6A002.b); 6D003.c; 6D991 (software “specially designed” for the “development,” “production,” or “use” of commodities controlled under 6A002 or 6A003); 6E001 (“technology” for the “development” of commodities controlled under ECCN 6A002 or 6A003); or 6E002 “technology” (for the “production” of commodities controlled under ECCN 6A002 or 6A003).

\* \* \* \* \*

**PART 742—[AMENDED]**

■ 5. The authority citation for part 742 is revised to read as follows:

**Authority:** Pub. L. 115–232, Title XVII, Subtitle B. 50 U.S.C. 4601 *et seq.*; 50 U.S.C. 1701 *et seq.*; 22 U.S.C. 3201 *et seq.*; 42 U.S.C. 2139a; 22 U.S.C. 7201 *et seq.*; 22 U.S.C. 7210; Sec. 1503, Pub. L. 108–11, 117 Stat. 559; E.O. 12058, 43 FR 20947, 3 CFR, 1978 Comp., p. 179; E.O. 12851, 58 FR 33181, 3 CFR, 1993 Comp., p. 608; E.O. 12938, 59 FR 59099, 3 CFR, 1994 Comp., p. 950; E.O. 13026, 61 FR 58767, 3 CFR, 1996 Comp., p. 228; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; Presidential Determination 2003–23, 68 FR 26459, 3 CFR, 2004 Comp., p. 320; Notice of November 6, 2017, 82 FR 51971 (November 8, 2017); Notice of August 8, 2018, 83 FR 39871 (August 13, 2018).

■ 6. Section 742.6 is amended by revising paragraph (b)(1)(ii) to read as follows:

**§ 742.6 Regional stability.**

\* \* \* \* \*

(b) \* \* \*

(1) \* \* \*

(ii) Applications for exports and reexports to a country listed in Country Group D:5 (in supplement no. 1 to part 740 of the EAR) of technology controlled under 6E001 for the development of focal plane arrays, read-out integrated circuits (ROICs) or image intensifier tubes described in 6A002 or technology controlled under 6E002 for the production of focal plane arrays, read-out integrated circuits (ROICs) or

image intensifier tubes described in 6A002 will be reviewed with a presumption of denial.

\* \* \* \* \*

**PART 744—[AMENDED]**

■ 7. The authority citation for part 744 is revised to read as follows:

**Authority:** Pub. L. 115–232, Title XVII, Subtitle B. 50 U.S.C. 4601 *et seq.*; 50 U.S.C. 1701 *et seq.*; 22 U.S.C. 3201 *et seq.*; 42 U.S.C. 2139a; 22 U.S.C. 7201 *et seq.*; 22 U.S.C. 7210; E.O. 12058, 43 FR 20947, 3 CFR, 1978 Comp., p. 179; E.O. 12851, 58 FR 33181, 3 CFR, 1993 Comp., p. 608; E.O. 12938, 59 FR 59099, 3 CFR, 1994 Comp., p. 950; E.O. 12947, 60 FR 5079, 3 CFR, 1995 Comp., p. 356; E.O. 13026, 61 FR 58767, 3 CFR, 1996 Comp., p. 228; E.O. 13099, 63 FR 45167, 3 CFR, 1998 Comp., p. 208; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; E.O. 13224, 66 FR 49079, 3 CFR, 2001 Comp., p. 786; Notice of September 18, 2017, 82 FR 43825 (September 19, 2017); Notice of November 6, 2017, 82 FR 51971 (November 8, 2017); Notice of January 17, 2018, 83 FR 2731 (January 18, 2018); Notice of August 8, 2018, 83 FR 39871 (August 13, 2018).

**§ 744.9 [Amended]**

■ 8. Section 744.9 is amended by removing the reference “6A990,” from paragraphs (a)(1) introductory text and (b).

**PART 772—[AMENDED]**

■ 9. The authority citation for part 772 is revised to read as follows:

**Authority:** Pub. L. 115–232, Title XVII, Subtitle B. 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 8, 2018, 83 FR 39871 (August 13, 2018).

■ 10. Section 772.1 is amended by:

- a. Removing definitions for “Automatic target tracking”, “Carbon fiber preforms”, “Commingled”, and “Comminution”;
- b. Revising the definition for “Compensation systems”;
- c. Removing the definition for “Compound rotary table”;
- d. Revising the definition for “Cryptographic activation”;
- e. Removing the definitions for “Deformable mirrors”, “Direct-acting hydraulic pressing”, “Effective Gram”, “Electronically steerable phased array antenna”, “Flight control optical sensor array”, “Flight path optimization”, “Frequency mask trigger”, “Frequency synthesizer”, “Gas Atomization”, “Geographically dispersed”, and “Hot isostatic densification”;
- f. Adding the definition for “Interleaved Analog-to-Digital Converter (ADC)” in alphabetical order;
- g. Removing the definitions for “Linearity”, “Main storage”,

- “Mechanical alloying”, “Melt Extraction”, and “Melt Spinning”;
- h. Adding the definition for “Multiple channel Analog-to-Digital Converter (ADC)” in alphabetical order;
- i. Removing the definitions for “Neural computer”, “Optical computer”, “Plasma atomization”, “Power management”, “Previously separated”, “Primary flight control”, “Real-time bandwidth”, “Resolution”, and “Rotary Atomization”;
- j. Adding the definition for “Sample rate” in alphabetical order;
- k. Removing the definitions for “Settling time” and “Splat Quenching”;
- l. Adding the definition for “Steady state mode” in alphabetical order;
- m. Removing the definitions for “Systolic array computer” and “Transfer laser”;
- n. In the definition for “User-accessible programmability”, removing “Cat 4, 5, and 6” and adding in its place “Cat 6”; and
- o. Removing the definitions for “Vacuum Atomization” and “Variable geometry airfoils”.

The revisions and additions read as follows:

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

\* \* \* \* \*

**Compensation systems.** (Cat 6) Consist of the primary scalar sensor, one or more reference sensors (e.g., vector “magnetometers”) together with software that permit reduction of rigid body rotation noise of the platform.

\* \* \* \* \*

**Cryptographic activation.** (Cat 5P2) Any technique that specifically activates or enables cryptographic capability of an item, by means of a mechanism implemented by the manufacturer of the item, where this mechanism is uniquely bound to any of the following:

- (1) A single instance of the item; or
- (2) One customer, for multiple instances of the item.

**Technical note 1 to definition of “Cryptographic activation”:** “Cryptographic activation” techniques and mechanisms may be implemented as hardware, “software” or “technology”.

**Technical note 2 to definition of “Cryptographic activation”:** Mechanisms for “cryptographic activation” can, for example, be serial number-based license keys or authentication instruments such as digitally signed certificates.

\* \* \* \* \*

**Interleaved Analog-to-Digital Converter (ADC).** (Cat 3) Devices that 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.

\* \* \* \* \*

**Multiple channel Analog-to-Digital Converter (ADC).** (Cat 3) Devices that integrate more than one ADC, designed so that each ADC has a separate analog input.

\* \* \* \* \*

**Sample rate.** (Cat 3) For an Analog-to-Digital Converter (ADC) the maximum number of samples that are measured at the analog input over a period of one second, except for oversampling ADCs. For oversampling ADCs the “sample rate” is taken to be its output word rate. “Sample rate” may also be referred to as sampling rate, usually specified in Mega Samples Per Second (MSPS) or Giga Samples Per Second (GSPS), or conversion rate, usually specified in Hertz (Hz).

\* \* \* \* \*

**Steady state mode.** (Cat 9) 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.

\* \* \* \* \*

**PART 774—[AMENDED]**

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

**Authority:** Pub. L. 115–232, Title XVII, Subtitle B. 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; 42 U.S.C. 2139a; 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 8, 2018, 83 FR 39871 (August 13, 2018).

■ 12. In supplement no. 1 to part 774, Category 0, ECCN 0A617 is revised to read as follows:

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

\* \* \* \* \*

**0A617 Miscellaneous “Equipment”, Materials, and Related Commodities (see List of Items Controlled).**

**License Requirements**

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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry, except 0A617.y.	NS Column 1.

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
RS applies to entire entry, except 0A617.y.	RS Column 1.
AT applies to entire entry.	AT Column 1.
UN applies to entire entry, except 0A617.y.	See § 764.1(b) of the EAR for UN controls.

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

LVS: \$1,500  
 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 0A617.

**List of Items Controlled**

*Related Controls:* (1) Defense articles, such as materials made from classified information, that are controlled by USML Category XIII, and technical data (including software) directly related thereto, are subject to the ITAR. (2) See ECCN 0A919 for foreign-made “military commodities” that incorporate more than a *de minimis* amount of U.S.-origin “600 series” controlled content. (3) For controls on self-contained diving and underwater swimming apparatus and related commodities, see ECCN 8A620.f. (4) For controls on robots, robot controllers, and robot end-effectors, see USML Category VII and ECCNs 0A606 and 2B007. (5) “Libraries”, *i.e.*, parametric technical databases, “specially designed” for military use with equipment controlled by the USML or a “600 series” ECCN are controlled by the technical data and technology controls pertaining to such items. (6) For controls on nuclear power generating equipment or propulsion equipment, including “nuclear reactors”, “specially designed” for military use, and “parts” and “components” “specially designed” therefor, see USML Categories VI, XIII, XV, and XX. (7) Simulators “specially designed” for military “nuclear reactors” are controlled by USML Category IX(b). (8) See USML Categories X, XI and XII for “laser” protection equipment (*e.g.*, eye and sensor protection) “specially designed” for military use. (9) “Fuel cells” “specially designed” for a defense article on the USML or a commodity controlled by a “600 series” ECCN are controlled according to the corresponding “600 series” ECCN for such end items. (10) See USML Category XV for controls on fuel cells “specially designed” for satellite or spacecraft.

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

- a. [Reserved]
- b. Concealment and deception equipment “specially designed” for military application, including special paints, decoys, smoke or obscuration equipment and simulators, and “parts”, “components”, “accessories”, and

“attachments” “specially designed” therefor, not controlled by USML Category XIII.

c. Ferries, bridges (other than those described in ECCN 0A606 or USML Category VII), and pontoons, “specially designed” for military use.

d. Test models “specially designed” for the “development” of defense articles controlled by USML Categories IV, VI, VII and VIII.

e. [Reserved]  
 f. “Metal embrittlement agents”.  
 g. through x. [Reserved]

y. Other commodities as follows, and “parts”, “components”, “accessories”, and “attachments” “specially designed” therefor:

y.1. Construction equipment “specially designed” for military use, including such equipment “specially designed” for transport in aircraft controlled by USML VIII(a) or ECCN 9A610.a.

y.2. “Parts”, “components”, “accessories”, and “attachments” “specially designed” for commodities in paragraph .y.1 of this entry, including crew protection kits used as protective cabs.

y.3. ISO intermodal containers or demountable vehicle bodies (*i.e.*, swap bodies), *n.e.s.*, “specially designed” or “modified” for shipping or packing defense articles or items controlled by a “600 series” ECCN.

**Technical Note:** For the purpose of 0A617.y.3, “modified” means any structural, electrical, mechanical, or other change that provides a non-military item with military capabilities equivalent to an item which is “specially designed” for military use.

y.4. Field generators “specially designed” for military use.

y.5. Power controlled searchlights and control units therefor, “specially designed” for military use, and “equipment” mounting such units.

■ 13. In supplement no. 1 to part 774, Category 0, ECCN 0A919 is revised to read as follows:

**0A919 “Military commodities” located and produced outside the United States as follows (see list of items controlled).**

**License Requirements**

*Reasons for Control:* RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
RS applies to entire entry.	RS Column 1, See § 742.6(a)(3) of the EAR for license requirements.
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) “Military commodities” are subject to the export licensing jurisdiction of the Department of State if

they incorporate items that are subject to the International Traffic in Arms Regulations (ITAR) (22 CFR parts 120 through 130). (2) “Military commodities” described in this paragraph are subject to the export licensing jurisdiction of the Department of State if such commodities are described on the U.S. Munitions List (22 CFR part 121) and are in the United States. (3) The furnishing of assistance (including training) to foreign persons, whether in the United States or abroad, in the design, development, engineering, manufacture, production, assembly, testing, repair, maintenance, modification, operation, demilitarization, destruction, processing, or use of defense articles that are subject to the ITAR; or the furnishing to foreign persons of any technical data controlled under 22 CFR 121.1 whether in the United States or abroad are under the licensing jurisdiction of the Department of State. (4) Brokering activities (as defined in 22 CFR part 129) of “military commodities” that are subject to the ITAR are under the licensing jurisdiction of the Department of State.

*Related Definitions:* “Military commodity” or “military commodities” means an article, material or supply that is described on the U.S. Munitions List (22 CFR part 121) or on the Munitions List that is published by the Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies (*i.e.*, the Wassenaar Arrangement Munitions List (WAML)), but does not include software, technology, any item listed in any ECCN for which the last three numerals are 018, or any item in the “600 series.”

*Items:*

a. “Military commodities” produced and located outside the United States that are not subject to the International Traffic in Arms Regulations (22 CFR parts 120 through 130) and having any of the following characteristics:

a.1. Incorporate more than a *de minimis* amount of U.S.-origin controlled content classified under ECCNs 6A002, 6A003, or 6A993.a (having a maximum frame rate equal to or less than 9 Hz and thus meeting the criterion of Note 3.a to 6A003.b.4);

a.2. Incorporate more than a *de minimis* amount of U.S.-origin “600 series” controlled content (see § 734.4 of the EAR); or

a.3. Are direct products of U.S.-origin “600 series” technology or software (see § 736.2(b)(3) of the EAR).

b. [Reserved]

■ 14. In supplement no. 1 to part 774, Category 1, ECCN 1A002 is revised to read as follows:

**1A002 “Composite” structures or laminates, 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.

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NP applies to 1A002.b.1 in the form of tubes with an inside diameter between 75 mm and 400 mm.	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)**

LVS: \$1,500; N/A for NP; N/A for “composite” structures or laminates controlled by 1A002.a, having an organic “matrix” and made from materials controlled by 1C010.c or 1C010.d.

GBS: N/A

CIV: N/A

**Special Conditions for STA**

STA: License Exception STA may not be used to ship any item 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 ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Also see ECCNs 1A202, 1C010, 1C210, 9A010, and 9A110. (3) “Composite” structures “specially designed” for missile applications (including “specially designed” subsystems, “parts”, and “components”) are controlled by ECCN 9A110. (4) “Composite” structures or laminates “specially designed” or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definitions:* N/A

*Items:*

- a. Made from any of the following:
  - a.1. An organic “matrix” and “fibrous or filamentary materials” specified by 1C010.c or 1C010.d; or
  - a.2. Prepregs or preforms specified by 1C010.e;
- b. Made from a metal or carbon “matrix”, and any of the following:
  - b.1. Carbon “fibrous or filamentary materials” having all of the following:
    - b.1.a. A “specific modulus” exceeding  $10.15 \times 10^6$  m; and
    - b.1.b. A “specific tensile strength” exceeding  $17.7 \times 10^4$  m; or
  - b.2. Materials controlled by 1C010.c.

**Note 1:** 1A002 does not control “composite” structures or laminates made from epoxy resin impregnated carbon “fibrous or filamentary materials”, for the repair of “civil aircraft” structures or laminates, having all of the following:

- a. An area not exceeding 1 m<sup>2</sup>;
- b. A length not exceeding 2.5 m; and
- c. A width exceeding 15 mm.

**Note 2:** 1A002 does not control semi-finished items, “specially designed” for civilian applications as follows:

- a. Sporting goods;
- b. Automotive industry;
- c. Machine tool industry;
- d. Medical applications.

**Note 3:** 1A002.b.1 does not apply to semi-finished items containing a maximum of two dimensions of interwoven filaments and “specially designed” for applications as follows:

- a. Metal heat-treatment furnaces for tempering metals;
- b. Silicon boule production equipment.

**Note 4:** 1A002 does not apply to finished items “specially designed” for a specific application.

■ 15. In supplement no. 1 to part 774, Category 1, ECCN 1C001 is revised to read as follows:

**1C001 Materials “specially designed” for absorbing electromagnetic radiation, or intrinsically conductive polymers, 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 entire entry.	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: N/A

GBS: N/A

CIV: N/A

**Special Conditions for STA**

STA: License Exception STA may not be used to ship any item 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:* See also 1C101

*Related Definitions:* N/A

*Items:*

- a. Materials for absorbing frequencies exceeding  $2 \times 10^8$  Hz but less than  $3 \times 10^{12}$  Hz.

**Note 1:** 1C001.a does not control:

- a. Hair type absorbers, constructed of natural or synthetic fibers, with non-magnetic loading to provide absorption;
- b. Absorbers having no magnetic loss and whose incident surface is non-planar in

shape, including pyramids, cones, wedges and convoluted surfaces;

- c. Planar absorbers, having all of the following:

- 1. Made from any of the following:
  - a. Plastic foam materials (flexible or non-flexible) with carbon-loading, or organic materials, including binders, providing more than 5% echo compared with metal over a bandwidth exceeding  $\pm 15\%$  of the center frequency of the incident energy, and not capable of withstanding temperatures exceeding 450 K (177 °C); or
  - b. Ceramic materials providing more than 20% echo compared with metal over a bandwidth exceeding  $\pm 15\%$  of the center frequency of the incident energy, and not capable of withstanding temperatures exceeding 800 K (527 °C);

**Technical Note:** Absorption test samples for 1C001.a. Note 1.c.1 should be a square at least 5 wavelengths of the center frequency on a side and positioned in the far field of the radiating element.

- 2. Tensile strength less than  $7 \times 10^6$  N/m<sup>2</sup>; and
- 3. Compressive strength less than  $14 \times 10^6$  N/m<sup>2</sup>;
- d. Planar absorbers made of sintered ferrite, having all of the following:
  - 1. A specific gravity exceeding 4.4; and
  - 2. A maximum operating temperature of 548 K (275 °C).

**Note 2:** Nothing in Note 1 releases magnetic materials to provide absorption when contained in paint.

b. Materials not transparent to visible light and specially designed for absorbing near-infrared radiation having a wavelength exceeding 810 nm but less than 2,000 nm (frequencies exceeding 150 THz but less than 370 THz);

**Note:** 1C001.b does not apply to materials, “specially designed” or formulated for any of the following applications:

- a. “Laser” marking of polymers; or
- b. “Laser” welding of polymers.
- c. Intrinsically conductive polymeric materials with a ‘bulk electrical conductivity’ exceeding 10,000 S/m (Siemens per meter) or a ‘sheet (surface) resistivity’ of less than 100 ohms/square, based on any of the following polymers:
  - c.1. Polyaniline;
  - c.2. Polypyrrole;
  - c.3. Polythiophene;
  - c.4. Poly phenylene-vinylene; or
  - c.5. Poly thienylene-vinylene.

**Note:** 1C001.c does not apply to materials in a liquid form.

**Technical Note:** ‘Bulk electrical conductivity’ and ‘sheet (surface) resistivity’ should be determined using ASTM D–257 or national equivalents.

■ 16. In supplement no. 1 to part 774, Category 1, ECCN 1C002 is revised to read as follows:

**1C002 Metal alloys, metal alloy powder and alloyed materials, as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, NP, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry.	NS Column 2.
NP applies to 1C002.b.3. or b.4 if they exceed the parameters stated in 1C202.	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: \$3000; N/A for NP

GBS: N/A

CIV: N/A

#### List of Items Controlled

*Related Controls:* (1) See ECCNs 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Also see ECCN 1C202. (3) Aluminum alloys and titanium alloys in physical forms and finished products “specially designed” or prepared for use in separating uranium isotopes are subject to the export licensing authority of the Nuclear Regulatory Commission (see 10 CFR part 110).

*Related Definition:* N/A

#### Items:

**Note:** 1C002 does not control metal alloys, metal alloy powder and alloyed materials, specially formulated for coating purposes.

**Technical Note 1:** The metal alloys in 1C002 are those containing a higher percentage by weight of the stated metal than of any other element.

**Technical Note 2:** ‘Stress-rupture life’ should be measured in accordance with ASTM standard E-139 or national equivalents.

**Technical Note 3:** ‘Low cycle fatigue life’ should be measured in accordance with ASTM Standard E-606 ‘Recommended Practice for Constant-Amplitude Low-Cycle Fatigue Testing’ or national equivalents. Testing should be axial with an average stress ratio equal to 1 and a stress-concentration factor ( $K_f$ ) equal to 1. The average stress is defined as maximum stress minus minimum stress divided by maximum stress.

a. Aluminides, as follows:

a.1. Nickel aluminides containing a minimum of 15% by weight aluminum, a maximum of 38% by weight aluminum and at least one additional alloying element;

a.2. Titanium aluminides containing 10% by weight or more aluminum and at least one additional alloying element;

b. Metal alloys, as follows, made from the powder or particulate material controlled by 1C002.c:

b.1. Nickel alloys having any of the following:

b.1.a. A ‘stress-rupture life’ of 10,000 hours or longer at 923 K (650 °C) at a stress of 676 MPa; or

b.1.b. A ‘low cycle fatigue life’ of 10,000 cycles or more at 823 K (550 °C) at a maximum stress of 1,095 MPa;

b.2. Niobium alloys having any of the following:

b.2.a. A ‘stress-rupture life’ of 10,000 hours or longer at 1,073 K (800 °C) at a stress of 400 MPa; or

b.2.b. A ‘low cycle fatigue life’ of 10,000 cycles or more at 973 K (700 °C) at a maximum stress of 700 MPa;

b.3. Titanium alloys having any of the following:

b.3.a. A ‘stress-rupture life’ of 10,000 hours or longer at 723 K (450 °C) at a stress of 200 MPa; or

b.3.b. A ‘low cycle fatigue life’ of 10,000 cycles or more at 723 K (450 °C) at a maximum stress of 400 MPa;

b.4. Aluminum alloys having any of the following:

b.4.a. A tensile strength of 240 MPa or more at 473 K (200 °C); or

b.4.b. A tensile strength of 415 MPa or more at 298 K (25 °C);

b.5. Magnesium alloys having all the following:

b.5.a. A tensile strength of 345 MPa or more; and

b.5.b. A corrosion rate of less than 1 mm/year in 3% sodium chloride aqueous solution measured in accordance with ASTM standard G-31 or national equivalents;

c. Metal alloy powder or particulate material, having all of the following:

c.1. Made from any of the following composition systems:

**Technical Note:** X in the following equals one or more alloying elements.

c.1.a. Nickel alloys (Ni-Al-X, Ni-X-Al) qualified for turbine engine “parts” or “components”, *i.e.*, with less than 3 non-metallic particles (introduced during the manufacturing process) larger than 100 μm in 10<sup>9</sup> alloy particles;

c.1.b. Niobium alloys (Nb-Al-X or Nb-X-Al, Nb-Si-X or Nb-X-Si, Nb-Ti-X or Nb-X-Ti);

c.1.c. Titanium alloys (Ti-Al-X or Ti-X-Al);

c.1.d. Aluminum alloys (Al-Mg-X or Al-X-Mg, Al-Zn-X or Al-X-Zn, Al-Fe-X or Al-X-Fe); or

c.1.e. Magnesium alloys (Mg-Al-X or Mg-X-Al);

c.2. Made in a controlled environment by any of the following processes:

c.2.a. ‘Vacuum atomization’;

c.2.b. ‘Gas atomization’;

c.2.c. ‘Rotary atomization’;

c.2.d. ‘Splat quenching’;

c.2.e. ‘Melt spinning’ and ‘comminution’;

c.2.f. ‘Melt extraction’ and ‘comminution’;

c.2.g. ‘Mechanical alloying’; or

c.2.h. ‘Plasma atomization’; and

c.3. Capable of forming materials controlled by 1C002.a or 1C002.b;

d. Alloyed materials, having all the following:

d.1. Made from any of the composition systems specified by 1C002.c.1;

d.2. In the form of uncomminuted flakes, ribbons or thin rods; and

d.3. Produced in a controlled environment by any of the following:

d.3.a. ‘Splat quenching’;

d.3.b. ‘Melt spinning’; or

d.3.c. ‘Melt extraction’.

**Technical Notes:** 1. ‘Vacuum atomisation’ is a process to reduce a molten stream of metal to droplets of a diameter of 500 μm or

less by the rapid evolution of a dissolved gas upon exposure to a vacuum.

2. ‘Gas atomisation’ is a process to reduce a molten stream of metal alloy to droplets of 500 μm diameter or less by a high pressure gas stream.

3. ‘Rotary atomisation’ is a process to reduce a stream or pool of molten metal to droplets to a diameter of 500 μm or less by centrifugal force.

4. ‘Splat quenching’ is a process to ‘solidify rapidly’ a molten metal stream impinging upon a chilled block, forming a flake-like product.

5. ‘Melt spinning’ is a process to ‘solidify rapidly’ a molten metal stream impinging upon a rotating chilled block, forming a flake, ribbon or rod-like product.

6. ‘Comminution’ is a process to reduce a material to particles by crushing or grinding.

7. ‘Melt extraction’ is a process to ‘solidify rapidly’ and extract a ribbon-like alloy product by the insertion of a short segment of a rotating chilled block into a bath of a molten metal alloy.

8. ‘Mechanical alloying’ is an alloying process resulting from the bonding, fracturing and rebonding of elemental and master alloy powders by mechanical impact. Non-metallic particles may be incorporated in the alloy by addition of the appropriate powders.

9. ‘Plasma atomisation’ is a process to reduce a molten stream or solid metal to droplets of 500 μm diameter or less, using plasma torches in an inert gas environment.

10. ‘Solidify rapidly’ is a process involving the solidification of molten material at cooling rates exceeding 1000 K/sec.

■ 17. In supplement no. 1 to part 774, 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

Control(s)	Country chart (see Supp. No. 1 to part 738)
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: \$5,000, 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 × 10<sup>3</sup> 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 specified by 1C007.c see 1C007.c.1.b.

d. [Reserved]

**N.B.:** For items previously specified by 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 specified by 1C007.f see 1C007.c.1.a.

■ 18. In supplement no. 1 to part 774, Category 1, ECCN 1C010 is revised to read as follows:

**1C010 “Fibrous or filamentary materials” as follows (see List of Items Controlled).**

**License Requirements**

Reason for Control: NS, NP, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry.	NS Column 2
NP applies to 1C010.a (aramid “fibrous or filamentary materials”, b (carbon “fibrous and filamentary materials”), and e.1 for “fibrous and filamentary materials” that meet or exceed the control criteria of ECCN 1C210.	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)**

LVS: \$1,500, N/A for NP  
 GBS: N/A  
 CIV: N/A

**Special Conditions for STA**

STA: License Exception STA may not be used to ship any item in 1C010.c 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 1E001 (“development” and “production”) and 1E201 (“use”) for technology for items controlled by this entry. (2) Also see ECCNs 1C210 and 1C990. (3) See also 9C110 for material not controlled by 1C010.e, as defined by notes 1 or 2.

Related Definitions: (1) “Specific modulus”: Young’s modulus in pascals, equivalent to N/m<sup>2</sup> divided by specific weight in N/m<sup>3</sup>, measured at a temperature of (296 + 2) K ((23 + 2) °C) and a relative humidity of (50 + 5)%. (2) “Specific tensile strength”: ultimate tensile strength in pascals, equivalent to N/m<sup>2</sup> divided by specific weight in N/m<sup>3</sup>, measured at a temperature of (296 + 2) K ((23 + 2) °C) and a relative humidity of (50 + 5)%.

Items:

**Technical Notes:** 1. For the purpose of calculating “specific tensile strength”, “specific modulus” or specific weight of “fibrous or filamentary materials” in 1C010.a, 1C010.b or 1C010.c, the tensile strength and modulus should be determined

by using Method A described in ISO 10618 (2004) or national equivalents.

2. Assessing the “specific tensile strength”, “specific modulus” or specific weight of non-unidirectional “fibrous or filamentary materials” (e.g., fabrics, random mats or braids) in 1C010 is to be based on the mechanical properties of the constituent unidirectional monofilaments (e.g., monofilaments, yarns, rovings or tows) prior to processing into the non-unidirectional “fibrous or filamentary materials”.

a. Organic “fibrous or filamentary materials”, having all of the following:  
 a.1. “Specific modulus” exceeding 12.7 × 10<sup>6</sup> m; and  
 a.2. “Specific tensile strength” exceeding 23.5 × 10<sup>4</sup> m;

**Note:** 1C010.a does not control polyethylene.

b. Carbon “fibrous or filamentary materials”, having all of the following:  
 b.1. “Specific modulus” exceeding 14.65 × 10<sup>6</sup> m; and  
 b.2. “Specific tensile strength” exceeding 26.82 × 10<sup>4</sup> m;

**Note:** 1C010.b does not control:  
 a. “Fibrous or filamentary materials”, for the repair of “civil aircraft” structures or laminates, having all of the following:

1. An area not exceeding 1 m<sup>2</sup>;  
 2. A length not exceeding 2.5 m; and  
 3. A width exceeding 15 mm.

b. Mechanically chopped, milled or cut carbon “fibrous or filamentary materials” 25.0 mm or less in length.

c. Inorganic “fibrous or filamentary materials”, having all of the following:  
 c.1. “Specific modulus” exceeding 2.54 × 10<sup>6</sup> m; and  
 c.2. Melting, softening, decomposition or sublimation point exceeding 1,922 K (1,649 °C) in an inert environment;

**Note:** 1C010.c does not control:  
 a. Discontinuous, multiphase, polycrystalline alumina fibers in chopped fiber or random mat form, containing 3% by weight or more silica, with a “specific modulus” of less than 10 × 10<sup>6</sup> m;  
 b. Molybdenum and molybdenum alloy fibers;  
 c. Boron fibers;  
 d. Discontinuous ceramic fibers with a melting, softening, decomposition or sublimation point lower than 2,043 K (1,770 °C) in an inert environment.

d. “Fibrous or filamentary materials”, having any of the following:  
 d.1. Composed of any of the following:  
 d.1.a. Polyetherimides controlled by 1C008.a; or  
 d.1.b. Materials controlled by 1C008.b to 1C008.f; or  
 d.2. Composed of materials controlled by 1C010.d.1.a or 1C010.d.1.b and ‘commingled’ with other fibers controlled by 1C010.a, 1C010.b or 1C010.c.

**Technical Note:** ‘Commingled’ is filament to filament blending of thermoplastic fibers and reinforcement fibers in order to produce a fiber reinforcement “matrix” mix in total fiber form.

e. Fully or partially resin impregnated or pitch impregnated “fibrous or filamentary

materials" (prepregs), metal or carbon coated "fibrous or filamentary materials" (preforms) or 'carbon fiber preforms', having all of the following:

- e.1. Having any of the following:
  - e.1.a. Inorganic "fibrous or filamentary materials" controlled by 1C010.c; or
  - e.1.b. Organic or carbon "fibrous or filamentary materials", having all of the following:
    - e.1.b.1. "Specific modulus" exceeding  $10.15 \times 10^6$  m; and
    - e.1.b.2 "Specific tensile strength" exceeding  $17.7 \times 10^4$  m; and
  - e.2. Having any of the following:
    - e.2.a. Resin or pitch, controlled by 1C008 or 1C009.b;
    - e.2.b. 'Dynamic Mechanical Analysis glass transition temperature (DMA T<sub>g</sub>)' equal to or exceeding 453 K (180 °C) and having a phenolic resin; or
    - e.2.c. 'Dynamic Mechanical Analysis glass transition temperature (DMA T<sub>g</sub>)' equal to or exceeding 505 K (232 °C) and having a resin or pitch, not specified by 1C008 or 1C009.b, and not being a phenolic resin;

**Note 1:** Metal or carbon coated "fibrous or filamentary materials" (preforms) or 'carbon fiber preforms', not impregnated with resin or pitch, are specified by "fibrous or filamentary materials" in 1C010.a, 1C010.b or 1C010.c.

**Note 2:** 1C010.e does not apply to:

a. Epoxy resin "matrix" impregnated carbon "fibrous or filamentary materials" (prepregs) for the repair of "civil aircraft" structures or laminates, having all of the following:

- 1. An area not exceeding 1 m<sup>2</sup>;
- 2. A length not exceeding 2.5 m; and
- 3. A width exceeding 15 mm;

b. Fully or partially resin-impregnated or pitch-impregnated mechanically chopped, milled or cut carbon "fibrous or filamentary materials" 25.0 mm or less in length when using a resin or pitch other than those specified by 1C008 or 1C009.b.

#### Technical Notes:

1. 'Carbon fiber preforms' are an ordered arrangement of uncoated or coated fibers intended to constitute a framework of a part before the "matrix" is introduced to form a "composite".
2. The 'Dynamic Mechanical Analysis glass transition temperature (DMA T<sub>g</sub>)' for materials controlled by 1C010.e is determined using the method described in ASTM D 7028-07, or equivalent national standard, on a dry test specimen. In the case of thermoset materials, degree of cure of a dry test specimen shall be a minimum of 90% as defined by ASTM E 2160 04 or equivalent national standard.

■ 19. In supplement no. 1 to part 774, Category 1, ECCN 1C608 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

Control(s)	Country chart (see Supp. no. 1 to part 738)
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) of the EAR for UN controls

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

LVS: \$1,500  
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 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.

**Note 1:** 1C608.n does not apply to the following “aircraft” fuels: JP-4, JP-5, and JP-8.

**Note 2:** “Aircraft” fuels specified by 1C608.n, Note 1 are finished products, not their constituents.

■ 20. In supplement no. 1 to part 774, 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.**

**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 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:* \$3,000, 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).

*Related Definitions:* Annular Bearing Engineers Committee (ABEC).

*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 national equivalents) 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.

■ 21. In supplement no. 1 to part 774, 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)*

NP applies to 2B001.a, .b, .c, and .d, EXCEPT: (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.

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:* (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.

*Related Definitions:* N/A

*Items:*

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

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

- a. Crank shafts or cam shafts;
- b. Tools or cutters;
- c. Extruder worms;
- d. Engraved or faceted jewelry parts; or
- e. Dental prostheses.

**Note 3:** A machine tool having at least two of the three turning, milling or grinding capabilities (e.g., a turning machine with

milling capability), must be evaluated against each applicable entry 2B001.a, .b or .c.

a. Machine tools for turning having two or more axes which can be coordinated simultaneously for “contouring control” having any of the following:

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; or

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;

**Note 1:** 2B001.a does not control turning machines “specially designed” for producing contact lenses, having all of the following:

a. Machine controller limited to using ophthalmic based “software” for part programming data input; and

b. No vacuum chucking.

**Note 2:** 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 or milling capabilities for machining parts with diameters less than 42 mm.

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

b.1. Three linear axes plus one rotary axis which can be coordinated simultaneously for “contouring control” having any of the following:

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; or

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;

b.2. Five or more axes which can be coordinated simultaneously for “contouring control” having any of the following:

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;

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; or

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;

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; or

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

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

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

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

c.1. Having all of the following:

c.1.a. “Unidirectional positioning repeatability” equal to or less (better) than 1.1 μm along one or more linear axis; and

c.1.b. Three or four axes which can be coordinated simultaneously for “contouring control”; or

c.2. Five or more axes which can be coordinated simultaneously for “contouring control” having any of the following:

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 1 m;

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; or

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.

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

a. Cylindrical external, internal, and external-internal grinding machines, having all of the following:

a.1. Limited to cylindrical grinding; and

a.2. Limited to a maximum workpiece capacity of 150 mm outside diameter or length.

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.

c. Surface grinders.

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

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

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

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

e.1.b. Electron beam; or

e.1.c. “Laser” beam; and

e.2. At least two rotary axes having all of the following:

e.2.a. Can be coordinated simultaneously for “contouring control”; and

e.2.b. A positioning “accuracy” of less (better) than 0.003°;

f. Deep-hole-drilling machines and turning machines modified for deep-hole-drilling, having a maximum depth-of-bore capability exceeding 5 m.

■ 22. In supplement no. 1 to part 774, Category 2, ECCN 2B006 is revised to read as follows:

**2B006 Dimensional inspection or measuring systems, equipment, position feedback units and “electronic assemblies”, 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>
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NS applies to entire entry.	NS Column 2
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<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
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NP applies to those items in 2B006.a, .b.1, b.3, and .c (angular displacement measuring instruments) that meet or exceed the technical parameters in 2B206.

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:* (1) See ECCNs 2D001 and 2D002 for “software” for items controlled under this entry. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry. (3) Also see ECCNs 2B206 and 2B996.

*Related Definitions:* N/A

*Items:*

a. Computer controlled or “numerically controlled” Coordinate Measuring Machines (CMM), having a three dimensional length (volumetric) maximum permissible error of length measurement ( $E_{0,MPE}$ ) at any point within the operating range of the machine (*i.e.*, within the length of axes) equal to or less (better) than  $(1.7 + L/1,000) \mu m$  (L is the measured length in mm) according to ISO 10360-2 (2009);

**Technical Note:** The  $E_{0,MPE}$  of the most accurate configuration of the CMM specified by the manufacturer (*e.g.*, best of the following: Probe, stylus length, motion parameters, environment) and with “all compensations available” shall be compared to the  $1.7 + L/1,000 \mu m$  threshold.

b. Linear displacement measuring instruments or systems, linear position feedback units, and “electronic assemblies”, as follows:

**Note:** Interferometer and optical-encoder measuring systems containing a “laser” are only specified by 2B006.b.3.

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

**Technical Note:** For the purposes of 2B006.b.1, ‘non-contact type measuring systems’ are designed to measure the distance between the probe and measured object along a single vector, where the probe or measured object is in motion.

b.2. Linear position feedback units “specially designed” for machine tools and having an overall “accuracy” less (better) than  $(800 + (600 \times L/1,000)) \text{ nm}$  (L equals effective length in mm);

b.3. Measuring systems having all of the following:  
 b.3.a. Containing a “laser”;  
 b.3.b. A ‘resolution’ over their full scale of 0.200 nm or less (better); *and*  
 b.3.c. Capable of achieving a “measurement uncertainty” equal to or less (better) than  $(1.6 + L/2,000)$  nm (L is the measured length in mm) at any point within a measuring range, when compensated for the refractive index of air and measured over a period of 30 seconds at a temperature of  $20 \pm 0.01^\circ\text{C}$ ; *or*

**Technical Note:** For the purposes of 2B006.b, ‘resolution’ is the least increment of a measuring device; on digital instruments, the least significant bit.

b.4. “Electronic assemblies” “specially designed” to provide feedback capability in systems controlled by 2B006.b.3;

c. Rotary position feedback units “specially designed” for machine tools or angular displacement measuring instruments, having an angular position “accuracy” equal to or less (better) than 0.9 second of arc;

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

d. Equipment for measuring surface roughness (including surface defects), by measuring optical scatter with a sensitivity of 0.5 nm or less (better).

**Note:** 2B006 includes machine tools, other than those specified by 2B001, that can be used as measuring machines, if they meet or exceed the criteria specified for the measuring machine function.

■ 23. In supplement no. 1 to part 774, Category 2, ECCN 2B007 is revised to read as follows:

**2B007 “Robots” having any of the following characteristics described in the List of Items Controlled and “specially designed” controllers and “end-effectors” therefor.**

**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 equipment that meets or exceeds the criteria in ECCNs 2B207.	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:* \$5,000, except 2B007.b and .c  
*GBS:* N/A  
*CIV:* N/A

**List of Items Controlled**

*Related Controls:*

(1) See ECCN 2D001 for “software” for items controlled under this entry. (2) See ECCNs 2E001 (“development”), 2E002

(“production”), and 2E201 (“use”) for technology for items controlled under this entry. (3) Also see ECCNs 2B207, 2B225 and 2B997.

*Related Definitions:* N/A

*Items:*

a. [Reserved]  
 b. “Specially designed” to comply with national safety standards applicable to potentially explosive munitions environments;

**Note:** 2B007.b does not apply to “robots” “specially designed” for paint-spraying booths.

c. “Specially designed” or rated as radiation-hardened to withstand a total radiation dose greater than  $5 \times 10^3$  Gy (silicon) without operational degradation; *or*

**Technical Note:** The term Gy (silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionizing radiation.

d. “Specially designed” to operate at altitudes exceeding 30,000 m.

■ 24. In supplement no. 1 to part 774, Category 2, ECCN 2B008 is revised to read as follows:

**2B008 ‘Compound rotary tables’ and “tilting spindles”, “specially designed” for machine tools, 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:* N/A  
*GBS:* N/A  
*CIV:* N/A

**List of Items Controlled**

*Related Controls:* See also 2B998

*Related Definition:* N/A

*Items:*

a. [Reserved]  
 b. [Reserved]  
 c. ‘Compound rotary tables’ having all of the following:  
 c.1. Designed for machine tools for turning, milling or grinding; *and*  
 c.2. Two rotary axes designed to be coordinated simultaneously for “contouring control”.

**Technical Note:** A ‘compound rotary table’ is a table allowing the workpiece to rotate and tilt about two non-parallel axes.

d. “Tilting spindles” having all of the following:  
 d.1. Designed for machine tools for turning, milling or grinding; *and*  
 d.2. Designed to be coordinated simultaneously for “contouring control”.

■ 25. In supplement no. 1 to part 774, Category 2, ECCN 2B206 is revised to read as follows:

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

**License Requirements**

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NP applies to entire entry.	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:* (1) See ECCNs 2D002 and 2D201 for “software” for items controlled under this entry. (2) See ECCNs 2E001 (“development”), 2E002 (“production”), and 2E201 (“use”) for technology for items controlled under this entry. (3) Also see ECCNs 2B006 and 2B996.

*Related Definitions:* N/A

*Items:*

**Control Notes to ECCN 2B206:** (1) Machine tools that can be used as measuring machines are controlled by ECCN 2B206 if they meet or exceed the control parameters specified in this entry for the measuring machine function. (2) The machines described in ECCN 2B206 are controlled by this entry if they exceed the specified control threshold anywhere in their operating range.

**Technical Note to ECCN 2B206:** All parameters of measurement values in this entry represent plus/minus, *i.e.*, not total band.

a. Computer controlled or numerically controlled coordinate measuring machines (CMM) with either of the following characteristics:

a.1. Having only two axes with a maximum permissible error of length measurement along any axis (one dimension), identified as any combination of  $E_{0x\ MPE}$ ,  $E_{0y\ MPE}$  or  $E_{0z\ MPE}$ , equal to or less (better) than  $(1.25 + L/1,000)$   $\mu\text{m}$  (where L is the measured length in mm) at any point within the operating range of the machine (*i.e.*, within the length of the axis), according to ISO 10360–2 (2009); *or*

a.2. Having three or more axes with a three dimensional (volumetric) maximum permissible error of length measurement, identified as  $E_{0\ MPE}$ , equal to or less (better) than  $(1.7 + L/800)$   $\mu\text{m}$  (where L is the measured length in mm) at any point within the operating range of the machine (*i.e.*, within the length of the axis), according to ISO 10360–2 (2009).

**Technical Note to 2B206.a.2:** The  $E_{0\ MPE}$  of the most accurate configuration of the

CMM specified according to ISO 10360–2 (2009) by the manufacturer (e.g., best of the following: Probe, stylus length, motion parameters, environment) and with all compensations available shall be compared to the 1.7 + L/800 μm threshold.

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

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

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

c. Linear displacement measuring systems having both of the following characteristics:

c.1. Containing a “laser;” and

c.2. Capable of maintaining, for at least 12 hours over a temperature range of ± 1 K around a standard temperature and a standard pressure, both:

c.2.a. A “resolution” over their full scale of 0.1 μm or better; and

c.2.b. A “measurement uncertainty” equal to or better (less) than (0.2 + L/2,000) μm (L is the measured length in millimeters).

**Control Note to 2B206.c:** 2B206.c does not control measuring interferometer systems, without closed or open loop feedback, containing a “laser” to measure slide movement errors of machine tools, dimensional inspection machines, or similar equipment.

**Technical Note to 2B206.c:** In 2B206.c, “linear displacement” means the change of distance between the measuring probe and the measured object.

d. Linear Variable Differential Transformer (LVDT) systems having all of the following:

d.1. Having any of the following:

d.1.a. “Linearity” equal to or less (better) than 0.1% measured from 0 to the full operating range, for LVDTs with a full operating range up to and including ±5 mm; or

d.1.b. “Linearity” equal to or less (better) than 0.1% measured from 0 to 5 mm for LVDTs with a ‘full operating range’ greater than ±5 mm; and

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

■ 26. In supplement no. 1 to part 774, 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

<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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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:* Yes, except 2E003.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. [Reserved]

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;

**Technical Notes:**

1. ‘Direct-acting hydraulic pressing’ is a deformation process which uses a fluid-filled flexible bladder in direct contact with the workpiece.

2. ‘Hot isostatic densification’ is a process of pressurizing a casting at temperatures exceeding 375 K (102 °C) in a closed cavity through various media (gas, liquid, solid particles, etc.) to create equal force in all directions to reduce or eliminate internal voids in the casting.

c. “Technology” for the “development” or “production” of hydraulic stretch-forming machines and dies therefor, for the manufacture of airframe structures;

d. [Reserved]

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).’

■ 27. In supplement no. 1 to part 774, Category 3, Product Group A is amended by revising Notes 1 and 2 and N.B. before ECCN 3A001 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, or 3A001.a.12 to 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, or 3A001.a.12 to 3A001.a.14, which 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, and 3A001.a.12 to 3A001.a.14.

■ 28. In supplement no. 1 to part 774, Category 3, ECCN 3A001 is revised to read as follows:

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

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

Control(s)	Country chart (see Supp. No. 1 to part 738)	List Based License Exceptions (See Part 740 for a Description of All License Exceptions)	
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	<p><i>LVS:</i> 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</p> <p>Yes for:                      \$1,500: 3A001.c                      \$3,000: 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.                      \$5,000: 3A001.a (except a.1.a and a.5.a when controlled for MT), b.4 to b.7, and b.12.</p> <p><i>GBS:</i> 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, .h, and .i.</p>	<p>a.1.a. A total dose of <math>5 \times 10^3</math> Gy (Si), or higher;                      a.1.b. A dose rate upset of <math>5 \times 10^6</math> Gy (Si)/s, or higher; <i>or</i>                      a.1.c. A fluence (integrated flux) of neutrons (1 MeV equivalent) of <math>5 \times 10^{13}</math> n/cm<sup>2</sup> or higher on silicon, or its equivalent for other materials;</p>
NS applies to entire entry.	NS Column 2		<p><b>Note:</b> 3A001.a.1.c does not apply to Metal Insulator Semiconductors (MIS).</p>
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		<p>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 in unknown, Fast Fourier Transform (FFT) processors, Static Random-Access Memories (SRAMs), or ‘non-volatile memories,’ having any of the following:</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 -54°C to above +125°C.	MT Column 1	<b>Special Conditions for STA</b>	<p><b>Technical Note:</b> ‘Non-volatile memories’ are memories with data retention over a period of time after a power shutdown.</p>
NP applies to pulse discharge capacitors 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><i>STA:</i> 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).</p>	<p>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); <i>or</i>                      a.2.c. Rated for operation over the entire ambient temperature range from 218 K (– 55 °C) to 398 K (125 °C);</p>
AT applies to entire entry.	AT Column 1	<b>List of Items Controlled</b>	<p><b>Note:</b> 3A001.a.2 does not apply to integrated circuits for civil automobile or railway train applications.</p>
<p><b>License Requirements Note:</b> 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.</p>		<p><i>Related Controls:</i> (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.</p> <p><i>Related Definitions:</i> ‘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, <math>5 \times 10^3</math> Gy (Si) = <math>5 \times 10^5</math> Rads (Si); <math>5 \times 10^6</math> Gy (Si)/s = <math>5 \times 10^8</math> Rads (Si)/s.</p> <p><i>Items:</i></p> <p>a. General purpose integrated circuits, as follows:</p> <p><b>Note 1:</b> 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.</p> <p><b>Note 2:</b> Integrated circuits include the following types:</p> <ul style="list-style-type: none"> <li>— “Monolithic integrated circuits”</li> <li>— “Hybrid integrated circuits”;</li> <li>— “Multichip integrated circuits”;</li> <li>— “Film type integrated circuits”, including silicon-on-sapphire integrated circuits;</li> <li>— “Optical integrated circuits”;</li> <li>— “Three dimensional integrated circuits”;</li> <li>— “Monolithic Microwave Integrated Circuits” (“MMICs”).</li> </ul> <p>a.1. Integrated circuits designed or rated as radiation hardened to withstand any of the following:</p>	<p>a.3. “Microprocessor microcircuits”, “microcomputer microcircuits” and microcontroller microcircuits, manufactured from a compound semiconductor and operating at a clock frequency exceeding 40 MHz;</p> <p><b>Note:</b> 3A001.a.3 includes digital signal processors, digital array processors and digital coprocessors.</p> <p>a.4. [Reserved]</p> <p>a.5. Analog-to-Digital Converter (ADC) and Digital-to-Analog Converter (DAC) integrated circuits, as follows:</p> <ul style="list-style-type: none"> <li>a.5.a. ADCs having any of the following:                             <ul style="list-style-type: none"> <li>a.5.a.1. A resolution of 8 bit or more, but less than 10 bit, with a “sample rate” greater than 1.3 Giga Samples Per Second (GSPS);</li> <li>a.5.a.2. A resolution of 10 bit or more, but less than 12 bit, with a “sample rate” rate greater than 600 Mega Samples Per Second (MSPS);</li> <li>a.5.a.3. A resolution of 12 bit or more, but less than 14 bit, with a “sample rate” rate greater than 400 MSPS;</li> <li>a.5.a.4. A resolution of 14 bit or more, but less than 16 bit, with a “sample rate” rate greater than 250 MSPS; <i>or</i></li> <li>a.5.a.5. A resolution of 16 bit or more with a “sample rate” rate greater than 65 MSPS;</li> </ul> </li> </ul> <p><b>N.B.:</b> For integrated circuits that contain analog-to-digital converters and store or process the digitized data see 3A001.a.14.</p>

**Technical Notes:**

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

2. The resolution of the ADC is the number of bits of the digital output that represents the measured analog input. Effective Number of Bits (ENOB) is not used to determine the resolution of the ADC.

3. For “multiple channel ADCs”, the “sample rate” is not aggregated and the “sample rate” is the maximum rate of any single channel.

4. For “interleaved ADCs” or for “multiple channel ADCs” that are specified to have an interleaved mode of operation, the “sample rates” are aggregated and the “sample rate” is the maximum combined total rate of all of the interleaved channels.

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 arrive at or within 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:

—Complex Programmable Logic Devices (CPLDs)

—Field Programmable Gate Arrays (FPGAs)

—Field Programmable Logic Arrays (FPLAs)

—Field Programmable Interconnects (FPLICs)

**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 or are programmable to 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 a “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 a “sample rate” greater than 1.0 GSPS;

a.14.a.3. A resolution of 12 bit or more, but less than 14 bit, with a “sample rate” greater than 1.0 GSPS;

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

*or*

a.14.a.5. A resolution of 16 bit or more with a “sample rate” greater than 180 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.

**Technical Notes:**

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

2. The resolution of the ADC is the number of bits of the digital output of the ADC that represents the measured analog input. Effective Number of Bits (ENOB) is not used to determine the resolution of the ADC.

3. For integrated circuits with non-interleaving “multiple channel ADCs”, the “sample rate” is not aggregated and the “sample rate” is the maximum rate of any single channel.

4. For integrated circuits with “interleaved ADCs” or with “multiple channel ADCs” that are specified to have an interleaved mode of operation, the “sample rates” are aggregated and the “sample rate” is the maximum combined total rate of all of the interleaved channels.

b. Microwave or millimeter wave items, as follows:

**Technical Note:**

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

b.1.c. 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.d. ‘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 0.1n 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.

3. For converters and harmonic mixers, designed to extend the operating or frequency range of signal analyzers, signal generators, network analyzers or microwave test receivers, see 3A001.b.7.

**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  $-(126 + 20\log 10F - 20\log 10f)$  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;

**Technical Note:** A 'frequency synthesizer' is any kind of frequency source, regardless of the actual technique used, providing a multiplicity of simultaneous or alternative output frequencies, from one or more outputs, controlled by, derived from or disciplined by a lesser number of standard (or master) frequencies.

**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.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  $\mu\text{s}$  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  $\mu\text{s}$ ; *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  $\mu\text{s}$  and bandwidth in MHz) of more than 100;

c.1.c.2. A dispersive delay of more than 10  $\mu\text{s}$ ; *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 any of the following at 20 °C:

e.1.a.1. 'Energy density' exceeding 550 Wh/kg and a 'continuous power density' exceeding 50 W/kg; *or*

e.1.a.2. 'Energy density' exceeding 50 Wh/kg and a 'continuous power density' exceeding 350 W/kg;

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.

5. For the purpose of 3A001.e.1.a, 'continuous power density' (W/kg) is calculated from the nominal voltage multiplied by the specified maximum continuous discharge current in ampere (A) divided by the mass in kilograms. 'Continuous power density' is also referred to as specific power.

**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 sun light 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/ $\mu\text{s}$  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/ $\mu\text{s}$  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:** 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:** 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.

i. Intensity, amplitude, or phase electro-optic modulators, designed for analog signals and having any of the following:

i.1. A maximum operating frequency of more than 10 GHz but less than 20 GHz, an optical insertion loss equal to or less than 3 dB and having any of the following:

i.1.a. A ‘half-wave voltage’ ( $V\pi$ ) less than 2.7 V when measured at a frequency of 1 GHz or below; or

i.1.b. A  $V\pi$  of less than 4 V when measured at a frequency of more than 1 GHz; or

i.2. A maximum operating frequency equal to or greater than 20 GHz, an optical insertion loss equal to or less than 3 dB and having any of the following:

i.2.a. A  $V\pi$  less than 3.3 V when measured at a frequency of 1 GHz or below; or

i.2.b. A  $V\pi$  less than 5 V when measured at a frequency of more than 1 GHz.

**Note:** 3A001.i includes electro-optic modulators having optical input and output connectors (e.g., fiber-optic pigtails).

**Technical Note:** For the purposes of 3A001.i, a ‘half-wave voltage’ ( $V\pi$ ) is the applied voltage necessary to make a phase change of 180 degrees in the wavelength of light propagating through the optical modulator.

■ 29. In supplement no. 1 to part 774, 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: \$3,000: 3A002.a, .e, .f, and .g

\$5,000: 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. to a.5. [Reserved]

**N.B.:** For waveform digitizers and transient recorders, see 3A002.h.

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 3 dB 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 40 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  $\mu$ s 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  $\mu$ s or less;

#### Technical Notes:

1. ‘Real-time bandwidth’ is the widest frequency range for which the analyzer can continuously transform time-domain data entirely into frequency-domain results, using a 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.

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

3. 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.

4. A ‘frequency mask trigger’ is a mechanism where the trigger function is able to select a frequency range to be triggered on as a subset of the acquisition bandwidth while ignoring other signals that may also be present within the same acquisition bandwidth. A ‘frequency mask trigger’ may contain more than one independent set of limits.

**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;
    - f.3. 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  $1 \times 10^{-11}$ /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  $1 \times 10^{-11}$ /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 Giga Samples Per Second (GSPS);
        - h.1.b. A resolution of 10 bit or more, but less than 12 bit, with an input sample rate greater than 1.0 GSPS;
        - h.1.c. A resolution of 12 bit or more, but less than 14 bit, with an input sample rate greater than 1.0 GSPS;
        - h.1.d. 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*
        - h.1.e. A resolution of 16 bit or more with an input sample rate greater than 180 MSPS; *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 Notes:**

- 1. A resolution of n bit corresponds to a quantization of  $2^n$  levels.
- 2. The resolution of the ADC is the number of bits in of the digital output of the ADC that represents the measured analog input word. Effective Number of Bits (ENOB) is not used to determine the resolution of the ADC.
- 3. For non-interleaved multiple-channel “electronic assemblies”, modules, or equipment, the “sample rate” is not aggregated and the “sample rate” is the maximum rate of any single channel.
- 4. For interleaved channels on multiple-channel “electronic assemblies”, modules, or equipment, the “sample rates” are aggregated and the “sample rate” is the maximum combined total rate of all the interleaved channels.

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

■ 30. In supplement no. 1 to part 774, 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 350 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 thyatron 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.

■ 31. In supplement no. 1 to part 774, 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

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:* \$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:

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

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;
- j. Mask “substrate blanks” with multilayer reflector structure consisting of molybdenum and silicon, and having all of the following:
  - j.1. “Specially designed” for ‘Extreme Ultraviolet (EUV)’ lithography; and
  - j.2. Compliant with SEMI Standard P37.

**Technical Note:** ‘Extreme Ultraviolet (EUV)’ refers to electromagnetic spectrum wavelengths greater than 5 nm and less than 124 nm.

■ 32. In supplement no. 1 to part 774, Category 3, ECCN 3B002 is revised to read as follows:

**3B002 Test equipment “specially designed” for testing finished or unfinished semiconductor devices as follows (see List of Items Controlled) and “specially designed” “components” and “accessories” therefor.**

**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

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

*LVS:* \$500  
*GBS:* Yes  
*CIV:* N/A

**List of Items Controlled**

*Related Controls:* See also 3A999.a and 3B992

*Related Definitions:* N/A

*Items:*

- a. For testing S-parameters of items specified by 3A001.b.3;
- b. [Reserved]
- c. For testing microwave integrated circuits controlled by 3A001.b.2.

■ 33. In supplement no. 1 to part 774, Category 3, ECCN 3C002 is revised to read as follows:

**3C002 Resist materials as follows (see List of Items Controlled) and “substrates” coated with the following resists.**

**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

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

*LVS:* \$3,000  
*GBS:* Yes for 3C002.a provided that they are not also controlled by 3C002.b through .e.

*CIV:* Yes for 3C002.a provided that they are not also controlled by 3C002.b through .e.

**List of Items Controlled**

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

- a. Resists designed for semiconductor lithography as follows:
  - a.1. Positive resists adjusted (optimized) for use at wavelengths less than 193 nm but equal to or greater than 15 nm;
  - a.2. Resists adjusted (optimized) for use at wavelengths less than 15 nm but greater than 1 nm;
  - b. All resists designed for use with electron beams or ion beams, with a sensitivity of 0.01 μcoulomb/mm<sup>2</sup> or better;
  - c. [Reserved]
  - d. All resists optimized for surface imaging technologies;
  - e. All resists designed or optimized for use with imprint lithography equipment specified by 3B001.f.2 that use either a thermal or photo-curable process.

■ 34. In supplement no. 1 to part 774, Category 3, ECCN 3C005 is revised to read as follows:

**3C005 High resistivity materials 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>
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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:* \$3,000  
*GBS:* Yes  
*CIV:* Yes

**List of Items Controlled**

*Related Controls:* See ECCN 3E001 for related development and production technology, and ECCN 3B991.b.1.b for related production equipment.

*Related Definition:* N/A

*Items:*

- a. Silicon carbide (SiC), gallium nitride (GaN), aluminum nitride (AlN) or aluminum gallium nitride (AlGaIn) semiconductor “substrates”, or ingots, boules, or other preforms of those materials, having resistivities greater than 10,000 ohm-cm at 20 °C;
- b. Polycrystalline “substrates” or polycrystalline ceramic “substrates”, having resistivities greater than 10,000 ohm-cm at 20 °C and having at least one non-epitaxial single-crystal layer of silicon (Si), silicon carbide (SiC), gallium nitride (GaN), aluminum nitride (AlN), or aluminum gallium nitride (AlGaIn) on the surface of the “substrate”.

■ 35. In supplement no. 1 to part 774, Category 3, ECCN 3C006 is revised to read as follows:

**3C006 Materials, not specified by 3C001, consisting of a “substrate” specified by 3C005 with at least one epitaxial layer of silicon carbide, gallium nitride, aluminum nitride or aluminum gallium nitride.**

**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:* \$3,000  
*GBS:* Yes  
*CIV:* Yes

**List of Items Controlled**

*Related Controls:* See ECCN 3D001 for related “development” or “production” “software”, ECCN 3E001 for related “development” and “production” “technology”, and ECCN 3B991.b.1.b for related “production” equipment.  
*Related Definition:* N/A

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

■ 36. In supplement no. 1 to part 774, Category 3, ECCN 3C992 is revised to read as follows:

**3C992 Positive resists designed for semiconductor lithography specially adjusted (optimized) for use at wavelengths between 370 and 193 nm.**

**License Requirements**

*Reason for Control:* AT

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

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

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

**List of Items Controlled**

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

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

■ 37. In supplement no. 1 to part 774, 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>
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:* N/A.  
*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.14, 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.

**Note 3:** 3E001 does not apply to ‘Process Design Kits’ (‘PDKs’) unless they include libraries implementing functions or technologies for items specified by 3A001.

**Technical Note:** A ‘Process Design Kit’ (‘PDK’) is a software tool provided by a semiconductor manufacturer to ensure that the required design practices and rules are taken into account in order to successfully produce a specific integrated circuit design in a specific semiconductor process, in accordance with technological and manufacturing constraints (each semiconductor manufacturing process has its particular ‘PDK’).

■ 38. In supplement no. 1 to part 774, the notes at the beginning of Category 4 are revised to read as follows:

**Category 4—Computers**

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

**Note 2:** Control units that directly interconnect the buses or channels of central processing units, ‘main storage’ or disk controllers are not regarded as



telecommunications equipment described in Category 5, Part 1 (Telecommunications).

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

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

■ 39. In supplement no. 1 to part 774, 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 a APP > 0.0128 but ≤ 29 WT).	AT Column 1

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

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

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

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

d. to f. [Reserved]

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

g. Equipment “specially designed” for aggregating the performance of “digital computers” by providing external interconnections which allow communications at unidirectional data rates exceeding 2.0 Gbyte/s per link.

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

■ 40. In supplement no. 1 to part 774, Category 4, ECCN 4A004 is revised to read as follows:

**4A004 Computers as follows (see List of Items Controlled) and “specially**

**designed” related equipment, “electronic assemblies” and “components” therefor.**

**License Requirements**

*Reason for Control:* NS, AT

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

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

*LVS:* \$5,000

*GBS:* N/A

*CIV:* N/A

**List of Items Controlled**

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

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

**Technical Notes:**

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

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

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

■ 41. In supplement no. 1 to part 774, 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>
NS applies to entire entry.	NS Column 1
CC applies to “software” for computerized finger-print equipment controlled by 4A003 for CC reasons.	CC Column 1
AT applies to entire entry.	AT Column 1

**Reporting Requirements**

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

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

*CIV:* N/A

*TSR:* Yes, except for “software” for the “development” or “production” of commodities with an “Adjusted Peak Performance” (“APP”) exceeding 29 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 29 Weighted TeraFLOPS (WT) to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**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 15 Weighted TeraFLOPS (WT);

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

■ 42. In supplement no. 1 to part 774, 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>
NS applies to entire entry.	NS Column 1
MT applies to “technology” for items controlled by 4A001.a and 4A101 for MT reasons.	MT Column 1
CC applies to “software” for computerized finger-print equipment controlled by 4A003 for CC reasons.	CC Column 1
AT applies to entire entry.	AT Column 1

**Reporting Requirements**

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

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

*CIV:* N/A

*TSR:* Yes, except for “technology” for the “development” or “production” of commodities with an “Adjusted Peak Performance” (“APP”) exceeding 29 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 29 Weighted TeraFLOPS (WT); or c. “software” specified in the License Exception STA paragraph found in the License Exception section of ECCN 4D001 to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls:* N/A

*Related Definitions:* N/A

*Items:*

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

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

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

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

■ 43. In supplement no. 1 to part 774, Category 4, the Technical Note on “Adjusted Peak Performance” (“APP”) is revised to read as follows:

**Technical Note on “Adjusted Peak Performance” (“APP”)**

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

**Abbreviations used in this Technical Note**

- n number of processors in the “digital computer”
  - I processor number (i . . . n)
  - t<sub>i</sub> processor cycle time (t<sub>i</sub> = 1/F<sub>i</sub>)
  - F<sub>i</sub> processor frequency
  - R<sub>i</sub> peak floating point calculating rate
  - W<sub>i</sub> architecture adjustment factor
- “APP” is expressed in Weighted TeraFLOPS (WT), in units of 10<sup>12</sup> adjusted floating point operations per second.

**Outline of “APP” calculation method**

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

**Note:** In determining FPO, include only 64-bit or larger floating point additions or multiplications. All floating point operations must be expressed in operations per processor cycle; operations requiring multiple cycles may be expressed in fractional results per cycle. For processors not capable of performing calculations on floating-point operands of 64-bits or more the effective calculating rate R is zero.

2. Calculate the floating point rate R for each processor

$$R_i = FPO_i / t_i$$

3. Calculate “APP” as

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

4. For ‘vector processors’, W<sub>1</sub> = 0.9. For non-‘vector processors’, W<sub>1</sub> = 0.3.

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

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

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

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

**Note 5:** “APP” values are not to be calculated for processor combinations(inter)connected by “Local Area Networks”, Wide Area Networks, I/O shared connections/devices, I/O controllers and any communication interconnection implemented by “software”.

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

**Technical Notes**

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

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

**Note 7:** A ‘vector processor’ is defined as a processor with built-in instructions that perform multiple calculations on floating-point vectors (one-dimensional arrays of 64-

bit or larger numbers) simultaneously, having at least 2 vector functional units and at least 8 vector registers of at least 64 elements each.

■ 44. In supplement no. 1 to part 774, 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

Control(s)	Country chart (see Supp. No. 1 to part 738).
NS applies to 5A001.a, .b.5, .e, 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).
AT applies to entire entry.	AT Column 1

**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.

**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; \$5,000 for 5A001.b.1, .b.2, .b.3, .b.6, .d, f.2, f.4, and .g; \$3,000 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;
  - a.3. “Specially designed” to operate below 218 K (–55 °C); or
  - a.4. “Specially designed” to operate above 397 K (124 °C);

**Note:** 5A001.a.3 and 5A001.a.4 apply 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;

**Technical Note:** ‘Channel switching time’: The time (*i.e.*, delay) to change from one receiving frequency to another, to arrive at or within ±0.05% of the final specified receiving frequency. Items having a specified frequency range of less than ±0.05% around their center frequency are defined to be incapable of channel frequency switching.

**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.

**N.B.:** For underwater umbilical cables, see 8A002.a.3.

**Technical Note:** ‘Electronically steerable phased array antennae’ 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

**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:** ‘Voice coding’: The time (*i.e.*, delay) to change from one receiving frequency to another, to arrive at or within ±0.05% of the final specified receiving frequency. Items having a specified frequency range of less than ±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 × 10<sup>9</sup> 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 antennae’ 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

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 × 10<sup>9</sup> 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 antennae’ 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

b.6. Employing functions of digital “signal processing” to provide ‘voice coding’ output at rates of less than 700 bit/s.

**Technical Note:** ‘Electronically steerable phased array antennae’ 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

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 1:** 5A001.d does not control ‘electronically steerable phased array antennae’ for landing systems with instruments meeting ICAO standards covering Microwave Landing Systems (MLS).

**Note 2:** 5A001.d does not apply to antennae specially designed for any of the following:

- a. Civil cellular or WLAN radio-communications systems;
- b. IEEE 802.15 or wireless HDMI; or
- c. Fixed or mobile satellite earth stations for commercial civil telecommunications.

**Technical Note:** For the purposes of 5A001.d ‘electronically steerable phased array antenna’ is an antenna which forms a beam by means of phase coupling, (*i.e.*, the beam direction is controlled by the complex excitation coefficients of the radiating elements) and the direction of that beam can be varied (both in transmission and reception) in azimuth or in elevation, or both, by application of an electrical signal.

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 through 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 through 130).

i. [Reserved]

**N.B.:** See 5A001.f.1 for items previously specified by 5A001.i.

■ 45. In supplement no. 1 to part 774, 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, has been activated, or can be activated by means of ‘cryptographic activation’ not employing a secure mechanism, 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 for converting, by means of “cryptographic activation”, an item not specified by Category 5—Part 2 into an item specified by 5A002.a or 5D002.c.1, and not released by the Cryptography Note (Note 3 in Category 5—Part 2), or for enabling, by means of “cryptographic activation”, additional functionality specified by 5A002.a of an item already specified by Category 5—Part 2;

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.

■ 46. In supplement no. 1 to part 774, 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

<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 “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.	Refer to § 742.15 of the EAR <b>Note:</b> 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

**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.

**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 “cryptography” 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 for converting, by means of “cryptographic activation”, an item not specified by Category 5—Part 2 into an item specified by 5A002.a or 5D002.c.1, and not released by the Cryptography Note (Note 3 in Category 5—Part 2), or for enabling, by means of “cryptographic activation”, additional functionality specified by 5A002.a of an item already specified by Category 5—Part 2;
  - 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.

■ 47. In supplement no. 1 to part 774, 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” for converting, by means of “cryptographic activation”, an item not specified by Category 5—Part 2 into an item specified by 5A002.a or 5D002.c.1, and not released by the Cryptography Note (Note 3 in Category 5—Part 2), or for enabling, by means of “cryptographic activation”, additional functionality specified by 5A002.a of an item already specified by Category 5—Part 2.

**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.

■ 48. In supplement no. 1 to part 774, Category 6, ECCN 6A002 is revised to read as follows:

**6A002 Optical sensors and equipment, and “components” therefor, as follows (see List of Items Controlled).**

**License Requirements**

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

<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).		
MT applies to optical detectors in 6A002.a.1, or a.3 that are "specially designed" or modified to protect "missiles" against nuclear effects (e.g., Electro-magnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for "missiles".	MT Column 1	<p>a.1.a. "Space-qualified" solid-state detectors having all of the following:</p> <p>a.1.a.1. A peak response in the wavelength range exceeding 10 nm but not exceeding 300 nm; and</p> <p>a.1.a.2. A response of less than 0.1% relative to the peak response at a wavelength exceeding 400 nm;</p> <p>a.1.b. "Space-qualified" solid-state detectors having all of the following:</p> <p>a.1.b.1. A peak response in the wavelength range exceeding 900 nm but not exceeding 1,200 nm; and</p> <p>a.1.b.2. A response "time constant" of 95 ns or less;</p> <p>a.1.c. "Space-qualified" solid-state detectors having a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;</p> <p>a.1.d. "Space-qualified" "focal plane arrays" having more than 2,048 elements per array and having a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm;</p> <p>a.2. Image intensifier tubes and "specially designed" "components" therefor, as follows:</p> <p><b>Note:</b> 6A002.a.2 does not control non-imaging photomultiplier tubes having an electron sensing device in the vacuum space limited solely to any of the following:</p> <p>a. A single metal anode; or</p> <p>b. Metal anodes with a center to center spacing greater than 500 <math>\mu\text{m}</math>.</p> <p><b>Technical Note:</b> 'Charge multiplication' is a form of electronic image amplification and is defined as the generation of charge carriers as a result of an impact ionization gain process. 'Charge multiplication' sensors may take the form of an image intensifier tube, solid state detector or "focal plane array".</p> <p>a.2.a. Image intensifier tubes having all of the following:</p> <p>a.2.a.1. A peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm;</p> <p>a.2.a.2. Electron image amplification using any of the following:</p> <p>a.2.a.2.a. A microchannel plate with a hole pitch (center-to-center spacing) of 12 <math>\mu\text{m}</math> or less; or</p> <p>a.2.a.2.b. An electron sensing device with a non-binned pixel pitch of 500 <math>\mu\text{m}</math> or less, "specially designed" or modified to achieve 'charge multiplication' other than by a microchannel plate; and</p> <p>a.2.a.3. Any of the following photocathodes:</p> <p>a.2.a.3.a. Multialkali photocathodes (e.g., S-20 and S-25) having a luminous sensitivity exceeding 350 <math>\mu\text{A}/\text{lm}</math>;</p> <p>a.2.a.3.b. GaAs or GaInAs photocathodes; or</p> <p>a.2.a.3.c. Other "III-V compound" semiconductor photocathodes having a maximum "radiant sensitivity" exceeding 10 mA/W;</p> <p>a.2.b. Image intensifier tubes having all of the following:</p> <p>a.2.b.1. A peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,800 nm;</p> <p>a.2.b.2. Electron image amplification using any of the following:</p> <p>a.2.b.2.a. A microchannel plate with a hole pitch (center-to-center spacing) of 12 <math>\mu\text{m}</math> or less; or</p>	<p>a.2.b.2.b. An electron sensing device with a non-binned pixel pitch of 500 <math>\mu\text{m}</math> or less, "specially designed" or modified to achieve 'charge multiplication' other than by a microchannel plate; and</p> <p>a.2.b.3. "III/V compound" semiconductor (e.g., GaAs or GaInAs) photocathodes and transferred electron photocathodes, having a maximum "radiant sensitivity" exceeding 15 mA/W;</p> <p>a.2.c. "Specially designed" "components" as follows:</p> <p>a.2.c.1. Microchannel plates having a hole pitch (center-to-center spacing) of 12 <math>\mu\text{m}</math> or less;</p> <p>a.2.c.2. An electron sensing device with a non-binned pixel pitch of 500 <math>\mu\text{m}</math> or less, "specially designed" or modified to achieve 'charge multiplication' other than by a microchannel plate;</p> <p>a.2.c.3. "III-V compound" semiconductor (e.g., GaAs or GaInAs) photocathodes and transferred electron photocathodes;</p> <p><b>Note:</b> 6A002.a.2.c.3 does not control compound semiconductor photocathodes designed to achieve a maximum "radiant sensitivity" of any of the following:</p> <p>a. 10 mA/W or less at the peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm; or</p> <p>b. 15 mA/W or less at the peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,800 nm.</p> <p>a.3. Non-"space-qualified" "focal plane arrays" as follows:</p> <p><b>N.B.:</b> 'Microbolometer' non-"space-qualified" "focal plane arrays" are only specified by 6A002.a.3.f.</p> <p><b>Technical Note:</b> Linear or two-dimensional multi-element detector arrays are referred to as "focal plane arrays";</p> <p><b>Note 1:</b> 6A002.a.3 includes photoconductive arrays and photovoltaic arrays.</p> <p><b>Note 2:</b> 6A002.a.3 does not control:</p> <p>a. Multi-element (not to exceed 16 elements) encapsulated photoconductive cells using either lead sulphide or lead selenide;</p> <p>b. Pyroelectric detectors using any of the following:</p> <p>b.1. Triglycine sulphate and variants;</p> <p>b.2. Lead-lanthanum-zirconium titanate and variants;</p> <p>b.3. Lithium tantalate;</p> <p>b.4. Polyvinylidene fluoride and variants; or</p> <p>b.5. Strontium barium niobate and variants.</p> <p>c. "Focal plane arrays" "specially designed" or modified to achieve 'charge multiplication' and 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:</p> <p>c.1. Incorporating a response limiting mechanism designed not to be removed or modified; and</p> <p>c.2. Any of the following:</p> <p>c.2.a. The response limiting mechanism is integral to or combined with the detector element; or</p> <p>c.2.b. The "focal plane array" is only operable with the response limiting mechanism in place.</p>
RS applies to 6A002.a.1, a.2, a.3 (except a.3.d.2.a and a.3.e for lead selenide based focal plane arrays (FPAs)), .c, and .f.	RS Column 1		
CC applies to police-model infrared viewers in 6A002.c.	CC Column 1		
AT applies to entire entry.	AT Column 1		
UN applies to 6A002.a.1, a.2, a.3 and .c.	See § 746.1(b) of the EAR for UN controls.		
<b>Reporting Requirements</b>			
See § 743.1 of the EAR for reporting requirements for exports under License Exceptions, and Validated End-User authorizations.			
<b>List Based License Exceptions (See Part 740 for a Description of All License Exceptions)</b>			
LVS: \$500 for 6A002.f. \$3,000; except N/A for MT and for 6A002.a.1, a.2, a.3, .c, and .f. GBS: N/A CIV: N/A			
<b>List of Items Controlled</b>			
<b>Related Controls:</b> (1) See USML Category XII(e) for infrared focal plane arrays, image intensifier tubes, and related parts and components, subject to the ITAR. (2) See USML Category XV(e) for space-qualified focal plane arrays subject to the ITAR. (3) See also ECCNs 6A102, 6A202, and 6A992. (4) See ECCN 0A919 for foreign-made military commodities that incorporate commodities described in 6A002. (5) Section 744.9 of the EAR imposes a license requirement on commodities described in ECCN 6A002 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. (6) See USML Categories XII(e) and XV(e)(3) for read-out integrated circuits "subject to the ITAR."			
<b>Related Definitions:</b> N/A			
<b>Items:</b>			
a. Optical detectors as follows:			
a.1. "Space-qualified" solid-state detectors as follows:			
<b>Note:</b> For the purpose of 6A002.a.1, solid-state detectors include "focal plane arrays".			



d. Thermopile arrays having less than 5,130 elements;

**Technical Note:** A response limiting mechanism integral to the detector element is designed not to be removed or modified without rendering the detector inoperable.

a.3.a. Non-“space-qualified” “focal plane arrays” having all of the following:

a.3.a.1. Individual elements with a peak response within the wavelength range exceeding 900 nm but not exceeding 1,050 nm; and

a.3.a.2. Any of the following:

a.3.a.2.a. A response “time constant” of less than 0.5 ns; or

a.3.a.2.b. “Specially designed” or modified to achieve ‘charge multiplication’ and having a maximum “radiant sensitivity” exceeding 10 mA/W;

a.3.b. Non-“space-qualified” “focal plane arrays” having all of the following:

a.3.b.1. Individual elements with a peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,200 nm; and

a.3.b.2. Any of the following:

a.3.b.2.a. A response “time constant” of 95 ns or less; or

a.3.b.2.b. “Specially designed” or modified to achieve ‘charge multiplication’ and having a maximum “radiant sensitivity” exceeding 10 mA/W;

a.3.c. Non-“space-qualified” non-linear (2-dimensional) “focal plane arrays” having individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 30,000 nm;

**N.B.:** Silicon and other material based ‘microbolometer’ non-“space-qualified” “focal plane arrays” are only specified by 6A002.a.3.f.

a.3.d. Non-“space-qualified” linear (1-dimensional) “focal plane arrays” having all of the following:

a.3.d.1. Individual elements with a peak response in the wavelength range exceeding 1,200 nm but not exceeding 3,000 nm; and

a.3.d.2. Any of the following:

a.3.d.2.a. A ratio of ‘scan direction’ dimension of the detector element to the ‘cross-scan direction’ dimension of the detector element of less than 3.8; or

a.3.d.2.b. Signal processing in the detector elements;

**Note:** 6A002.a.3.d does not control “focal plane arrays” (not to exceed 32 elements) having detector elements limited solely to germanium material.

**Technical Note:** For the purposes of 6A002.a.3.d, ‘cross-scan direction’ is defined as the axis parallel to the linear array of detector elements and the ‘scan direction’ is defined as the axis perpendicular to the linear array of detector elements.

a.3.e. Non-“space-qualified” linear (1-dimensional) “focal plane arrays” having individual elements with a peak response in the wavelength range exceeding 3,000 nm but not exceeding 30,000 nm;

a.3.f. Non-“space-qualified” non-linear (2-dimensional) infrared “focal plane arrays” based on ‘microbolometer’ material having individual elements with an unfiltered response in the wavelength range equal to or exceeding 8,000 nm but not exceeding 14,000 nm;

**Technical Note:** For the purposes of 6A002.a.3.f, ‘microbolometer’ is defined as a thermal imaging detector that, as a result of a temperature change in the detector caused by the absorption of infrared radiation, is used to generate any usable signal.

a.3.g. Non-“space-qualified” “focal plane arrays” having all of the following:

a.3.g.1. Individual detector elements with a peak response in the wavelength range exceeding 400 nm but not exceeding 900 nm;

a.3.g.2. “Specially designed” or modified to achieve ‘charge multiplication’ and having a maximum “radiant sensitivity” exceeding 10 mA/W for wavelengths exceeding 760 nm; and

a.3.g.3. Greater than 32 elements;

b. “Monospectral imaging sensors” and “multispectral imaging sensors”, designed for remote sensing applications and having any of the following:

b.1. An Instantaneous-Field-Of-View (IFOV) of less than 200  $\mu$ rad (microradians); or

b.2. Specified for operation in the wavelength range exceeding 400 nm but not exceeding 30,000 nm and having all the following:

b.2.a. Providing output imaging data in digital format; and

b.2.b. Having any of the following characteristics:

b.2.b.1. “Space-qualified”; or

b.2.b.2. Designed for airborne operation, using other than silicon detectors, and having an IFOV of less than 2.5 mrad (milliradians);

**Note:** 6A002.b.1 does not control “monospectral imaging sensors” with a peak response in the wavelength range exceeding 300 nm but not exceeding 900 nm and only incorporating any of the following non-“space-qualified” detectors or non-“space-qualified” “focal plane arrays”:

a. Charge Coupled Devices (CCD) not designed or modified to achieve ‘charge multiplication’; or

b. Complementary Metal Oxide Semiconductor (CMOS) devices not designed or modified to achieve ‘charge multiplication’.

c. ‘Direct view’ imaging equipment incorporating any of the following:

c.1. Image intensifier tubes having the characteristics listed in 6A002.a.2.a or 6A002.a.2.b;

c.2. “Focal plane arrays” having the characteristics listed in 6A002.a.3; or

c.3. Solid state detectors specified by 6A002.a.1;

**Technical Note:** ‘Direct view’ refers to imaging equipment that presents a visual image to a human observer without converting the image into an electronic signal for television display, and that cannot record or store the image photographically, electronically or by any other means.

**Note:** 6A002.c does not control equipment as follows, when incorporating other than GaAs or GaInAs photocathodes:

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

b. Medical equipment;

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

d. Flame detectors for industrial furnaces;

e. Equipment “specially designed” for laboratory use.

d. Special support “components” for optical sensors, as follows:

d.1. “Space-qualified” cryocoolers;

d.2. Non-“space-qualified” cryocoolers having a cooling source temperature below 218K (–55°C), as follows:

d.2.a. Closed cycle type with a specified Mean-Time-To-Failure (MTTF) or Mean-Time-Between-Failures (MTBF), exceeding 2,500 hours;

d.2.b. Joule-Thomson (JT) self-regulating minicoolers having bore (outside) diameters of less than 8 mm;

d.3. Optical sensing fibers specially fabricated either compositionally or structurally, or modified by coating, to be acoustically, thermally, inertially, electromagnetically or nuclear radiation sensitive.

**Note:** 6A002.d.3 does not apply to encapsulated optical sensing fibers “specially designed” for bore hole sensing applications.

e. [Reserved]

f. ‘Read-Out Integrated Circuits’ (‘ROIC’) “specially designed” for “focal plane arrays” specified by 6A002.a.3.

**Note:** 6A002.f does not apply to read-out integrated circuits “specially designed” for civil automotive applications.

**Technical Note:** A ‘Read-Out Integrated Circuit’ (‘ROIC’) is an integrated circuit designed to underlie or be bonded to a “focal plane array” (“FPA”) and used to read-out (i.e., extract and register) signals produced by the detector elements. At a minimum the ‘ROIC’ reads the charge from the detector elements by extracting the charge and applying a multiplexing function in a manner that retains the relative spatial position and orientation information of the detector elements for processing inside or outside the ‘ROIC’.

■ 49. In supplement no. 1 to part 774, 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

<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 cameras controlled by 6A003.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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
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) of the EAR 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) of the EAR 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 of the EAR), must be reported to BIS.

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

LVS: \$1,500, except N/A for 6A003.a.3 through a.6, b.1, b.3 and b.4

GBS: N/A

CIV: N/A

#### 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 of the EAR 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. [Reserved]
- a.2. [Reserved]
- a.3. 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;
  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.

■ 50. In supplement no. 1 to part 774, Category 6, ECCN 6A004 is revised to read as follows:

**6A004 Optical 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: \$3,000

GBS: Yes for 6A004.a.1, a.2, a.4, .b, d.2, and .f.

CIV: Yes for 6A004.a.1, a.2, a.4, .b, d.2, and .f.

**Special Conditions for STA**

STA: Paragraph (c)(2) of License Exception STA may not be used to ship any commodity in 6A004.c or .d 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) For optical mirrors or 'aspheric optical elements' "specially designed" for lithography "equipment", see ECCN 3B001. (2) See USML Category XII(e) for gimbals "subject to the ITAR". (3) See also 6A994.

*Related Definitions:* An 'aspheric optical element' is any element used in an optical system whose imaging surface or surfaces are designed to depart from the shape of an ideal sphere.

*Items:*

- a. Optical mirrors (reflectors) as follows:

**Technical Note:** For the purpose of 6A004.a, Laser Induced Damage Threshold (LIDT) is measured according to ISO 21254-1:2011.

a.1. 'Deformable mirrors' having an active optical aperture greater than 10 mm and having any of the following, and specially designed components therefor:

- a.1.a. Having all the following:
  - a.1.a.1. A mechanical resonant frequency of 750 Hz or more; and
  - a.1.a.2. More than 200 actuators; or
- a.1.b. A Laser Induced Damage Threshold (LIDT) being any of the following:
  - a.1.b.1. Greater than 1 kW/cm<sup>2</sup> using a "CW laser"; or
  - a.1.b.2. Greater than 2 J/cm<sup>2</sup> using 20 ns "laser" pulses at 20 Hz repetition rate;

**Technical Note:** 'Deformable mirrors' are mirrors having any of the following:

- a. A single continuous optical reflecting surface which is dynamically deformed by the application of individual torques or forces to compensate for distortions in the optical waveform incident upon the mirror; or
- b. Multiple optical reflecting elements that can be individually and dynamically repositioned by the application of torques or forces to compensate for distortions in the optical waveform incident upon the mirror.

'Deformable mirrors' are also known as adaptive optic mirrors.

a.2. Lightweight monolithic mirrors having an average "equivalent density" of less than 30 kg/m<sup>2</sup> and a total mass exceeding 10 kg;

a.3. Lightweight "composite" or foam mirror structures having an average "equivalent density" of less than 30 kg/m<sup>2</sup> and a total mass exceeding 2 kg;

**Note:** 6A004.a.2 and 6A004.a.3 do not apply to mirrors "specially designed" to direct solar radiation for terrestrial heliostat installations.

a.4. Mirrors specially designed for beam steering mirror stages specified in 6A004.d.2.a with a flatness of  $\lambda/10$  or better ( $\lambda$  is equal to 633 nm) and having any of the following:

a.4.a. Diameter or major axis length greater than or equal to 100 mm; *or*

a.4.b. Having all of the following:

a.4.b.1. Diameter or major axis length greater than 50 mm but less than 100 mm; *and*

a.4.b.2. A Laser Induced Damage Threshold (LIDT) being any of the following:

a.4.b.2.a. Greater than 10 kW/cm<sup>2</sup> using a "CW laser"; *or*

a.4.b.2.b. Greater than 20 J/cm<sup>2</sup> using 20 ns "laser" pulses at 20 Hz repetition rate;

**N.B.** For optical mirrors specially designed for lithography equipment, see 3B001.

b. Optical "components" made from zinc selenide (ZnSe) or zinc sulphide (ZnS) with transmission in the wavelength range exceeding 3,000 nm but not exceeding 25,000 nm and having any of the following:

b.1. Exceeding 100 cm<sup>3</sup> in volume; *or*

b.2. Exceeding 80 mm in diameter or length of major axis and 20 mm in thickness (depth);

c. "Space-qualified" "components" for optical systems, as follows:

c.1. "Components" lightweighted to less than 20% "equivalent density" compared with a solid blank of the same aperture and thickness;

c.2. Raw substrates, processed substrates having surface coatings (single-layer or multi-layer, metallic or dielectric, conducting, semiconducting or insulating) or having protective films;

c.3. Segments or assemblies of mirrors designed to be assembled in space into an optical system with a collecting aperture equivalent to or larger than a single optic 1 m in diameter;

c.4. "Components" manufactured from "composite" materials having a coefficient of linear thermal expansion equal to or less than  $5 \times 10^{-6}$  in any coordinate direction;

d. Optical control equipment as follows:

d.1. Equipment "specially designed" to maintain the surface figure or orientation of the "space-qualified" "components" controlled by 6A004.c.1 or 6A004.c.3;

d.2. Steering, tracking, stabilisation and resonator alignment equipment as follows:

d.2.a. Beam steering mirror stages designed to carry mirrors having diameter or major axis length greater than 50 mm and having all of the following, and specially designed electronic control equipment therefor:

d.2.a.1. A maximum angular travel of  $\pm 26$  mrad or more;

d.2.a.2. A mechanical resonant frequency of 500 Hz or more; *and*

d.2.a.3. An angular "accuracy" of 10  $\mu$ rad (microradians) or less (better);

d.2.b. Resonator alignment equipment having bandwidths equal to or more than 100 Hz and an "accuracy" of 10  $\mu$ rad or less (better);

d.3. Gimbals having all of the following:

d.3.a. A maximum slew exceeding 5°;

d.3.b. A bandwidth of 100 Hz or more;

d.3.c. Angular pointing errors of 200  $\mu$ rad (microradians) or less; *and*

d.3.d. Having any of the following:

d.3.d.1. Exceeding 0.15 m but not exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 2 rad (radians)/s<sup>2</sup>; *or*

d.3.d.2. Exceeding 1 m in diameter or major axis length and capable of angular accelerations exceeding 0.5 rad (radians)/s<sup>2</sup>;

d.4. [Reserved]

e. 'Aspheric optical elements' having all of the following:

e.1. Largest dimension of the optical-aperture greater than 400 mm;

e.2. Surface roughness less than 1 nm (rms) for sampling lengths equal to or greater than 1 mm; *and*

e.3. Coefficient of linear thermal expansion's absolute magnitude less than  $3 \times 10^{-6}$ /K at 25 °C;

#### Technical Note:

1. [See Related Definitions section of this ECCN]

2. Manufacturers are not required to measure the surface roughness listed in 6A004.e.2 unless the optical element was designed or manufactured with the intent to meet, or exceed, the control parameter.

**Note:** 6A004.e does not control 'aspheric optical elements' having any of the following:

a. Largest optical-aperture dimension less than 1 m and focal length to aperture ratio equal to or greater than 4.5:1;

b. Largest optical-aperture dimension equal to or greater than 1 m and focal length to aperture ratio equal to or greater than 7:1;

c. Designed as Fresnel, flyeye, stripe, prism or diffractive optical elements;

d. Fabricated from borosilicate glass having a coefficient of linear thermal expansion greater than  $2.5 \times 10^{-6}$ /K at 25 °C; *or*

e. An x-ray optical element having inner mirror capabilities (*e.g.*, tube-type mirrors).

f. Dynamic wavefront measuring equipment having all of the following:

f.1. 'Frame rates' equal to or more than 1 kHz; *and*

f.2. A wavefront accuracy equal to or less (better) than  $\lambda/20$  at the designed wavelength.

**Technical Note:** For the purposes of 6A004.f, 'frame rate' is a frequency at which all "active pixels" in the "focal plane array" are integrated for recording images projected by the wavefront sensor optics.

■ 51. In supplement no. 1 to part 774, 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

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

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.

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.

#### 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 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 1ps 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 μs 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 μs 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 μs 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 μs 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 50 W/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 6A005.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";

**Technical Note:** "Transfer lasers" are "lasers" in which the lasing species are excited through the transfer of energy by collision of a non-lasing atom or molecule with a lasing atom or molecule species.

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. [Reserved]

**N.B.:** For items previously specified by 6A005.f.1, see 6A004.f.

f.2. "Laser" diagnostic equipment "specially designed" for dynamic measurement of "SHPL" system angular beam steering errors and having an angular "accuracy" of 10 μrad (microradians) or less (better);

f.3. Optical equipment and "components", "specially designed" for coherent beam combination in a phased-array "SHPL" system and having any of the following:

f.3.a. An "accuracy" of 0.1 μm or less, for wavelengths greater than 1 μm; or

f.3.b. An "accuracy" of λ/10 or less (better) at the designed wavelength, for wavelengths equal to or less than 1 μm;

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.

■ 52. In supplement no. 1 to part 774, 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" therefor.**

**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:* \$5,000; 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 ITAR.

*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 scanned array antennae;

**Technical Note:** Electronically scanned array antennae are also known as electronically steerable array antennae.

- 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) = ±√(a<sup>2</sup> + (b \* d)<sup>2</sup>) 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.'

**Technical Note:** 'Automatic target tracking' is a processing technique that automatically determines and provides as output an extrapolated value of the most probable position of the target in real time.

- 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.

**Technical Note:** Sensors are considered 'geographically dispersed' when each location is distant from any other more than 1,500 m in any direction. Mobile sensors are

always considered 'geographically dispersed'.

**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".

■ 53. In supplement no. 1 to part 774, Category 6, ECCN 6A203 is revised to read as follows:

**6A203 High-speed cameras, imaging devices and "components" therefor, other than those controlled by 6A003 (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NP applies to entire entry.	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:* (1) See ECCNs 6E001 ("development"), 6E002 ("production"), and 6E201 ("use") for technology for items controlled under this entry. (2) Also see ECCN 6A003.a.3, and a.4.

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

- a. Streak cameras and "specially designed" components therefor, as follows:
  - a.1. Streak cameras with writing speeds greater than 0.5 mm/μs;
  - a.2. Electronic streak cameras capable of 50 ns or less time resolution;
  - a.3. Streak tubes for cameras described in 6A203.a.2;
  - a.4. Plug-ins, "specially designed" for use with streak cameras having modular structures, that enable the performance characteristics described in 6A203.a.1 or .a.2;
  - a.5. Synchronizing electronics units, and rotor assemblies consisting of turbines, mirrors and bearings, that are "specially designed" for cameras described in 6A203.a.1.
- b. Framing cameras and "specially designed" components therefor, as follows:
  - b.1. Framing cameras with recording rates greater than 225,000 frames per second;
  - b.2. Framing cameras capable of 50 ns or less frame exposure time;
  - b.3. Framing tubes, and solid-state imaging devices, that have a fast image gating

- (shutter) time of 50 ns or less and are "specially designed" for cameras described in 6A203.b.1 or .b.2;
- b.4. Plug-ins, "specially designed" for use with framing cameras having modular structures, that enable the performance characteristics described in 6A203.b.1 or .b.2;
- b.5. Synchronizing electronic units, and rotor assemblies consisting of turbines, mirrors and bearings, that are "specially designed" for cameras described in 6A203.b.1 or .b.2.
- c. Solid-state or electron tube cameras and "specially designed" components therefor, as follows:
  - c.1. Solid-state cameras, or electron tube cameras, with a fast image gating (shutter) time of 50 ns or less;
  - c.2. Solid-state imaging devices, and image intensifiers tubes, that have a fast image gating (shutter) time of 50 ns or less and are "specially designed" for cameras described in 6A203.c.1;
  - c.3. Electro-optical shuttering devices (Kerr or Pockels cells) with a fast image gating (shutter) time of 50 ns or less;
  - c.4. Plug-ins, "specially designed" for use with cameras having modular structures, that enable the performance characteristics described in 6A203.c.1.

**Technical Note:** High speed single frame cameras can be used alone to produce a single image of a dynamic event, or several such cameras can be combined in a sequentially-triggered system to produce multiple images of an event.

d. Radiation-hardened TV cameras, or lenses therefor, "specially designed" or rated as radiation hardened to withstand a total radiation dose greater than 5 × 10<sup>4</sup> Gy (silicon) without operational degradation.

**Technical Note:** The term Gy (silicon) refers to the energy in Joules per kilogram absorbed by an unshielded silicon sample when exposed to ionizing radiation.

- 54. In supplement no. 1 to part 774, Category 6, ECCN 6A990 is removed.
- 55. In supplement no. 1 to part 774, 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 having all of the following:

h.2.a. "Specially designed" to protect the "electronically scanned array antennae" specified 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.

■ 56. In supplement no. 1 to part 774, Category 6, ECCN 6D991 is revised to read as follows:

**6D991 "Software," n.e.s., "specially designed" for the "development", "production", or "use" of commodities controlled by 6A002, 6A003, 6A991, 6A996, 6A997, or 6A998.**

**License Requirements**

*Reason for Control:* RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
RS applies to "software" for commodities controlled by 6A002, 6A003, or 6A998.b.	RS Column 1
RS applies to "software" for commodities controlled by 6A998.c.	RS Column 2
AT applies to entire entry, except "software" for commodities controlled by 6A991.	AT Column 1
AT applies to "software" for commodities controlled by 6A991.	AT Column 2

**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:* (1) See ECCN 6D002 for "software" "specially designed" for the "use" of commodities controlled under ECCN 6A002.b. (2) See ECCN 6D003.c for "software" "specially designed" for cameras incorporating "focal plane arrays" specified by 6A002.a.3.f and "specially designed" to remove a frame rate restriction and allow the camera to exceed the frame rate specified in 6A003.b.4 Note 3.a.

*Related Definitions:* N/A

*Items:*

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

■ 57. In supplement no. 1 to part 774, Category 6, ECCN 6E001 is revised to read as follows:

**6E001 "Technology" according to the General Technology Note for the "development" of equipment, materials or "software" controlled by 6A (except 6A991, 6A992, 6A994, 6A995, 6A996, 6A997, 6A998, or 6A999.c), 6B (except 6B995), 6C (except 6C992 or 6C994), or 6D (except 6D991, 6D992, or 6D993).**

**License Requirements**

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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to "technology" for items controlled by 6A001 to 6A008, 6B004 to 6B008, 6C002 to 6C005, or 6D001 to 6D003.	NS Column 1
MT applies to "technology" for items controlled by 6A002, 6A007, 6A008, 6A102, 6A107, 6A108, 6B008, 6B108, 6D001, 6D002, 6D102 or 6D103 for MT reasons.	MT Column 1
NP applies to "technology" for items controlled by 6A003, 6A005, 6A202, 6A203, 6A205, 6A225, 6A226, 6D001, or 6D201 for NP reasons.	NP Column 1
RS applies to "technology" for items controlled by 6A002.a.1, .a.2, .a.3, .c, or .f, 6A003.b.3 or .b.4, or 6A008.j.1.	RS Column 1

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
CC applies to "technology" for equipment controlled by 6A002 for CC reasons.	CC Column 1
AT applies to entire entry.	AT Column 1
UN applies to "technology" for equipment controlled by 6A002 or 6A003 for UN reasons.	See § 746.1(b) of the EAR for UN controls

**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; (2) "Technology" for commodities controlled by 6A002, 6A004.e or 6A008.j.1; (3) "Technology" for 6A003 cameras, unless for "technology" for the integration of 6A003 cameras into camera systems "specially designed" for civil automotive applications; (4) "Technology" for "software" "specially designed" for "space qualified" "laser" radar or Light Detection and Ranging (LIDAR) equipment defined in 6A008.j.1 and controlled by 6D001 or 6D002; or (5) 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" for the "development" of the following: (a) Items controlled by 6A001.a.1.b, 6A001.a.1.e, 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.3, 6A001.a.2.a.5, 6A001.a.2.a.6, 6A001.a.2.b, 6A001.a.2.d, 6A001.a.2.e, 6A004.c, 6A004.d, 6A006.a.2, 6A006.c.1, 6A006.d, 6A006.e, 6A008.d, 6A008.h, 6A008.k, 6B008, or 6D003.a; (b) Equipment controlled by 6A001.a.2.c or 6A001.a.2.f when "specially designed" for real time applications; or (c) "Software" controlled by 6D001 and "specially designed" for the "development" or "production" of equipment controlled by 6B008, or 6D003.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) Technical data directly related to satellites and all other items described in USML Category XV are subject to the ITAR under USML Category XV(f). (2) Technical data directly related to laser systems, infrared imaging systems, and all other items described in USML Category XII are subject to the ITAR under USML Category XII(f). (3) Technical data

directly related to read-out integrated circuits described in USML Categories XII(e) or XV(e)(3) is subject to the ITAR under USML Categories XII(f) or XV(f), respectively. (4) See also 6E101, 6E201, and 6E991.

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

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

■ 58. In supplement no. 1 to part 774, Category 6, ECCN 6E002 is revised to read as follows:

**6E002 “Technology” according to the General Technology Note for the “production” of equipment or materials controlled by 6A (except 6A991, 6A992, 6A994, 6A995, 6A996, 6A997, 6A998 or 6A999.c), 6B (except 6B995) or 6C (except 6C992 or 6C994).**

**License Requirements**

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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to “technology” for equipment controlled by 6A001 to 6A008, 6B004 to 6B008, or 6C002 to 6C005.	NS Column 1
MT applies to “technology” for equipment controlled by 6A002, 6A007, 6A008, 6A102, 6A107, 6A108, 6B008, or 6B108 for MT reasons.	MT Column 1
NP applies to “technology” for items controlled by 6A003, 6A005, 6A202, 6A203, 6A205, 6A225 or 6A226 for NP reasons.	NP Column 1
RS applies to “technology” for items controlled by 6A002.a.1, .a.2, .a.3, .c, or .f, 6A003.b.3 or .b.4, or 6A008.j.1.	RS Column 1
CC applies to “technology” for equipment controlled by 6A002 for CC reasons.	CC Column 1
AT applies to entire entry.	AT Column 1
UN applies to “technology” for equipment controlled by 6A002 or 6A003 for UN reasons.	See § 746.1(b) of the EAR for UN controls

**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;
- (2) “Technology” for commodities controlled by 6A002, 6A004.e, or 6A008.j.1;
- (3) “Technology” for 6A003 cameras, unless for “technology” for the integration of 6A003 cameras into camera systems “specially designed” for civil automotive applications; or
- (4) 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” for the “production” of the following: (a) Items controlled by 6A001.a.1.b, 6A001.a.1.e, 6A001.a.2.a.1, 6A001.a.2.a.2, 6A001.a.2.a.3, 6A001.a.2.a.5, 6A001.a.2.a.6, 6A001.a.2.b, 6A004.c, 6A004.d, 6A006.a.2, 6A006.c.1, 6A006.d, 6A006.e, 6A008.d, 6A008.h, 6A008.k, or 6B008; and (b) Items controlled by 6A001.a.2.c or 6A001.a.2.f when “specially designed” for real time applications.

**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 “production” of equipment specified in the STA exclusion paragraphs found in the License Exception sections of by ECCNs 6A001, 6A002, 6A003, 6A004, 6A006, 6A008, or 6B008 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) Technical data directly related to satellites and all other items described in USML Category XV are subject to the ITAR under USML Category XV(f). (2) Technical data directly related to laser systems, infrared imaging systems, and all other items described in USML Category XII are subject to the ITAR under USML Category XII(f). (3) Technical data directly related to read-out integrated circuits described in USML Categories XII(e) or XV(e)(3) is subject to the ITAR under USML Categories XII(f) or XV(f), respectively. (4) See also 6E992.

*Related Definitions:* N/A

*Items:*

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

■ 59. In supplement no. 1 to part 774, Category 6, ECCN 6E201 is revised to read as follows:

**6E201 “Technology” according to the General Technology Note for the “use” of equipment controlled by 6A003.a.3, 6A003.a.4; 6A005.a.2, 6A005.b.2.b, 6A005.b.3, 6A005.b.4.b.2, 6A005.b.6.c, 6A005.c.1.b, 6A005.c.2.b, 6A005.d.2, 6A005.d.3.c, or 6A005.d.4.c (that meet or exceed the parameters of 6A205); 6A202, 6A203, 6A205, 6A225 or 6A226.**

**License Requirements**

*Reason for Control:* NP, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NP applies to entire entry.	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)**

*CIV:* N/A

*TSR:* N/A

**List of Items Controlled**

*Related Controls:* N/A

*Related Definitions:* N/A

*ECCN Controls:* This entry only controls “technology” for “lasers” in 6A005 that are controlled for NP reasons.

*Items:*

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

■ 60. In supplement no. 1 to part 774, Category 6, ECCN 6E990 is removed.

■ 61. In supplement no. 1 to part 774, Category 7, ECCN 7A006 is revised to read as follows:

**7A006 Airborne altimeters operating at frequencies other than 4.2 to 4.4 GHz inclusive and 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 commodities in this entry that meet or exceed the parameters of 7A106.	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 7A106, 7A994 and Category 6 for controls on radar.

*Related Definitions:* N/A

*Items:*

a. ‘Power management’; or

**Technical Note:** ‘Power management’ is changing the transmitted power of the altimeter signal so that received power at the “aircraft” altitude is always at the minimum necessary to determine the altitude.

b. Using phase shift key modulation.

■ 62. In supplement no. 1 to part 774, 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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 1
MT applies to “technology” for 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”;

**Technical Note:** ‘Primary flight control’ is “aircraft” stability or manoeuvring control

using force/moment generators, *i.e.* aerodynamic control surfaces or propulsive thrust vectoring.

- a.6. ‘Flight control optical sensor array’ “specially designed” for implementing “active flight control systems”; or

**Technical Note:** A ‘flight control optical sensor array’ is a network of distributed optical sensors, using “laser” beams, to provide real-time flight control data for on-board processing.

- 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.

**Technical Note:** ‘Flight path optimization’ is a procedure that minimizes deviations from a four-dimensional (space and time) desired trajectory based on maximizing performance or effectiveness for mission tasks.

- 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.

**Technical Note:** ‘Variable geometry airfoils’ use trailing edge flaps or tabs, or leading edge slats or pivoted nose droop, the position of which can be controlled in flight.

■ 63. In supplement no. 1 to part 774, Category 9, ECCN 9A002 is revised to read as follows:

**9A002 ‘Marine gas turbine engines’ designed to use liquid fuel and having all of the following (see List of Items Controlled), and “specially designed” assemblies and “components” therefor.**

**License Requirements**

*Reason for Control:* NS, AT

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

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

LVS: \$5,000  
GBS: N/A  
CIV: N/A

**List of Items Controlled:**

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

a. Maximum continuous power when operating in “steady state mode” at standard reference conditions specified by ISO 3977–2:1997 (or national equivalent) of 24,245 kW or more; and

b. ‘Corrected specific fuel consumption’ not exceeding 0.219 kg/kWh at 35% of the maximum continuous power when using liquid fuel.

**Note:** The term ‘marine gas turbine engines’ includes those industrial, or aero-derivative, gas turbine engines adapted for a ship’s electric power generation or propulsion.

**Technical Note:** For the purposes of 9A002, ‘corrected specific fuel consumption’ is the specific fuel consumption of the engine corrected to a marine distillate liquid fuel having a net specific energy (*i.e.*, net heating value) of 42 MJ/kg (ISO 3977–2:1997).

■ 64. In supplement no. 1 to part 774, 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 “specially designed” for any of the following data processing functions:

f.1.a. Telemetry data processing of frame synchronization and error corrections, for monitoring of operational status (also known as health and safe status) of the “spacecraft bus”; or

f.1.b. Command data processing for formatting command data being sent to the “spacecraft” to control the “spacecraft bus”;

f.2. Simulators “specially designed” for ‘verification of operational procedures’ of “spacecraft”.

**Technical Note:** For the purposes of 9A004.f.2, ‘verification of operational procedures’ is any of the following:

- 1. Command sequence confirmation;
  - 2. Operational training;
  - 3. Operational rehearsals; or
  - 4. Operational analysis.
- 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) of the EAR as warranting control in 9A004.y.

■ 65. In supplement no. 1 to part 774, Category 9, ECCN 9D001 is revised to read as follows:

**9D001 “Software”, not specified in 9D003 or 9D004, “specially designed” or modified for the “development” of equipment or “technology” controlled by ECCN 9A001 to 9A004, 9A012, 9A101 (except for items in 9A101.b that are “subject to the ITAR”, see 22 CFR part 121), 9A106.d. or .e, 9A110, or 9A120, 9B (except for ECCNs 9B604, 9B610, 9B619, 9B990, and 9B991), or ECCN 9E003.**

**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 “software” for equipment controlled by 9A001 to 9A004, 9A012, 9B001 to 9B010, and technology controlled by 9E003.	NS Column 1
MT applies to “software” for equipment controlled by 9B116 for MT reasons.	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” “specially designed” or modified for the “development” of equipment or “technology”, specified by ECCNs 9B001.b. or 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:* “Software” that is “required” for the “development” of items specified in ECCNs 9A005 to 9A011, 9A101.b (except for items that are subject to the EAR), 9A103 to 9A105, 9A106.a, .b, and .c, 9A107 to 9A109, 9A110 (for items that are “specially designed” for use in missile systems and subsystems), and 9A111 to 9A119 is “subject to the ITAR”.

*Related Definitions:* N/A

*Items:*

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

■ 66. In supplement no. 1 to part 774, Category 9, ECCN 9D002 is revised to read as follows:

**9D002 “Software”, not specified in 9D003 or 9D004, “specially designed” or modified for the “production” of equipment controlled by ECCN 9A001 to 9A004, 9A012, 9A101 (except for items in 9A101.b that are “subject to the ITAR”, see 22 CFR part 121), 9A106.d or .e, 9A110, or 9A120, 9B (except for ECCNs 9B604, 9B610, 9B619, 9B990, and 9B991).**

**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 “software” for equipment controlled by 9A001 to 9A004, 9A012, 9B001 to 9B010.	NS Column 1
MT applies to “software” for equipment controlled by 9B116 for MT reasons.	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” “specially designed” or modified for the “production” of equipment specified by 9B001.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:* “Software” that is “required” for the “production” of items specified in ECCNs 9A005 to 9A011,

9A101.b (except for items that are subject to the EAR), 9A103 to 9A105, 9A106.a, .b, and .c, 9A107 to 9A109, 9A110 (for items that are “specially designed” for use in missile systems and subsystems), and 9A111 to 9A119 is “subject to the ITAR”.

*Related Definitions:* N/A

*Items:*

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

■ 67. In supplement no. 1 to part 774, Category 9, ECCN 9D004 is revised to read as follows:

**9D004 Other “software” 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:* N/A.

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship or transmit software in 9D004.a and 9D004.c 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 9D104.

*Related Definitions:* N/A

*Items:*

a. 2D or 3D viscous “software”, validated with wind tunnel or flight test data required for detailed engine flow modelling;

b. “Software” for testing aero gas turbine engines, assemblies, “parts” or “components”, having all of the following:

b.1. “Specially designed” for testing any of the following:

b.1.a. Aero gas turbine engines, assemblies or components, incorporating “technology” specified by 9E003.a, 9E003.h or 9E003.i; or

b.1.b. Multi-stage compressors providing either bypass or core flow, specially designed for aero gas turbine engines incorporating “technology” specified by 9E003.a or 9E003.h; and

b.2. “Specially designed” for all of the following:

a. Acquisition and processing of data, in real time; and

b. Feedback control of the test article or test conditions (e.g., temperature, pressure, flow rate) while the test is in progress;

**Note:** 9D004.b does not specify software for operation of the test facility or operator safety (e.g., overspeed shutdown, fire detection and suppression), or production, repair or maintenance acceptance-testing limited to determining if the item has been properly assembled or repaired.

c. “Software” “specially designed” to control directional solidification or single crystal material growth in equipment specified by 9B001.a or 9B001.c;

d. [Reserved]

e. “Software” “specially designed” or modified for the operation of items specified by 9A012;

f. “Software” “specially designed” to design the internal cooling passages of aero gas turbine engine blades, vanes and “tip shrouds”;

g. “Software” having all of the following:

g.1. “Specially designed” to predict aero thermal, aeromechanical and combustion conditions in aero gas turbine engines; and

g.2. Theoretical modeling predictions of the aero thermal, aeromechanical and combustion conditions, which have been validated with actual turbine engine (experimental or production) performance data.

■ 68. In supplement no. 1 to part 774, 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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
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 Note:** '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.

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. Methods for manufacturing holes in 9E003.c include "laser" beam machining, water jet machining, Electro-Chemical Machining (ECM) or Electrical Discharge Machining (EDM).

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 rpm, provided the rated speed is 2,300 rpm 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.

■ 69. In supplement no. 6 to part 774, paragraphs (1) and (2) are revised to read as follows:

**Supplement No. 6 to Part 774— Sensitive List**

\* \* \* \* \*

(1) Category 1

- (i) 1A002.a.1.
- (ii) 1C001.
- (iii) 1C007.c.
- (iv) 1C010.c and .d.
- (v) 1C012.
- (vi) 1D002—"Software" for the "development" of organic "matrix", metal "matrix", or carbon "matrix" laminates or composites controlled under 1A002, 1C007.c, 1C010.c or 1C010.d.
- (vii) 1E001—"Technology" according to the General Technology Note for the "development" or "production" of equipment and materials controlled under 1A002, 1C001, 1C007.c, 1C010.c, 1C010.d, or 1C012.
- (viii) 1E002.e and .f.

(2) Category 2

- (i) 2D001—"Software", other than that controlled by 2D002, "specially designed" for the "development" or "production" of equipment as follows:
    - (A) Specified by 2B001.a, 2B001.b.1, or 2B001.b.2, and having a "unidirectional positioning repeatability" equal to or less (better) than 0.9 µm along one or more linear axis;
    - (B) Specified by 2B001.b.3, 2B001.d, 2B001.f or 2B003.
  - (ii) 2E001—"Technology" according to the General Technology Note for the "development" of equipment or "software", as follows:
    - (A) Equipment specified by 2B001.a, 2B001.b.1 or 2B001.b.2, and having a "unidirectional positioning repeatability" equal to or less (better) than 0.9 µm along one or more linear axis;
    - (B) Equipment specified by 2B001.b.3, 2B001.d, 2B001.f or 2B003.
    - (C) "Software" specified by 2D001 of this Supplement;
    - (iii) 2E002—"Technology" according to the General Technology Note for the "production" of equipment as follows:
      - (A) Specified by 2B001.a, 2B001.b.1, or 2B001.b.2, and having a "unidirectional positioning repeatability" equal to or less (better) than 0.9 µm along one or more linear axis;
      - (B) Specified by 2B001.b.3, 2B001.d, 2B001.f or 2B003.
- \* \* \* \* \*

■ 70. Supplement no. 7 to part 774 is amended by:

- a. Revising paragraph (1)(i); and
- b. Removing the phrase "user accessible programmability" and adding in its place "user-accessible programmability" in paragraphs (3)(iv) and (vi).

The revision reads as follows:

**Supplement No. 7 to Part 774—Very Sensitive List**

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(1) \* \* \*

(i) 1A002.a.1.

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Dated: October 4, 2018.

**Richard E. Ashooh,**  
*Assistant Secretary for Export Administration.*

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