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**DEPARTMENT OF COMMERCE**

**Bureau of Industry and Security**

**15 CFR Parts 743, 772, and 774**

**[Docket No. 200717-0194]**

**RIN 0694-AH77**

# Wassenaar Arrangement 2018 Plenary Decisions Implementation; and other Revisions Related to National Security Controls

**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 and other corresponding parts of the EAR, to implement changes made to the Wassenaar Arrangement List of Dual-Use Goods and Technologies and Munitions List (WA Lists) maintained by the 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 2018 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. BIS published a final rule on May 23, 2019, implementing certain new controls on emerging technologies, as decided at the 2018 Plenary meeting. This rule harmonizes the CCL with the remaining decisions reached at the 2018 Plenary meeting by revising Export Control Classification Numbers (ECCNs) controlled for national security reasons in each category of the CCL, except Category 4. This rule also makes other associated changes to the EAR, as well as adjustments to license exception eligibility for national security-controlled items and revisions to reporting requirements.

**DATES:** This rule is effective **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

**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 e-mail: Sharron.Cook@bis.doc.gov.

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**SUPPLEMENTARY INFORMATION:**

**Background**

The Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies (Wassenaar or WA) (https://www.wassenaar.org) is a group of 42 like-minded Participating States committed to promoting transparency and greater responsibility in transfers of conventional arms and dual-use goods and technologies, thus preventing destabilizing accumulations of those items. As a Participating State, the United States has committed to controlling for export all items on the WA Lists. The lists were first established in

1996 and have been revised annually thereafter. Proposals for changes to the WA Lists that achieve consensus are approved by Participating States at annual plenary meetings. Participating States are charged with implementing the list changes as soon as possible after approval. The United States' implementation of changes to the WA Lists ensures U.S. companies have a level playing field with competitors in other WA Participating States.

By a final rule published on May 23, 2019 (84 FR 23886), BIS implemented changes decided at the December 2018 Plenary Meeting concerning five emerging technologies essential to the national security of the United States, specifically, discrete microwave transistors, continuity of operation software, post-quantum cryptography, underwater transducers designed to operate as hydrophones, and air-launch platforms. The changes in this rule, which reflect the remaining changes to the WA Lists that were approved at the December 2018 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 ECCNs in the Commerce Control List to Implement WA 2018 Plenary Decisions**

Following are lists of the ECCNs in the CCL that are revised or added by this rule in order to implement the WA 2018 Plenary decisions. Each change is further described below, by category.

**Revisions to (28) ECCNs**: 0A617, 1C001, 2A001, 2B003, 2B006, 3A001, 3A002, 3B001, 3E003, 5E001, 5A002, 5D002, 5E002, 5E992, 6A003, 6A005, 7A002, 7A003, 7A005, 7D003, 7D005, 8A001, 8A002, 8B001, 9A010, 9A610, 9B001, and 9E003.

**License Exception Revisions to ECCNs**: 1C004: GBS; 8A001: LVS, STA; 8D001: TSR, STA; 8E001: TSR, STA.

**New ECCNs:** 6B002 (masks and reticles for optical sensors specified in 6A002.a.1.b or 6A002.a.1.d).

**Conforming Changes to Eight ECCNs**: 0A606, 1A008, 3A991, 6A002, 6E001, 6E002, 8D001, 8E001.

**CATEGORY 0 - Nuclear Materials, Facilities, and Equipment [and Miscellaneous Items]**

**0A606 Ground vehicles and related commodities**

WA decided to change the phrase "other than those specified by …" to "not specified by" as the more concise and consistent way, within the WA List, to indicate that items in an entry are controlled by that entry only if not controlled elsewhere. A similar phrase is used in 0A606.y.8 and is therefore changed for consistency (i.e., "other than those controlled by…" is changed to "not controlled by …").

**0A617 Miscellaneous "equipment," materials, and related commodities**

For reasons explained above in the description of changes to ECCN 0A606, the phrase "other than those described in" is changed to read "not described in" in 0A617.c.

**Category 1 Special Materials and Related Equipment, Chemicals, "Microorganisms", and "Toxins"**

**1A004 Protective and detection equipment and "components," not "specially designed" for military use**

ECCN 1A004 is amended by adding License Exception GBS eligibility for 1A004.a, .b, and .c.2, because these items have a long history of approvals and are deemed not "sensitive" by the WA. In 2018, there were over 800 license applications with 796 approvals. There were two denials for 1A004.d that also would not have qualified under the License Exception GBS eligibility paragraph that is implemented by this rule. The addition of License Exception GBS eligibility for 1A004.a, .b, and .c.2 is estimated to alleviate the need for preparing and processing 200 license applications annually, thus alleviating the burden on reviewing agencies as well as private industry.

**1A008 Charges, devices and "components"**

For reasons explained in the description of changes to ECCN 0A606, the phrase "other than those specified by…" is revised to read "not specified by …" in 1A008.d. This is changed for consistent treatment of this phrase throughout the CCL.

**1C001 Materials "specially designed" for absorbing electromagnetic radiation, or intrinsically conductive polymers**

This rule amends ECCN 1C001 by adding paragraph e. (specified planar absorbers) to exclusion Note 1, which is located after the introductory Items paragraph a, as well as a Technical Note to define the term "open-cell foams".

**ANNEX to Category 1, "List of Explosives (See ECCNs 1A004 and 1A008)"**

In the List of Explosives that is in the Annex to Category 1, “FOX 7” is corrected by adding a hyphen (“FOX-7”) in paragraph 6 in order to make it consistent with the “FOX-12” in item 46 of this Annex.

**Category 2 - Materials Processing**

**2A001 Anti-friction bearings and bearing systems**

The ISO citation reference in Note 2, located at the top of the Items paragraph, is being clarified by changing it from “ISO 3290 as grade 5” to read “ISO 3290:2001 as grade G5” in order to assist the public to find the correct standard by its citation and year of the standard to use for classification purposes. In Items paragraph .a (ball bearings and solid roller bearings), the phrase “or Class 2” is added to the ISO 492 tolerance class reference to clarify which tolerance class is required to satisfy 2A001.

**2B003 “Numerically controlled” machine tools**

The Heading is amended by deleting the words “or manual” and moving much of the text to the Items paragraph of the List of Items Controlled in order to more clearly state the control text. With this change, there will be three subparagraphs that list separate control parameters previously listed in the Heading.

**2B006 Dimensional inspection or measuring systems, equipment, position feedback units and “electronic assemblies”**

Item paragraph b.1 is amended to replace “a measuring range up to 0.2mm” with “0 to 0.2 mm of the ‘measuring range’” and adding Technical Note 2 to define ‘measuring range’. The

new text will clarify that for purposes of paragraph b.1 ”measuring range” means the difference between the minimum and maximum working distance of the probe, and that the measuring range always starts from 0mm. This revision does not change the scope of control for this entry and clarifies the intent of this control.

**The Technical Note to the Table on Deposition Techniques in Category 2**

This rule corrects the punctuation of paragraph b.4 by replacing the comma with a semi-colon.

**Category 3 – Electronics**

**Product Group A. “End items”, “equipment”, “accessories”, “attachments”, “parts”, “components”, and “systems”**

The N.B. at the beginning of Category 3, Product Group A, is amended by adding an “or” and replacing an “or” with “to” in order to harmonize the text with the WA List. In addition, Note 3 is added to alert the public to look in specified paragraphs of Category 3 for the classification of wafers (finished or unfinished). Exporters should now understand by reading the note that these wafers are to be evaluated against the control metric, as if they were finished.

**3A001 Electronic items**

In the license exception section, under the License Exception GBS paragraph, this rule replaces the term “vacuum electronic device amplifiers” with “vacuum electronic devices” to reflect the correct name of the devices. This term is also added to part 772 “Definitions of Terms Used in the EAR”.

Note 1 under 3A001.a is removed, because the note has been expanded and placed as Note 3 at the beginning of Category 3, Product Group A. Note 2 under 3A001.a is now designated as Note 1.

The Note under Item paragraph 3A001.a.2.c is amended by adding the word "designed", which narrows the decontrol note to apply only to integrated circuits of 3A001.a.2 that are designed for civil automobile or railway train applications.

The parameters for digital-to-analog converters (DAC) in 3A001.a.5.b are amended by revising 3A001.a.5.b.1 and 3A001.a.5.b.2 to fix the overlapping controls between the two subparagraphs. Specifically, "but less than 12-bit" is added to Item paragraph a.5.b.1, "but not exceeding 3,500 MSPS" is added to Item paragraph a.5.b.2, and a new subparagraph a.5.b.2.b is added to read "An 'adjusted update rate' exceeding 3,500 MSPS."

Technical Note 2, located below the introductory text of Item paragraph .b, is removed because the definition of "vacuum electronic devices" is moved to part 772 "Definitions of Terms Used in the EAR". As a result of this change, all of the single quotes around this term found in 3A001, 3A991.g, 3E003.g are replaced with double quotes to indicate it is a defined term located in part 772.

**3A002 General purpose "electronic assemblies", modules and equipment**

Item paragraph a.6.b is amended by replacing the phrase "A processor that performs analysis of the radio frequency signal data while it is being recorded" with ""Signal processing" of the radio frequency signal data while it is being recorded;". Including the defined term "signal processing," the definition of which is found in Part 772, more clearly sets out details of the processing done to the data.

Item paragraph 3A002.d.5 "maximum frequency exceeding 90 GHz" is re-designated as Item paragraph 3A002.d.6. New Item paragraph d.5 adds a control parameter for signal generators having the ability of frequency switching by means of a 'Radio Frequency (RF) modulation bandwidth' of digital baseband signals within specified frequency ranges. Three subparagraphs are added (subparagraphs d.5.a through d.5.c) to specify bandwidth and frequency ranges. Also, a Technical Note is added to define 'RF modulation bandwidth'. Signal generators meeting any of the parameters in 3A002.d.5 are subject to national security controls to countries in NS column 2 of the Commerce Country Chart (see supplement no. 1 to part 738 of the EAR) and anti-terrorism controls to countries in AT column 1 of the Commerce Country Chart, as well as any end use or end user controls in part 744 of the EAR. As indicated in the license exception section of this ECCN, this paragraph is eligible for License Exception LVS ($5,000) if all the criteria for this license exception are met and none of the license exception restrictions in § 740.2 apply (see part 740 of the EAR). Transaction-based license exceptions may also be available (see part 740 of the EAR). Use of license exceptions and Validated End-user authorizations for this item may be subject to Wassenaar reporting requirements in § 743.1 of the EAR.

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

The single quotes around the term "vacuum electronic devices" in 3A991.g are replaced with double quotes to indicate the term is defined in part 772. See above explanation under ECCN 3A001.

**3B001 Equipment for the manufacturing of semiconductor devices or materials**

Item paragraph 3B001.h "multi-layer masks" is amended by removing subparagraph h.1 (parameter of the substrate blank composition) and merging subparagraph h.2 with Item paragraph .h in order to focus the control solely on the lithography equipment wavelength.

**3E003 Other "technology" for the "development" or "production" of specified electronics.**

The single quotes around the term "vacuum electronic devices" in 3E003.g are replaced with double quotes to indicate the term is defined in part 772. See above explanation under ECCN 3A001.

**Category 5 - Part 1 – "Telecommunications"**

**5E001 "Technology"**

This final rule makes an editorial revision in paragraph d.4 by removing two unnecessary spaces, so that the text reads "0.1 nW".

**Category 5 – Part 2 – "Information Security"**

**5A002 "Information security" systems, equipment and "components"**

The Related Control Note 3 is amended by replacing the term "Global Navigation Satellite Systems (GNSS)" with the EAR defined term "satellite navigation system," which includes Global Navigation Satellite Systems (GNSS) and Regional Navigation Satellite Systems (RNSS), see part 772.

Exclusion Note 2 of 5A002 is amended by adding a new paragraph j. that lists "items specially designed for a 'connected civil industry application'". Paragraph j. also includes 2 Technical Notes that define 'connected civil industry application' and 'non-arbitrary data'.

Paragraph 5A002.b is amended by replacing the existing text with "Being a 'cryptographic

activation token', *i.e.,* "information security" systems, equipment and "components," that are 'cryptographic activation tokens' are controlled. A Technical Note is included to explain more about converting by means of "cryptographic activation" and enabling by means of "cryptographic activation".

**5D002 "Software"**

Paragraph 5D002.b is amended by replacing a large portion of the text with "having the characteristics of a 'cryptographic activation token' specified by 5A002.b" to simplify the text and for consistency.

**5E002 "Technology"**

Paragraph 5E002.b is amended by replacing a large portion of the text with the phrase "having the characteristics of a 'cryptographic activation token' specified by 5A002.b" to simplify the text and for consistency.

**Category 6 - Sensors and Lasers**

**6A002 Optical sensors and equipment, and "components" therefor**

The Related Controls paragraph is amended by adding a seventh Note to refer to new ECCN 6B002 for masks and reticles that are "specially designed" for optical sensors specified by 6A002.a.1.b or 6A002.a.1.d.

**6A003 Cameras, systems or equipment, and "components" therefor**

In Note 3 to 6A003.b.4.b, located under 6A003.b.4.c, paragraph b.1 is amended by revising the exclusion parameter for imaging cameras with minimum horizontal or vertical 'Instantaneous-Field-of View (IFOV)' of "at least 10 mrad (milliradians)" to "at least 2 mrad (milliradians)". This change is an update to the parameter to address increased civilian use of imaging cameras with IFOV of at least 2 mrad.

**6A005 "Lasers," "components" and optical equipment**

The terms 'single transverse mode' and 'multiple transverse mode' are not defined in 6A005, but are used to distinguish between parameters for control. This rule adds Note 6 to 6A005 to define these terms using easily identifiable and measurable characteristics of lasers in order for the laser controls to be applied consistently. Therefore, single quotes are added around each of these terms throughout 6A005 to indicate these terms are defined within a Note in 6A005.

Paragraph 6A005.a.6.a is amended by adding a spectral bandwidth parameter for the control of single transverse mode non-tunable continuous wave lasers. This change is being made because the simplest way to characterize scalability of a laser is to specify the laser linewidth, which is essentially a measure of the spectral purity of the laser.

Paragraph 6A005.a.6.b.1 is amended by raising the output power from 500 W to 1000 W because the market for these single-mode lasers has matured substantially in recent years, resulting in increased demand for higher power and beam quality. Also, the lasers with lower power and beam quality have become more available in countries outside the WA membership.

Exclusion Note 2 to 6A005.a.6.b is amended by removing and reserving paragraph a., which stated "having to do with output power exceeding 500 W but not exceeding 1 kW and all of the following: Beam Parameter Product (BPP) exceeding 0.7 mm•mrad." The associated Technical Note to paragraph a. is also removed. In addition, paragraph e. of the Note is amended by raising the upper limit of the output power range from 4 kW to 6 kW, in order to narrow the controls of solid state lasers to the performance of lasers that are available from outside the WA countries. Paragraphs f. and g. of the Note are removed and reserved because of technological advancement of multiple transverse mode industrial lasers.

**6B002 Masks and reticles, "specially designed" for optical sensors specified by 6A002.a.1.b or 6A002.a.1.d**

Masks and reticles are process tools for electronics components from which the design can be inferred. Masks and reticles are already controlled for integrated circuits in Category 3, under ECCN 3B001.g, when they are designed for circuits specified in 3A001. 6B002 is added to the CCL to control masks and reticles for optical sensors specified in 6A002.a.1.b or 6A002.a.1.d because the inferred design of these masks and reticles would allow the reproduction and/or the retro-engineering of such circuits. ECCN 6B002 items require a license for national security reasons for all countries that have an "X" under NS Column 2 and for anti-terrorism reasons for all countries that have an "X" under AT Column 1 on the Commerce Country Chart in supplement no. 1 to part 738. Adding masks and reticles to ECCN 6B002 will ensure they are controlled to these sensitive destinations.

As indicated under the list-based license exception section of ECCN 6B002, these items are eligible for license exceptions LVS ($5000), and GBS, so long as all the criteria of these license

exceptions are met and none of the restrictions of § 740.2 apply. Other license exceptions, e.g., RPL, GOV, and STA, may be available depending on the transaction details and eligibility criteria of the license exceptions in part 740.

**6E001 and 6E002 "Technology"**

The License Requirements tables of ECCN 6E001 and 6E002 have been amended to revise the national security rows in order to add in the new ECCN 6B002. A license is required for "technology" for the "development" and "production" of masks and reticles controlled by 6B002 for national security and anti-terrorism reasons for countries with an "X" in column NS Column 1 or in column AT Column 1 in the Commerce Country Chart in supplement no. 1 to part 738 of the EAR. For technology that has a license requirement, License Exception TSR is available if all the criteria for TSR are met and none of the restrictions of § 740.2 apply. License Exception STA is available if none of the restrictions outlined in ECCN 6E001 or 6E002 apply, all the criteria of STA are met, and none of the restrictions of § 740.2 apply. Other license exceptions in part 740 may also be available depending on the details of the transaction.

**Category 7 - Navigation and Avionics**

**7A002 Gyros or angular rate sensors**

ECCN 7A002 is being amended by removing the parenthetical phrase (see list of items controlled) in the Heading because the list of items controlled section of the ECCN contains a list of characteristics instead of a list of items.

Paragraphs 7A002.a.1 and a.2 are amended by replacing "A rate range" with "An angular

rate range" in order to more accurately describe the parameter that applies to the change rate of angle.

**7A003 'Inertial measurement equipment or systems'**

ECCN 7A003 is amended by removing the parenthetical phrase (see list of items controlled) in the Heading because the list of items controlled section of the ECCN contains a list of characteristics instead of a list of items.

Paragraph a. of the Technical Note at the beginning of the Items paragraph is amended by replacing "Global Navigation Satellite Systems (GNSS)" with "satellite navigation system" in order to clarify that the control applies to all satellite navigation systems, not just those that have global coverage. The term "satellite navigation system" is added to § 772.1, thus the term is in double quotes.

**7A005 "Satellite navigation system" receiving equipment**

ECCN 7A005 is amended by removing the parenthetical phrase (see list of items controlled) in the Heading, because the list of items controlled section of the ECCN contains a list of characteristics instead of a list of items.

The Heading, Related Controls, and the Note below Item paragraph 7A005.b are amended by replacing the term "Global Navigation Satellite Systems (GNSS)" with the newly defined term "satellite navigation system" for reasons stated in the explanation under ECCN 7A003 above.

**7D003 Other "software**

ECCN 7D003.b.2 is amended by replacing the term "Global Navigation Satellite Systems

(GNSS)" with the newly defined term "satellite navigation system" for reasons stated above under ECCN 7A003.

**7D005 "Software" "specially designed" to decrypt "satellite navigation system" ranging signals designed for government use**

The Heading is amended by replacing the term "Global Navigation Satellite Systems (GNSS)" with the newly defined term "satellite navigation system" for reasons stated above under ECCN 7A003.

**Category 8 – Marine**

**8A001 Submersible vehicles and surface vessels**

Paragraph 8A001.c is amended to specify all unmanned submersible vehicles controlled under ECCN 8A001. Unmanned submersible vehicles are moved from 8A001.d to 8A001.c.1, and 8A001.d is reserved. Unmanned tethered submersible vehicles are moved from 8A001.c to 8A001.c.2. The license requirements for the unmanned tethered submersible vehicles is unchanged and is controlled for national security reasons for NS column 2 countries. The License Exception LVS paragraph is amended by revising the reference to 8A001.d to read 8A001.c.1, and maintaining ineligibility for unmanned untethered submersible vehicles in 8A001.c.1.

**8A002 Marine systems, equipment, "parts" and "components"**

Paragraph 8A002.d is amended by cascading the parameters into subparagraphs for clarity. There is no change in the scope of this control by this revision.

**8B001 Water tunnels**

The Heading of 8B001 is amended by replacing "having" with "designed to have", replacing "in the frequency range" with "within the frequency range", and replacing "from 0 to 500 Hz" with "exceeding 0 Hz but not exceeding 500 Hz", in order to make clear that only water tunnels designed to meet these parameters are controlled by this entry and that background noise must be less than 100 dB within the frequency range exceeding 0 Hz, but not exceeding 500 Hz.

**8D001 "Software" "specially designed" or modified for the "development," "production" or "use" of equipment or materials, controlled by 8A (except 8A992), 8B or 8C**

***and***

**8E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials, controlled by 8A (except 8A992), 8B or 8C.**

8D001 and 8E001 are amended by replacing the reference to 8A001.d with 8A001.c.1 in the License Exception TSR eligibility paragraph; and amending the Special Conditions for STA by removing the reference to 8A001.d, because unmanned submersible vehicles are moved from 8A001.d to 8A001.c.1, and 8A001.c is already listed in this paragraph.

**Category 9 - Aerospace and Propulsion**

**9A010 "Specially Designed" "Parts," "Components," Systems and Structures, for Launch**

**Vehicles, Launch Vehicle Propulsion Systems or "Spacecraft"**

Paragraph 9A010.d (pulsed liquid rocket engines) is amended by moving the text within parentheses to a new Technical Note below the paragraph.

**9A610 Military aircraft and related commodities, other than those enumerated in 9A991.a**

Note 2 to 9A610.a, which excludes from 9A610.a 'military aircraft' that were first manufactured before 1946, is amended by adding "or "lighter-than-air vehicles"" after the words 'military aircraft,' because there was no intent to maintain controls on lighter-than-air vehicles from pre-1946, or their components.

**9B001 Manufacturing equipment, tooling or fixtures**

The Heading of 9B001 is amended by adding "manufacturing" to the front and moving the "specially designed for …." phrase to 9B001.b and 9B001.c. Item paragraph 9B001.a (Directional solidification or single crystal casting equipment) is amended by adding the parameter "designed for "superalloys" to narrow the scope of control.

**9E003 Other "technology"**

Paragraph 9E003.a.7 (gas turbine engine "parts" or "components" using "diffusion bonding" "technology" controlled by 2D003.b) is removed and reserved, because it is redundant to other controls for such parts and components. Paragraph 9E003.a.7 is not necessary for several reasons. First, diffusion bonding is a subset of solid-state joining. Second, 9E003.a.6 presently controls diffusion bonding and other solid-state joining techniques when applied to the components of concern, i.e., airfoil-to-disk blade combinations. Third, 9E003.a.1–5 also

presently controls "development" and "production" "technology" for components of concern, regardless of construction method. Fourth, ECCN 1B003 covers the control of tools, dies, molds or fixtures for diffusion bonding of specified alloys in aircraft/aerospace applications, and ECCN 1E001 controls the "technology" "required" for the "development" or "production" of items controlled by ECCN 1B003. All of these other controls cover what was already controlled in paragraph 9E003.a.7, and therefore to end this redundancy, this paragraph is being removed.

**Part 772 – Definitions of terms as used in the Export Administration Regulations (EAR)**

The definition of "cryptography" is amended by adding Note 2 to alert the public that "cryptography" includes decryption.

The definition of "radiant sensitivity" is amended by adding a period to the end of the definition.

The definition of "satellite navigation system" is added to § 772.1 in order to clarify that the term applies to all satellite navigation systems, not just those that have global coverage.

The definition of "stability" is amended by revising the Note to the definition to add accelerometers. The term "stability" is used in ECCN 7A001 (accelerometers), specifically in 7A001.a.1.a and a.1.b.

The definition of "vacuum electronic devices" is added to § 772.1. The term was defined in Technical Note 2 under 3A001.b, however, because it is used in two separate ECCNs 3A001.b.1 and 3E003, the definition is removed from 3A001 and added (unchanged) to § 772.1.

**Supplement No. 6 to part 774 "Sensitive List"**

Paragraph (3) is amended by re-designating paragraphs (3)(i) through (iii) as paragraphs (3)(iii) through (v) and adding new paragraph (3)(i) 3A001.b.2 - "Monolithic Microwave

Integrated Circuit" ("MMIC") amplifiers and new paragraph (3)(ii) 3A001.b.3 - Discrete microwave transistors, because these items warrant higher levels of control and monitoring. New paragraphs (iv) 3D001and (v) 3E001 are amended by adding reference to 3A001.b.2 and 3A001.b.3. Items on the Sensitive List tend to be ineligible for license exceptions by WA Participating States or are subject to reporting requirements.

Paragraph (6)(xiii) is amended by merging Note 7 and Note 8. Therefore, Note 8 is removed.

Paragraphs (8)(i) "8A001.b" and introductory paragraphs (ii) "8A002.b", (vi) "8D001" and (viii) "8E001" are amended by replacing "8A001.b to .d" with "8A001.b.to .c" because the Item paragraph specifying unmanned submersible vehicles is moved from 8A001.d to 8A001.c.1.

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

The WA Very Sensitive List (VSL) is amended by revising paragraph (5) of Category 8 to replace paragraph citations "8A001.d" with "8A001.c.1" throughout paragraph (5), because the item 8A001.d is moved to c.1 in this final rule (see explanation above under 8A001).

**Other National Security Revisions**

This rule revises paragraph (b) in § 743.3 "Thermal Imaging Camera Reporting" by only requiring the report for exports of more than 100 thermal imaging devices in a monocular, biocular, or binocular configuration. This will reduce the burden on the public and only require the report for exports of concern.

**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), 50 U.S.C. Sections 4801–4852. ECRA provides the legal basis for BIS's principal authorities and serves as the authority under which BIS issues this rule.

**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 **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER],** 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 **[INSERT DATE 60 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER].** Any such items not actually exported, reexported or transferred (in-country) before midnight, on **[INSERT DATE 60 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER],** 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 consensus decisions 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", which 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; 0694-0096 "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. This rule revises Section 743.3 "Thermal Imaging Reporting Requirements" by narrowing the reporting requirement, which carried a burden hour estimate of 60 minutes per submission and 60 submissions per year under collection 0694-0137 "License Exceptions and Exclusions". Because collection 0694-0137 applies to a group of collections with a burden hour estimate average based upon the burden hours and responses for a large total number of collections, the current burden hour estimate average for collection 0694-0137 is not affected by this rule's revision of the Section 743.3 "Thermal Imaging Reporting Requirements", and therefore remains at 1.5 hours per submission.

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, D.C. 20503; and to Jasmeet K. Seehra, Office of Management and Budget (OMB), by e-mail to Jasmeet_K._Seehra@omb.eop.gov, or by fax to (202) 395-7285.

**Administrative Procedure Act and Regulatory Flexibility Act Requirements**

Pursuant to Section 4821 of ECRA, this action is exempt from the Administrative Procedure Act (5 U.S.C. 553) requirements for notice of proposed rulemaking, opportunity for public participation and delay in effective date.

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 743

Administrative practice and procedure, Reporting and recordkeeping requirements

15 CFR Part 772

Exports

15 CFR Part 774

Exports, Reporting and recordkeeping requirements

Accordingly, parts 743, 772, and 774 of the Export Administration Regulations (15 CFR Parts 730 through 774) are amended as follows:

**PART 743—[AMENDED]**

1. The authority citation for part 743 is revised to read as follows:

**Authority:** 50 U.S.C. 4801 et seq.; 50 U.S.C. 1701 *et seq.*; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; E.O. 13637, 78 FR 16129, 3 CFR, 2014 Comp., p. 223; 78 FR 16129; Notice of May 7, 2020, 85 FR 27639.

2. Section 743.3 is amended by revising paragraph (b) to read as follows:

**§743.3 Thermal imaging camera reporting.**

*****

(b) *Transactions to be reported*. Exports that are not authorized by an individually validated license of more than 100 thermal imaging cameras in a monocular, biocular or binocular configuration controlled by ECCN 6A003.b.4.b to a destination in Country Group A:1 (see supplement no. 1 to part 740 of the EAR), except Canada, must be reported to BIS.

*****

**PART 772—[AMENDED]**

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

**Authority:** 50 U.S.C. 4801 et seq.; 50 U.S.C. 1701 *et seq.*; E.O. 13222, 66 FR 44025, 3

CFR, 2001 Comp., p. 783.

4. Section 772.1 is amended by:

a. Revising the definitions of "cryptography" and "radiant sensitivity";

b. Adding a definition for "satellite navigation system" in alphabetical order;

c. Revising the definition of "stability"; and

d. Adding a definition for "vacuum electronic devices" in alphabetical order.

The revisions and additions read as follows:

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

*****

*Cryptography* (Cat 5P2)-- The discipline that embodies principles, means and methods for the transformation of data in order to hide its information content, prevent its undetected modification or prevent its unauthorized use. "Cryptography" is limited to the transformation of information using one or more 'secret parameters' (e.g., crypto variables) and/or associated key management.

***Notes:***

1. "Cryptography" does not include 'fixed' data compression or coding techniques.
2. "Cryptography" includes decryption.

***Technical Notes:***

1. 'Secret parameter': a constant or key kept from the knowledge of others or shared only

within a group.

2. 'Fixed': the coding or compression algorithm cannot accept externally supplied parameters (e.g., cryptographic or key variables) and cannot be modified by the user.

*****

*Radiant sensitivity* (Cat 6)—Radiant sensitivity (mA/W) = 0.807 × (wavelength in nm) × 'Quantum Efficiency (QE)'.

***Technical Note**: 'QE' is usually expressed as a percentage; however, for the purposes of this formula 'QE' is expressed as a decimal number less than one, e.g., 78% is 0.78.*

*****

*Satellite navigation system* (Cat 5P2, 7)--A system consisting of ground stations, a constellation of satellites, and receivers, that enables receiver locations to be calculated on the basis of signals received from the satellites. It includes Global Navigation Satellite Systems (GNSS) and Regional Navigation Satellite Systems (RNSS).

*****

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

***Note:** For gyroscopes and accelerometers, "stability" can be estimated by determining*

*the Allan variance noise-analysis value at the integration period (i.e., sample time) consistent with the stated measurement period, which may include extrapolating the Allan variance noise analysis beyond the instability point into the rate/acceleration random walk or rate/acceleration ramp regions to an integration period consistent with the stated measurement period (Reference: IEEE Std. 952-1997 [R2008] or IEEE Std 1293-1998 [R2008]).*

*****

*Vacuum electronic devices* (Cat 3) 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, travelling-wave tubes, and their derivatives.

*****

**PART 774—[AMENDED]**

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

**Authority:** 50 U.S.C. 4801 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.

6. In Supplement No. 1 to Part 774 (the Commerce Control List), Category 0, ECCN 0A606 is revised to read as follow:

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

* * * * *

**0A606 Ground vehicles and related commodities, as follows (see List of Items Controlled).**

**License Requirements**

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

| Control(s) | Country Chart (See Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry, except 0A606.b and .y. | NS Column 1 |
| NS applies to 0A606.b. | NS Column 2 |
| RS applies to entire entry, except 0A606.b and .y. | RS Column 1 |
| RS applies to 0A606.b. | RS Column 2 |
| RS applies to 0A606.y. | China, Russia, or Venezuela (see §742.6(a)(7)) |
| AT applies to entire entry. | AT Column 1 |
| UN applies to entire entry, except 0A606.y. | See § 746.1(b) |

| | |
|---|---|
| | for UN controls |

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

*LVS:* $1500

*GBS:* N/A

**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 any item in 0A606.a, unless determined by BIS to be eligible for License Exception STA in accordance with §740.20(g) (License Exception STA eligibility requests for 9x515 and "600 series" items). (2) Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2) of the EAR) may not be used for any item in 0A606.

**List of Items Controlled**

*Related Controls:* (1) The ground vehicles, other articles, technical data (including software) and services described in 22 CFR part 121, Category VII are subject to the jurisdiction of the International Traffic in Arms Regulations. (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.

*Related Definitions:* N/A

*Items:*

a. Ground vehicles, whether manned or unmanned, "specially designed" for a military use and not enumerated or otherwise described in USML Category VII.

***Note 1 to paragraph .a:*** *For purposes of paragraph .a, "ground vehicles" include (i) tanks and armored vehicles manufactured prior to 1956 that have not been modified since 1955 and that do not contain a functional weapon or a weapon capable of becoming functional through repair; (ii) military railway trains except those that are armed or are "specially designed" to launch missiles; (iii) unarmored military recovery and other support vehicles; (iv) unarmored, unarmed vehicles with mounts or hard points for firearms of .50 caliber or less; and (v) trailers "specially designed" for use with other ground vehicles enumerated in USML Category VII or ECCN 0A606.a, and not separately enumerated or otherwise described in USML Category VII. For purposes of this note, the term "modified" does not include incorporation of safety features required by law, cosmetic changes (e.g., different paint or repositioning of bolt holes) or addition of "parts" or "components" available prior to 1956.*

***Note 2 to paragraph .a:*** *A ground vehicle's being "specially designed" for military use for purposes of determining controls under paragraph .a. entails a structural, electrical or mechanical feature involving one or more "components" that are "specially designed" for military use. Such "components" include:*

*a. Pneumatic tire casings of a kind "specially designed" to be bullet-proof;*

*b. Armored protection of vital "parts" (e.g., fuel tanks or vehicle cabs);*

*c. Special reinforcements or mountings for weapons;*

*d. Black-out lighting.*

b. Other ground vehicles, "parts" and "components," as follows:

b.1. Unarmed vehicles that are derived from civilian vehicles and that have all of the following:

b.1.a. Manufactured or fitted with materials or "components" other than reactive or electromagnetic armor to provide ballistic protection to level III (National Institute of Justice standard 0108.01, September 1985) or better;

b.1.b. A transmission to provide drive to both front and rear wheels simultaneously, including those vehicles having additional wheels for load bearing purposes whether driven or not;

b.1.c. Gross vehicle weight rating (GVWR) greater than 4,500 kg; *and*

b.1.d. Designed or modified for off-road use.

b.2. "Parts" and "components" having all of the following:

b.2.a. "Specially designed" for vehicles specified in paragraph .b.1 of this entry; *and*

b.2.b. Providing ballistic protection to level III (National Institute of Justice standard 0108.01, September 1985) or better.

***Note 1 to paragraph b:*** *Ground vehicles otherwise controlled by 0A606.b.1 that contain reactive or electromagnetic armor are subject to the controls of USML Category VII.*

***Note 2 to paragraph b:*** *ECCN 0A606.b.1does not control civilian vehicles "specially designed" for transporting money or valuables.*

***Note 3 to paragraph b:*** *"Unarmed" means not having installed weapons, installed mountings for weapons, or special reinforcements for mounts for weapons.*

c. Air-cooled diesel engines and engine blocks for armored vehicles that weigh more than 40 tons.

d. Fully automatic continuously variable transmissions for tracked combat vehicles.

e. Deep water fording kits "specially designed" for ground vehicles controlled by ECCN 0A606.a or USML Category VII.

f. Self-launching bridge "components" not enumerated in USML Category VII(g) "specially designed" for deployment by ground vehicles enumerated in USML Category VII or this ECCN.

g. through w. [Reserved]

x. “Parts,” “components,” “accessories,” and “attachments” that are “specially designed” for a commodity enumerated or otherwise described in ECCN 0A606 (other than 0A606.b or 0A606.y) or a defense article enumerated in USML Category VII and not elsewhere specified on the USML or in 0A606.y.

***Note 1:*** *Forgings, castings, and other unfinished products, such as extrusions and machined bodies, that have reached a stage in manufacture where they are clearly identifiable by mechanical properties, material composition, geometry, or function as commodities controlled by ECCN 0A606.x are controlled by ECCN 0A606.x.*

***Note 2:*** *“Parts,” “components,” “accessories” and “attachments” enumerated in USML paragraph VII(g) are subject to the controls of that paragraph. “Parts,” “components,” “accessories” and “attachments” described in ECCN 0A606.y are subject to the controls of that paragraph.*

y. Specific “parts,” “components,” “accessories,” and “attachments” “specially designed” for a commodity enumerated or otherwise described in this ECCN (other than ECCN 0A606.b) or for a defense article in USML Category VII and not elsewhere specified on the USML or the CCL, as follows, and “parts,” “components,” “accessories,” and “attachments” “specially designed” therefor:

y.1. Brake discs, rotors, drums, calipers, cylinders, pads, shoes, lines, hoses, vacuum boosters, and parts therefor;

y.2. Alternators and generators;

y.3. Axles;

y.4. Batteries;

y.5. Bearings (*e.g.,* ball, roller, wheel);

y.6. Cables, cable assembles, and connectors;

y.7. Cooling system hoses;

y.8. Hydraulic, fuel, oil, and air filters, not controlled by ECCN 1A004;

y.9. Gaskets and o-rings;

y.10. Hydraulic system hoses, fittings, couplings, adapters, and valves;

y.11. Latches and hinges;

y.12. Lighting systems, fuses, and "components;"

y.13. Pneumatic hoses, fittings, adapters, couplings, and valves;

y.14. Seats, seat assemblies, seat supports, and harnesses;

y.15 Tires, except run flat; and

y.16 Windows, except those for armored vehicles.

7. In Supplement No. 1 to Part 774, Category 0, ECCN 0A617 is revised to read as follow:

**0A617 Miscellaneous "equipment," materials, and related commodities (see List of Items Controlled).**

**License Requirements**

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

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|

| | |
|---|---|
| NS applies to entire entry, except 0A617.y. | NS Column 1 |
| RS applies to entire entry, except 0A617.y. | RS Column 1 |
| RS applies to 0A617.y | China, Russia, or Venezuela (see §742.6(a)(7)) |
| AT applies to entire entry. | AT Column 1 |
| UN applies to entire entry, except 0A617.y. | See § 764.1(b) for UN controls |

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

*LVS:* $1500

*GBS:* 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 not 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" therefore:

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.

8. In Supplement No. 1 to Part 774), Category 1, ECCN 1A004 is revised to read as follow:

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

**License Requirements**

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

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 2 |
| CB applies to chemical detection systems and dedicated detectors therefor, in 1A004.c, that also have the technical characteristic | CB Column 2 |
| RS apply to 1A004.d | RS Column 2 |
| AT applies to entire entry | AT Column 1 |

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

*LVS:* N/A

*GBS:* Yes for 1A004.a, .b, and .c.2.

**List of Items Controlled**

*Related Controls:* (1) See ECCNs 1A995, 2B351, and 2B352. (2) See ECCN 1D003 for "software" "specially designed" or modified to enable equipment to perform the functions of equipment controlled under section 1A004.c (Nuclear, biological and chemical (NBC) detection systems). (3) See ECCN 1E002.g for control libraries (parametric technical databases) "specially designed" or modified to enable equipment to perform the functions of equipment controlled under 1A004.c (Nuclear, biological and chemical (NBC) detection systems). (4) Chemical and biological protective and detection equipment specifically designed, developed, modified, configured, or adapted for military applications is "subject to the ITAR" (see 22 CFR parts 120 through 130, including USML Category XIV(f)), as is commercial equipment that incorporates "parts" or "components" controlled under that category except for domestic preparedness devices for individual protection that integrate "components" and "parts" identified in USML Category XIV(f)(4) when such "parts" or "components" are: 1) integral to the device; 2) inseparable from the device; and 3) incapable of replacement without compromising the effectiveness of the device, in which case the equipment is subject to the export licensing jurisdiction of the Department of Commerce under ECCN 1A004. (5) This entry does not control radionuclides incorporated in equipment listed in this entry - such materials are subject to the licensing jurisdiction of the Nuclear Regulatory Commission (See 10 CFR part 110).

*Related Definitions:* 1) 'Biological agents' means: pathogens or toxins, selected or modified (such as altering purity, shelf life, virulence, dissemination characteristics, or resistance to UV radiation) to produce casualties in humans or animals, degrade equipment or damage crops or the environment. 2) 'Riot control agents' are substances which, under the expected conditions of use for riot control purposes, produce rapidly in humans sensory irritation or disabling physical effects

which disappear within a short time following termination of exposure. (Tear gases are a subset of 'riot control agents.')

*Items:*

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

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

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

***1.** Full face masks are also known as gas masks.*

***2.** Filter canisters include filter cartridges.*

a.1. 'Biological agents';

a.2. 'Radioactive materials;'

a.3. Chemical warfare (CW) agents; *or*

a.4. 'Riot control agents', as follows:

a.4.a. α-Bromobenzeneacetonitrile, (Bromobenzyl cyanide) (CA) (CAS 5798-79-8);

a.4.b. [(2-chlorophenyl) methylene] propanedinitrile, (o-Chlorobenzylidenemalononitrile) (CS) (CAS 2698-41-1);

a.4.c. 2-Chloro-1-phenylethanone, Phenylacyl chloride (ω-chloroacetophenone) (CN) (CAS 532-27-4);

a.4.d. Dibenz-(b,f)-1,4-oxazephine, (CR) (CAS 257-07-8);

a.4.e. 10-Chloro-5, 10-dihydrophenarsazine, (Phenarsazine chloride), (Adamsite), (DM) (CAS 578-94-9);

a.4.f. N-Nonanoylmorpholine, (MPA) (CAS 5299-64-9);

b. Protective suits, gloves and shoes, "specially designed" or modified for defense against any of the following:

b.1. 'Biological agents';

b.2. 'Radioactive materials;' *or*

b.3. Chemical warfare (CW) agents;

c. Detection systems, “specially designed” or modified for detection or identification of any of the following, and “specially designed” “components” therefor:

c.1. ‘Biological agents’;

c.2. ‘Radioactive materials;’ *or*

c.3. Chemical warfare (CW) agents;

d. Electronic equipment designed for automatically detecting or identifying the presence of “explosives” (as listed in the annex at the end of Category 1) residues and utilizing ‘trace detection’ techniques (e.g., surface acoustic wave, ion mobility spectrometry, differential mobility spectrometry, mass spectrometry).

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

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

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

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

*a. Personal radiation monitoring dosimeters;*

*b. Occupational health or safety equipment limited by design or function to protect against hazards specific to residential safety or civil industries, including:*

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

***Technical Notes:***

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

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

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

9. In Supplement No. 1 to Part 774, Category 1, ECCN 1A008 is revised to read as follow:

**1A008 Charges, devices and "components," as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control:* NS, UN, 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 |
| UN applies to entire entry | See § 746.1(b) for UN controls. |

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

*LVS:* $3,000 for .a through .c;

$6,000 for .d.

*GBS:* N/A

**List of Items Controlled**

*Related Controls:* (1) All of the following are "subject to the ITAR" (see 22 CFR parts 120 through 130):

a. High explosives and related equipment "specially designed" for military use;

b. Explosive devices or charges in this entry that utilize USML controlled energetic materials (See 22 CFR 121.1 Category V), if they have been specifically designed, developed, configured, adapted, or modified for a military application;

c. Shaped charges that have all of the following a uniform shaped conical liner with an included angle of 90 degrees or less, more than 2.0 kg of controlled materials, and a diameter exceeding 4.5 inches;

d. Detonating cord containing greater than 0.1 kg per meter (470 grains per foot) of controlled materials;

e. Cutters and severing tools containing greater than 10 kg of controlled materials;

f. With the exception of cutters and severing tools, devices or charges controlled by this entry where the USML controlled materials can be easily extracted without destroying the device or charge; *and*

g. Individual USML controlled energetic materials in this entry, even when compounded with other materials, when not incorporated into explosive devices or charges controlled by this entry or 1C992.

(2) See also ECCNs 1C011, 1C018, 1C111, 1C239, and 1C608 for additional controlled energetic materials. See ECCN 1E001 for the "development" or "production" "technology" for the commodities controlled by ECCN 1A008, but not for explosives or commodities that are "subject to the ITAR" (see 22 CFR parts 120 through 130).

*Related Definitions:* N/A

*Items:*

a. 'Shaped charges' having all of the following:

a.1. Net Explosive Quantity (NEQ) greater than 90 g; *and*

a.2. Outer casing diameter equal to or greater than 75 mm;

b. Linear shaped cutting charges having all of the following, and "specially designed" "components" therefor:

b.1. An explosive load greater than 40 g/m; *and*

b.2. A width of 10 mm or more;

c. Detonating cord with explosive core load greater than 64 g/m;

d. Cutters, not specified by 1A008.b, and severing tools, having a NEQ greater than 3.5 kg.

***Technical Note:*** *'Shaped charges' are explosive charges shaped to focus the effects of the explosive blast.*

***Note:*** *The only charges and devices specified in 1A008 are those containing "explosives" (see list of explosives in the Annex at the end of Category 1) and mixtures thereof.*

10. In Supplement No. 1 to Part 774, Category 1, ECCN 1C001 is revised to read as follow:

**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

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1 |
| MT applies to entire entry | MT Column 1 |
| AT applies to entire entry | AT Column 1 |

**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

**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 x $10^8$ Hz but less than 3 x $10^{12}$ 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 ± 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 ± 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$^2$; and*

*3. Compressive strength less than $14 \times 10^6$ N/m$^2$;*

*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);*

*e. Planar absorbers having no magnetic loss and fabricated from 'open-cell foams' plastic material with a density of 0.15 grams/cm$^3$ or less.*

***Technical Note**: 'Open-cell foams' are flexible and porous materials, having an inner structure open to the atmosphere. 'Open-cell foams' are also known as reticulated foams.*

***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; <u>or</u>*

*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.*

11. In Supplement No. 1 to Part 774, "ANNEX to Category 1, List of Explosives (See ECCNs 1A004 and 1A008)" is amended by revising paragraph 6 to read as follows:

**ANNEX to Category 1, "List of Explosives (See ECCNs 1A004 and 1A008)"**

*****

6. DADE (1,1-diamino-2,2-dinitroethylene, FOX-7) (CAS 145250- 81-3);

*****

12. 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

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|
| NS applies to entire entry | NS Column 2 |

| | |
|---|---|
| MT applies to radial ball bearings having all tolerances specified in accordance with ISO 492 Tolerance Class 2 (or ANSI/ABMA Std 20 Tolerance Class ABEC-9, or other national equivalents) or better and having all the following characteristics: an inner ring bore diameter between 12 and 50 mm; an outer ring outside diameter between 25 and 100 mm; and a width between 10 and 20 mm. | MT Column 1 |
| AT applies to entire entry | AT Column 1 |

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

*LVS*: $3000, N/A for MT

*GBS*: Yes, for 2A001.a,

N/A for MT

**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 3290:2001 as grade G5 (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 2 or 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.

13. In Supplement No. 1 to Part 774, Category 2, ECCN 2B003 is revised to read as follows:

**2B003 "Numerically controlled" machine tools, "specially designed" for the shaving, finishing, grinding or honing of hardened ($R_c$ = 40 or more) spur, helical and double-helical gears having all of the following.**

**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 |

**Reporting Requirements**

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

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

*LVS*: $5000

*GBS*: N/A

**List of Items Controlled**

*Related Controls*: See also 2B993

*Related Definitions*: N/A

*Items*:

a. A pitch diameter exceeding 1,250 mm;

b. A face width of 15% of pitch diameter or larger; *and*

c. A finished quality of AGMA 14 or better (equivalent to ISO 1328 class 3).

14. 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

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 2 |
| 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

**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) μm (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 μm 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 0 to 0.2 mm of the 'measuring range';

***Technical Notes**:*

*1. 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.*

*2. For the purposes of 2B006.b.1, 'measuring range' means the distance between the minimum and maximum working distance.*

b.2. Linear position feedback units "specially designed" for machine tools and having an overall "accuracy" less (better) than (800 + (600 x L/1,000)) 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±0.01°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.*

15. In Supplement No. 1 to Part 774, Category 2, under "Category 2E—Materials Processing Table; Deposition Techniques," the Technical Note to Table on Deposition Techniques is

revised to read as follows:

**Category 2—Materials Processing**

* * * * *

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

* * * * *

***Technical Note to Table on Deposition Techniques:*** *Processes specified in Column 1 of the Table are defined as follows:*

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

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

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

***Note 3:*** *The gaseous reactants used in the out-of-pack process are produced using the same basic reactions and parameters as the pack cementation process, except that the substrate to be*

*coated is not in contact with the powder mixture.*

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

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

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

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

*4. Cathodic Arc Deposition employs a consumable cathode of the material which forms the*

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

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

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

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

*1. The metallic powders that are to be deposited (usually aluminum, chromium, silicon or combinations thereof);*

*2. An activator (normally a halide salt); and*

*3. An inert powder, most frequently alumina.*

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

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

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

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

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

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

*surface atoms to be released and deposited on an appropriately positioned substrate.*

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

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

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

16. In Supplement No. 1 to Part 774, the introductory text for Category 3 is revised to read as follows:

**Category 3 - Electronics**A. "END ITEMS," "EQUIPMENT," "ACCESSORIES," "ATTACHMENTS," "PARTS," "COMPONENTS," AND "SYSTEMS"

***Note 1:*** *The control status of equipment and "components" described in 3A001 or 3A002, other than those described in 3A001.a.3 to 3A001.a.10, 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 that are unalterably programmed or designed for a specific function for other equipment is determined by the control status of the other equipment.*

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

***Note 3****: The status of wafers (finished or unfinished), in which the function has been determined, is to be evaluated against the parameters of 3A001.a, 3A001.b, 3A001.d, 3A001.e.4, 3A001.g, 3A001.h, or 3A001.i.*

*****

17. 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)** |
|---|---|
| NS applies to "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers in 3A001.b.2 and discrete microwave transistors in 3A001.b.3, except those 3A001.b.2 and b.3 items being exported or reexported for use in civil telecommunications applications | NS Column 1 |
| NS applies to entire entry | NS Column 2 |
| RS applies "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers in 3A001.b.2 and discrete microwave transistors in 3A001.b.3, except those 3A001.b.2 and b.3 items being exported or reexported for use in civil telecommunications applications | RS Column 1 |
| 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 -54ºC to above +125ºC | MT Column 1 |
| NP applies to pulse discharge capacitors in in 3A001.e.2 and superconducting solenoidal electromagnets in 3A001.e.3 that meet or exceed the technical parameters in 3A201.a and 3A201.b, respectively | NP Column 1 |
| AT applies to entire entry | AT Column 1 |

***Reporting Requirements:*** *See §743.1 of the EAR for reporting requirements for exports under 3A001.b.2 or b.3 under License Exceptions, and Validated End-User authorizations.*

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

Yes for:

$1500: 3A001.c

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

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

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

**Special Conditions for STA**

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

**List of Items Controlled**

*Related Controls:* (1) See Category XV of the USML for certain "space-qualified" electronics and Category XI of the USML for certain ASICs, 'transmit/receive modules,' or 'transmit modules' "subject to the ITAR" (see 22 CFR parts 120 through 130). (2) See also 3A101, 3A201, 3A611, 3A991, and 9A515.

*Related Definitions*: 'Microcircuit' means a device in which a number of passive or active elements are considered as indivisibly associated on or within a continuous structure to perform the function of a circuit. For the purposes of integrated circuits in 3A001.a.1, $5 \times 10^3$ Gy(Si) = $5 \times 10^5$ Rads (Si); $5 \times 10^6$ Gy (Si)/s = $5 \times 10^8$ Rads (Si)/s.

*Items*:

a. General purpose integrated circuits, as follows:

***Note 1*****:** *Integrated circuits include the following types:*

- *Monolithic integrated circuits;*
- *Hybrid integrated circuits;*
- *Multichip integrated circuits;*
- *Film type integrated circuits, including silicon-on-sapphire integrated circuits;*
- *Optical integrated circuits;*
- *"Three dimensional integrated circuits";*

*"Monolithic Microwave Integrated Circuits" ("MMICs").*

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

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

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

a.1.c. A fluence (integrated flux) of neutrons (1 MeV equivalent) of $5 \times 10^{13}$ n/cm² or higher on silicon, or its equivalent for other materials;

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

a.2. “Microprocessor microcircuits,” “microcomputer microcircuits,” microcontroller microcircuits, storage integrated circuits manufactured from a compound semiconductor, analog-to-digital converters, integrated circuits that contain analog-to-digital converters and store or process the digitized data, digital-to-analog converters, electro-optical or “optical integrated circuits” designed for “signal processing,” field programmable logic devices, custom integrated circuits for which either the function is unknown or the control status of the equipment in which the integrated circuit will be used in unknown, Fast Fourier Transform (FFT) processors, Electrical Erasable Programmable Read-Only Memories (EEPROMs), flash memories, Static Random-Access Memories (SRAMs), or Magnetic Random Access Memories (MRAMs), having any of the following:

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

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

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

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

a.3. “Microprocessor microcircuits”, “microcomputer microcircuits” and microcontroller microcircuits, manufactured from a compound semiconductor and operating at a clock frequency

exceeding 40 MHz;

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

a.4. [Reserved]

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

a.5.a. ADCs having any of the following:

a.5.a.1. A resolution of 8 bit or more, but less than 10 bit, with an output rate greater than 1.3 Giga Samples Per Second (GSPS);

a.5.a.2. A resolution of 10 bit or more, but less than 12 bit, with an output rate greater than 600 Mega Samples Per Second (MSPS);

a.5.a.3. A resolution of 12 bit or more, but less than 14 bit, with an output rate greater than 400 Mega Samples Per Second (MSPS);

a.5.a.4. A resolution of 14 bit or more, but less than 16 bit, with an output rate greater than 250 Mega Samples Per Second (MSPS); *or*

a.5.a.5. A resolution of 16 bit or more with an output rate greater than 65 Mega Samples Per Second (MSPS);

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

***Technical Notes*:**

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

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

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

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

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

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

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

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

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

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

a.5.b.1. A resolution of 10-bit or more but less than 12-bit,with an 'adjusted update rate' of exceeding 3,500 MSPS; *or*

a.5.b.2. A resolution of 12-bit or more and having any of the following:

a.5.b.2.a. An 'adjusted update rate' exceeding 1,250 MSPS but not exceeding 3,500 MSPS, and having any of the following:

a.5.b.2.a.1. A settling time less than 9 ns to 0.024 % of full scale from a full scale step; *or*

a.5.b.2.a.2. 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; or

a.5.b.2.b. An 'adjusted update rate' exceeding 3,500 MSPS;

***Technical Notes***

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

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

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

*4. 'Adjusted update rate' for DACs is:*

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

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

• *input data rate*

• *input word rate*

• *input sample rate*

• *maximum total input bus rate*

• *maximum DAC clock rate for DAC clock input.*

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

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

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

a.6.c. Optical waveguides;

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

a.7.a. A maximum number of single-ended digital input/outputs of greater than 700; *or*

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

***Note*****:** *3A001.a.7 includes:*

*-Simple Programmable Logic Devices (SPLDs)*

*-Complex Programmable Logic Devices (CPLDs)*

*-Field Programmable Gate Arrays (FPGAs)*

*-Field Programmable Logic Arrays (FPLAs)*

*-Field Programmable Interconnects (FPICs)*

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

***Technical Notes**:*

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

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

a.8. [Reserved]

a.9. Neural network integrated circuits;

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

a.10.a. More than 1,500 terminals;

a.10.b. A typical “basic gate propagation delay time” of less than 0.02 ns; *or*

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

a.14.b. Any of the following:

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

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

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

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

b. Microwave or millimeter wave items, as follows:

***Technical Note****: 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.*

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; <u>and</u>*

*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$^2$ or a pulsed (non-continuous) current density at rated operating conditions exceeding 10 A/cm$^2$;

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 0.1 nW (-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;

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; *or*

b.3.f. Other than those specified by 3A001.b.3.a to 3A001.b.3.e and rated for operation with a peak saturated power output greater than 5 W (37.0 dBm) at all frequencies exceeding 8.5 GHz up to and including 31.8 GHz;

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

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

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

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

b.4.a.1. A peak saturated power output greater than 500 W (57 dBm) at any frequency

exceeding 2.7 GHz up to and including 2.9 GHz;

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

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

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

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

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

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

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

b.4.b.4. A peak saturated power output greater than 20 W (43 dBm) at any frequency

exceeding 16 GHz up to and including 31.8 GHz;

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

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

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

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

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

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

b.4.f. [Reserved]

***N.B.*:**

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

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

***Note 1*:** *[Reserved]*

***Note 2*:** *The control status of an item whose rated operating frequency includes frequencies listed in more than one frequency range, as defined by 3A001.b.4.a through 3A001.b.4.e, is determined by the lowest peak saturated power output control threshold.*

b.5. Electronically or magnetically tunable band-pass or band-stop filters, having more than 5 tunable resonators capable of tuning across a 1.5:1 frequency band ($f_{max}/f_{min}$) in less than 10 μs 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 $cm^3$;

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

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 $cm^3/W$; *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 X 10 $cm^3$/W = 200 $cm^3$.*

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

b.10. Oscillators or oscillator assemblies, specified to operate with a single sideband (SSB) phase noise, in dBc/Hz, less (better) than $-(126 + 20\log_{10}F - 20\log_{10}f)$ anywhere within the range of 10 Hz $\leq$ F $\leq$ 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 μs 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 μs 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 μs for any frequency change exceeding 2.2 GHz within the synthesized frequency range exceeding 37 GHz but not exceeding 90 GHz; *or*

b.11.f. [Reserved]

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

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

b.12. 'Transmit/receive modules,' 'transmit/receive MMICs,' 'transmit modules,' and 'transmit

MMICs,' rated for operation at frequencies above 2.7 GHz and having all of the following*:*

b.12.a. A peak saturated power output (in watts), $P_{sat}$, greater than 505.62 divided by the maximum operating frequency (in GHz) squared [$P_{sat}$>505.62 W*$GHz^2/f_{GHz}^2$] 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 [$d \leq 15cm*GHz*N/f_{GHz}$] 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 ($f_{GHz}$) in the formula in 3A001.b.4.12.c for transmit/receive or transmit modules that have a rated operation range extending downward to 2.7 GHz and below [d≤15cm*GHz*N/2.7 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 μs and bandwidth in MHz) of more than 100;

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

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

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

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

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

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

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

*data sheet.*

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

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

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

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

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

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

e. High energy devices as follows:

e.1. ‘Cells’ as follows:

e.1.a. ‘Primary cells’ having an ‘energy density’ exceeding 550 Wh/kg at 293 K (20ºC);

e.1.b. ‘Secondary cells’ having an ‘energy density’ exceeding 350 Wh/kg at 293 K (20ºC);

***Technical Notes*:**

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

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

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

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

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

e.2. High energy storage capacitors as follows:

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

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

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

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

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

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

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

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

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

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

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

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

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

e.3.c. Rated for a magnetic induction of more than 8 T or "overall current density" in the winding of more than 300 A/mm$^2$;

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 (28ºC) under simulated 'AM0' illumination with an irradiance of 1,367 Watts per square meter (W/m$^2$);

***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 ± 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/µs 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/µs and having all of the following:

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

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

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

*- Silicon Controlled Rectifiers (SCRs)*

*- Electrical Triggering Thyristors (ETTs)*

*- Light Triggering Thyristors (LTTs)*

*- Integrated Gate Commutated Thyristors (IGCTs)*

*- Gate Turn-off Thyristors (GTOs)*

*- MOS Controlled Thyristors (MCTs)*

*- Solidtrons*

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

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

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

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

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

h.3. Continuous current greater than 1 A.

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

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

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

*- Junction Field Effect Transistors (JFETs)*

- *Vertical Junction Field Effect Transistors (VJFETs)*

- *Metal Oxide Semiconductor Field Effect Transistors (MOSFETs)*

- *Double Diffused Metal Oxide Semiconductor Field Effect Transistor (DMOSFET)*

*- Insulated Gate Bipolar Transistor (IGBT)*

- *High Electron Mobility Transistors (HEMTs)*

- *Bipolar Junction Transistors (BJTs)*

- *Thyristors and Silicon Controlled Rectifiers (SCRs)*

- *Gate Turn-Off Thyristors (GTOs)*

- *Emitter Turn-Off Thyristors (ETOs)*

- *PiN Diodes*

- *Schottky Diodes*

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

18. 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

| Control(s) | Country Chart (See Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 2 |
| MT applies to 3A002.h when the parameters in 3A101.a.2.b are met or exceeded | MT Column 1 |
| AT applies to entire entry | AT Column 1 |

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

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

*LVS:* $3000: 3A002.a, .e, .f, and .g

$5000: 3A002.c to .d, and .h (unless controlled for MT);

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

**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. “Signal processing” of the radio frequency signal data while it is being recorded;

***Technical Notes**:*

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

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

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

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

b. [Reserved]

c. “Signal analyzers” as follows:

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

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

c.3. “Signal analyzers” having a frequency exceeding 90 GHz;

c.4. “Signal analyzers” having all of the following:

c.4.a. “Real-time bandwidth” exceeding 170 MHz; *and*

c.4.b. Having any of the following:

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

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

***Technical Notes:***

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

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

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

c.5. [Reserved]

d. Signal generators having any of the following:

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

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

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

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

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

d.3.a. [Reserved]

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

d.3.c. [Reserved]

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

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

d.3.f. [Reserved]

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

d.4.a. Less (better) than -(126 + 20 $\log_{10}$ F - 20$\log_{10}$f) for anywhere within the range of 10 Hz ≤ F ≤ 10 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 kHz < F ≤ 100 kHz anywhere within the frequency range exceeding 3.2 GHz but not exceeding 90 GHz;

***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. An 'RF modulation bandwidth' of digital baseband signals as specified by any of the following:

d.5.a. Exceeding 2.2 GHz within the frequency range exceeding 4.8 GHz but not exceeding 31.8 GHz;

d.5.b. Exceeding 550 MHz within the frequency range exceeding 31.8 GHz but not exceeding 37 GHz; or

d.5.c. Exceeding 2.2 GHz within the frequency range exceeding 37 GHz but not exceeding 90 GHz; *or*

***Technical Note:*** *'RF modulation bandwidth' is the Radio Frequency (RF) bandwidth occupied by a digitally encoded baseband signal modulated onto an RF signal. It is also referred to as information bandwidth or vector modulation bandwidth. I/Q digital modulation is the technical method for producing a vector-modulated RF output signal, and that output signal is typically specified as having an 'RF modulation bandwidth'.*

d.6. 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 Note*s:**

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

***2.*** *For the purposes of 3A002.d.1.a, 'pulse duration' is defined as the time interval from the point on the leading edge that is 50% of the pulse amplitude to the point on the trailing edge that is 50% of the pulse amplitude.*

e. Network analyzers having any of the following:

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

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

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

***Technical Note****: 'Nonlinear vector measurement functionality' is an instrument's ability to*

*analyze the test results of devices driven into the large-signal domain or the non-linear distortion range.*

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

f. Microwave test receivers having all of the following:

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

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

g. Atomic frequency standards being any of the following:

g.1. “Space-qualified”;

g.2. Non-rubidium and having a long-term stability less (better) than 1 x $10^{-11}$/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 x $10^{-11}$/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 billion samples per second;

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

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

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

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

h.2. Any of the following:

h.2.a. Output of digitized data;

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

h.2.c. Processing of digitized data;

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

***Technical Note:*** *For multiple-channel "electronic assemblies" or modules, control status is determined by the highest single-channel specified performance.*

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

19. In Supplement No. 1, 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

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| 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

**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 (20ºC);

j.2. Secondary cells having an energy density of 300 Wh/kg or less at 293 K (20ºC);

***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$^2$;

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 $MJ/M^3$ or more; *and*

l.3. A discharge time of less than 1 ms;

m. Hydrogen/hydrogen-isotope thyratrons 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.

20. 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).

**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 20 keV 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:*

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

*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 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.*

21. In Supplement No. 1, Category 3, ECCN 3E003 is revised to read as follows:

**3E003 Other "technology" for the "development" or "production" of the following (see List**

**of Items Controlled).**

**License Requirements**

*Reason for Control*: NS, AT

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1 |
| AT applies to entire entry | AT Column 1 |

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

*TSR:* Yes, except .f and .g

**List of Items Controlled**

*Related Controls*: See 3E001 for silicon-on-insulation (SOI) technology for the "development" or "production" related to radiation hardening of integrated circuits.

*Related Definitions*: N/A

*Items*:

a. Vacuum microelectronic devices;

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

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

c. "Superconductive" electronic devices;

d. Substrates of films of diamond for electronic components;

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

f. Substrates of silicon carbide for electronic components;

g. "Vacuum electronic devices" operating at frequencies of 31.8 GHz or higher.

22. In Supplement No. 1 to Part 774, Category 5, ECCN 5E001 is revised to read as follows:

**5E001 "Technology" as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control*: NS, SL, AT

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1. |
| SL applies to "technology" for the "development" or "production" of equipment, functions or features controlled by 5A001.f.1, or for the "development" or "production" of "software" controlled by ECCN 5D001.a (for 5A001.f.1) | |
| AT applies to entire entry | AT Column 1. |

**Reporting Requirements**

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

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

TSR: Yes, except for exports or reexports to destinations outside of those countries listed in Country Group A:5 (See Supplement No. 1 to part 740 of the EAR) of "technology" controlled by 5E001.a for the "development" or "production" of the following:

1) Items controlled by 5A001.b.5 or 5A001.h; or

2)"Software" controlled by 5D001.a that is "specially designed" for the "development" or "production" of equipment, functions or features controlled by 5A001.b.5 or 5A001.h.

**Special Conditions for STA**

STA: License Exception STA may not be used to ship or transmit "technology" according to the General Technology Note for the "development" or "production" of equipment, functions or features specified by 5A001.b.3, b.5 or .h; or for "software" in 5D001.a that is specified in the STA paragraph in the License Exception section of ECCN 5D001 to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls*: (1) See also 5E101, 5E980 and 5E991. (2) "Technology" for "development" or "production" of "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers that

meet the control criteria given at 3A001.b.2 is controlled in 3E001; 5E001.d refers only to that additional “technology” “required” for telecommunications.

*Related Definitions*: N/A

*Items:*

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

b. Specific “technology”, as follows:

b.1. “Technology” “required” for the “development” or “production” of telecommunications equipment “specially designed” to be used on board satellites;

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

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

b.4. “Technology” for the “development” of “spread spectrum” techniques, including

"frequency hopping" techniques.

***Note:*** *5E001.b.4 does not apply to "technology" for the "development" of any of the following:*

*a. Civil cellular radio-communications systems; or*

*b. Fixed or mobile satellite Earth stations for commercial civil telecommunications.*

c. "Technology" according the General Technology Note for the "development" or "production" of any of the following:

c.1. [Reserved]

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

c.2.a. A transmission wavelength exceeding 1,750 nm;

c.2.b. [Reserved]

c.2.c. [Reserved]

c.2.d. Employing wavelength division multiplexing techniques of optical carriers at less than 100 GHz spacing; *or*

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

***Note:*** *5E001.c.2.e does not control "technology" for commercial TV systems.*

***N.B.:*** *For "technology" for the "development" or "production" of non-telecommunications equipment employing a "laser", see Product Group E of Category 6, e.g., 6E00x*

c.3. Equipment employing "optical switching" and having a switching time less than 1 ms; *or*

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

c.4.a. Quadrature-Amplitude-Modulation (QAM) techniques above level 1,024; *or*

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

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

c.4.c. Operating in the 1.5 MHz to 87.5 MHz band and incorporating adaptive techniques providing more than 15 dB suppression of an interfering signal; *or*

c.5. [Reserved]

c.6. Mobile equipment having all of the following:

c.6.a. Operating at an optical wavelength greater than or equal to 200nm and less than or equal to 400nm; *and*

c.6.b. Operating as a "local area network";

d. "Technology" according to the General Technology Note for the "development" or "production" of "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers "specially designed" for telecommunications and that are any of the following:

***Technical Note:*** *For purposes of 5E001.d, the parameter peak saturated power output may also be referred to on product data sheets as output power, saturated power output, maximum power output, peak power output, or peak envelope power output.*

d.1. Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz with a "fractional bandwidth" greater than 15%, and having any of the following:

d.1.a. A peak saturated power output greater than 75 W (48.75 dBm) at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;

d.1.b. A peak saturated power output greater than 55 W (47.4 dBm) at any frequency

exceeding 2.9 GHz up to and including 3.2 GHz;

d.1.c. A peak saturated power output greater than 40 W (46 dBm) at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; *or*

d.1.d. A peak saturated power output greater than 20 W (43 dBm) at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

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

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

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

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

d.4. Rated for operation with a peak saturated power output greater than 0.1 nW (-70 dBm) at any frequency exceeding 31.8 GHz up to and including 37 GHz;

d.5. Rated for operation with a peak saturated power output greater than 1 W (30 dBm) at any frequency exceeding 37 GHz up to and including 43.5 GHz, and with a "fractional bandwidth" of greater than 10%;

d.6. Rated for operation with a peak saturated power output greater than 31.62 mW (15 dBm) at any frequency exceeding 43.5 GHz up to and including 75 GHz, and with a "fractional bandwidth" of greater than 10%;

d.7. Rated for operation with a peak saturated power output greater than 10 mW (10 dBm) at any frequency exceeding 75 GHz up to and including 90 GHz, and with a "fractional bandwidth" of greater than 5%; or

d.8. Rated for operation with a peak saturated power output greater than 0.1 nW (-70 dBm) at any frequency exceeding 90 GHz;

e. "Technology" according to the General Technology Note for the "development" or "production" of electronic devices and circuits, "specially designed" for telecommunications and containing "components" manufactured from "superconductive" materials, "specially designed" for operation at temperatures below the "critical temperature" of at least one of the "superconductive" constituents and having any of the following:

e.1. Current switching for digital circuits using "superconductive" gates with a product of

delay time per gate (in seconds) and power dissipation per gate (in watts) of less than $10^{-14}$ J; *or*

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

**Category 5 – Part 2 – "Information Security"**

23. In Supplement No. 1 to Part 774, Category 5, 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

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1 |
| AT applies to entire entry | AT Column 1 |
| 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

*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 "component" 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 "satellite navigation system" 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 a 'described security algorithm', where that cryptographic capability is usable without "cryptographic

activation" or has been activated, as follows:

a.1. Items having "information security" as a primary function;

a.2. Digital communication or networking systems, equipment or components, not specified in paragraph 5A002.a.1;

a.3. Computers, other items having information storage or processing as a primary function, and components therefor, not specified in paragraphs 5A002.a.1 or .a.2;

***N.B.:*** *For operating systems see also 5D002.a.1 and .c.1.*

a.4. Items, not specified in paragraphs 5A002.a.1 to a.3, where the 'cryptography for data confidentiality' having 'in excess of a 'described security algorithm' 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, 'described security algorithm' 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).*

*2.c.An "asymmetric algorithm" where the security of the algorithm is based on any of the following:*

*2.c.1. Shortest vector or closest vector problems associated with lattices (e.g., NewHope, Frodo, NTRUEncrypt, Kyber, Titanium);*

*2.c.2. Finding isogenies between Supersingular elliptic curves (e.g., Supersingular Isogeny Key Encapsulation); or*

*2.c.3. Decoding random codes (e.g., McEliece, Niederreiter).*

***Technical Note:*** *An algorithm described by Technical Note 2.c. may be referred to as being post-quantum, quantum-safe or quantum-resistant.*

***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 a 'described security algorithm'; 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;*

*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; or*

*j. Items specially designed for a 'connected civil industry application', meeting all of the following:*

*j.1. Being any of the following:*

*j.1.a. A network-capable endpoint device meeting any of the following:*

*j.1.a.1. The "information security" functionality is limited to securing 'non-arbitrary data' or the tasks of "Operations, Administration or Maintenance" ("OAM"); or*

*j.1.a.2. The device is limited to a specific 'connected civil industry application'; or*

*j.1.b. Networking equipment meeting all of the following:*

*j.1.b.1. Being specially designed to communicate with the devices specified by paragraph j.1.a. above; and*

*j.1.b.2. The "information security" functionality is limited to supporting the 'connected civil industry application' of devices specified by paragraph j.1.a. above, or the tasks of "OAM" of this networking equipment or of other items specified by paragraph j. of this Note; and*

*j.2. Where the "information security" functionality implements only published or commercial cryptographic standards, and the cryptographic functionality cannot easily be changed by the user.*

***Technical Notes:***

*1. 'Connected civil industry application' means a network-connected consumer or civil industry application other than "information security", digital communication, general purpose networking or computing.*

*2. 'Non-arbitrary data' means sensor or metering data directly related to the stability, performance or physical measurement of a system (e.g., temperature, pressure, flow rate, mass, volume, voltage, physical location, etc.), that cannot be changed by the user of the device.*

b. Being a 'cryptographic activation token';

***Technical Note**: A 'cryptographic activation token' is an item designed or modified for any of the following:*

1. *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*
2. *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.

24. In Supplement No. 1 to Part 774, Category 5, 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

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|
| NS applies to entire entry | NS Column 1 |
| AT applies to entire entry | AT Column 1 |
| 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. ***Note:*** *Encryption software is controlled because of its functional capacity, and not* |

| | |
|---|---|
| | *because of any informational value of such software; such software is not accorded the same treatment under the EAR as other "software"; and for export licensing purposes, encryption software is treated under the EAR in the same manner as a commodity included in ECCN 5A002.* |

***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)

*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" having the characteristics of a 'cryptographic activation token' specified by 5A002.b;

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.*

25. In Supplement No. 1 to Part 774, Category 5, 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

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|
| NS applies to entire entry | NS Column 1 |
| AT applies to entire entry | AT Column 1 |
| 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)

*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" having the characteristics of a 'cryptographic activation token' specified by 5A002.b.

***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.*

26. 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

| Control(s) | Country Chart |
|---|---|

| | **(see Supp. No. 1 to part 738)** |
|---|---|
| NS applies to entire entry | NS Column 2 |
| 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., Electromagnetic Pulse (EMP), X-rays, combined blast and thermal effects), and usable for "missiles" | MT Column 1 |
| 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) 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)

*LVS:* $500 for 6A002.f.

$3000; except N/A for MT and for 6A002.a.1, a.2, a.3, .c, and .f.

*GBS:* N/A

**List of Items Controlled**

*Related Controls:* (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 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." (7) See 6B002 for masks and reticles, "specially designed" for optical sensors specified by 6A002.a.1.b or 6A002.a.1.d.

*Related Definitions*: N/A

*Items*:

a. Optical detectors as follows:

a.1. "Space-qualified" solid-state detectors as follows:

***Note:*** *For the purpose of 6A002.a.1, solid-state detectors include "focal plane arrays".*

a.1.a. “Space-qualified” solid-state detectors having all of the following:

a.1.a.1. A peak response in the wavelength range exceeding 10 nm but not exceeding 300 nm; *and*

a.1.a.2. A response of less than 0.1% relative to the peak response at a wavelength exceeding 400 nm;

a.1.b. “Space-qualified” solid-state detectors having all of the following:

a.1.b.1. A peak response in the wavelength range exceeding 900 nm but not exceeding 1,200 nm; *and*

a.1.b.2. A response “time constant” of 95 ns or less;

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;

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;

a.2. Image intensifier tubes and “specially designed” “components” therefor, as follows:

***Note*****:** *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:*

*a. A single metal anode; or*

*b. Metal anodes with a center to center spacing greater than 500 μm.*

***Technical Note:*** *'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".*

a.2.a. Image intensifier tubes having all of the following:

a.2.a.1. A peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm;

a.2.a.2. Electron image amplification using any of the following:

a.2.a.2.a. A microchannel plate with a hole pitch (center-to-center spacing) of 12 μm or less; *or*

a.2.a.2.b. An electron sensing device with a non-binned pixel pitch of 500 μm or less,

"specially designed" or modified to achieve 'charge multiplication' other than by a microchannel plate; *and*

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

a.2.a.3.a. Multialkali photocathodes (e.g., S-20 and S-25) having a luminous sensitivity exceeding 350 μA/lm;

a.2.a.3.b. GaAs or GaInAs photocathodes; *or*

a.2.a.3.c. Other "III-V compound" semiconductor photocathodes having a maximum "radiant sensitivity" exceeding 10 mA/W;

a.2.b. Image intensifier tubes having all of the following:

a.2.b.1. A peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,800 nm;

a.2.b.2. Electron image amplification using any of the following:

a.2.b.2.a. A microchannel plate with a hole pitch (center-to-center spacing) of 12 μm or less; *or*

a.2.b.2.b. An electron sensing device with a non-binned pixel pitch of 500 μm or less, “specially designed” or modified to achieve 'charge multiplication' other than by a microchannel plate; *and*

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;

a.2.c. “Specially designed” “components” as follows:

a.2.c.1. Microchannel plates having a hole pitch (center-to-center spacing) of 12 μm or less;

a.2.c.2. An electron sensing device with a non-binned pixel pitch of 500 μm or less, “specially designed” or modified to achieve 'charge multiplication' other than by a microchannel plate;

a.2.c.3. “III-V compound” semiconductor (*e.g.,* GaAs or GaInAs) photocathodes and transferred electron photocathodes;

***Note:*** *6A002.a.2.c.3 does not control compound semiconductor photocathodes designed to achieve a maximum “radiant sensitivity” of any of the following:*

*a. 10 mA/W or less at the peak response in the wavelength range exceeding 400 nm but not exceeding 1,050 nm; or*

*b. 15 mA/W or less at the peak response in the wavelength range exceeding 1,050 nm but not exceeding 1,800 nm.*

a.3. Non-"space-qualified" "focal plane arrays" as follows:

***N.B.:*** *'Microbolometer' non-"space-qualified" "focal plane arrays" are only specified by 6A002.a.3.f.*

***Technical Note:*** *Linear or two-dimensional multi-element detector arrays are referred to as "focal plane arrays";*

***Note 1:*** *6A002.a.3 includes photoconductive arrays and photovoltaic arrays.*

***Note 2:*** *6A002.a.3 does not control:*

*a. Multi-element (not to exceed 16 elements) encapsulated photoconductive cells using either lead sulphide or lead selenide;*

*b. Pyroelectric detectors using any of the following:*

*b.1. Triglycine sulphate and variants;*

*b.2. Lead-lanthanum-zirconium titanate and variants;*

*b.3. Lithium tantalate;*

*b.4. Polyvinylidene fluoride and variants; or*

*b.5. Strontium barium niobate and variants.*

*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:*

*c.1. Incorporating a response limiting mechanism designed not to be removed or modified; and*

*c.2. Any of the following:*

*c.2.a. The response limiting mechanism is integral to or combined with the detector element; or*

*c.2.b. The "focal plane array" is only operable with the response limiting mechanism*

*in place.*

*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 μrad (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 218 K (-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'.*

27. 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

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|
| 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 |
| RS applies to 6A003.b.3, 6A003.b.4.a, 6A003.b.4.c and to items | RS Column 1 |

| | |
|---|---|
| controlled in 6A003.b.4.b that have a frame rate greater than 60 Hz or that incorporate a focal plane array with more than 111,000 elements, or to items in 6A003.b.4.b when being exported or reexported to be embedded in a civil product. (But see § 742.6(a)(2)(iii) and (v) for certain exemptions) | |
| RS applies to items controlled in 6A003.b.4.b that have a frame rate of 60 Hz or less and that incorporate a focal plane array with not more than 111,000 elements if not being exported or reexported to be embedded in a civil product | RS Column 2 |
| AT applies to entire entry | AT Column 1 |
| UN applies to 6A003.b.3 and b.4 | See § 746.1(b) for UN controls |

***License Requirement Note***: Commodities that are not subject to the ITAR but are of the type described in USML Category XII(c) are controlled as cameras in ECCN 6A003 when they incorporate a camera controlled in this ECCN.

***Reporting Requirements***

See §743.3 of the EAR for thermal camera reporting for exports that are not authorized by an individually validated license of thermal imaging cameras controlled by ECCN 6A003.b.4.b to destinations in Country Group A:1 (see Supplement No. 1 to part 740 of the EAR), must be reported to BIS.

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

*LVS:* $1500, except N/A for 6A003.a.3 through a.6, b.1, b.3 and b.4

*GBS:* 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 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 x $10^6$ "active pixels" per solid state array for monochrome (black and white) cameras;

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

b.1.a.3. More than 12 x $10^6$ "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 2 mrad (milliradians);*

*2. Incorporating a fixed focal-length lens that is not designed to be removed;*

*3. Not incorporating a 'direct view' display; and*

***Technical Note:*** *'Direct view' refers to an imaging camera operating in the infrared spectrum that presents a visual image to a human observer using a near-to-eye micro display incorporating any light-security mechanism.*

*4. Having any of the following:*

*a. No facility to obtain a viewable image of the detected field-of-view; or*

*b. The camera is designed for a single kind of application and designed not to be user*

*modified; or*

***Technical Note:***

*'Instantaneous Field of View (IFOV)' specified in Note 3.b is the lesser figure of the 'Horizontal FOV' or the 'Vertical FOV'.*

*'Horizontal IFOV' = horizontal Field of View (FOV)/number of horizontal detector elements*

*'Vertical IFOV'= vertical Field of View (FOV)/number of vertical detector elements.*

*c. The camera is "specially designed" for installation into a civilian passenger land vehicle and having all of the following:*

*1. The placement and configuration of the camera within the vehicle are solely to assist the driver in the safe operation of the vehicle;*

*2. Is operable only when installed in any of the following:*

*a. The civilian passenger land vehicle for which it was intended and the vehicle weighs less than 4,500 kg (gross vehicle weight); or*

*b. A "specially designed", authorized maintenance test facility; and*

*3. Incorporates an active mechanism that forces the camera not to function when it is removed from the vehicle for which it was intended.*

***Note:*** *When necessary, details of the items will be provided, upon request, to the Bureau of Industry and Security in order to ascertain compliance with the conditions described in Note 3.b.4 and Note 3.c in this Note to 6A003.b.4.b.*

***Note 4:*** *6A003.b.4.c does not apply to 'imaging cameras' having any of the following characteristics:*

*a. Having all of the following:*

*1. Where the camera is "specially designed" for installation as an integrated component into indoor and wall-plug-operated systems or equipment, limited by design for a single kind of application, as follows:*

*a. Industrial process monitoring, quality control, or analysis of the properties of materials;*

*b. Laboratory equipment "specially designed" for scientific research;*

*c. Medical equipment;*

*d. Financial fraud detection equipment; and*

*2. Is only operable when installed in any of the following:*

*a. The system(s) or equipment for which it was intended; or*

*b. A "specially designed," authorized maintenance facility; and*

*3. Incorporates an active mechanism that forces the camera not to function when it is removed from the system(s) or equipment for which it was intended;*

*b. Where the camera is "specially designed" for installation into a civilian passenger land vehicle or passenger and vehicle ferries and having all of the following:*

*1. The placement and configuration of the camera within the vehicle or ferry are solely to assist the driver or operator in the safe operation of the vehicle or ferry;*

*2. Is only operable when installed in any of the following:*

*a. The civilian passenger land vehicle for which it was intended and the vehicle weighs less than 4,500 kg (gross vehicle weight);*

*b. The passenger and vehicle ferry for which it was intended and having a length overall (LOA) 65 m or greater; or*

*c. A "specially designed", authorized maintenance test facility; and*

*3. Incorporates an active mechanism that forces the camera not to function when it is removed from the vehicle for which it was intended;*

*c. Limited by design to have a maximum "radiant sensitivity" of 10 mA/W or less for wavelengths exceeding 760 nm, having all of the following:*

*1. Incorporating a response limiting mechanism designed not to be removed or modified; and*

*2. Incorporates an active mechanism that forces the camera not to function when the response limiting mechanism is removed; and*

*3. Not "specially designed" or modified for underwater use; or*

*d. Having all of the following:*

*1. Not incorporating a 'direct view' or electronic image display;*

*2. Has no facility to output a viewable image of the detected field of view;*

*3. The "focal plane array" is only operable when installed in the camera for which it was intended; and*

*4. The "focal plane array" incorporates an active mechanism that forces it to be permanently inoperable when removed from the camera for which it was intended.*

***Note:*** *When necessary, details of the item will be provided, upon request, to the Bureau of Industry and Security in order to ascertain compliance with the conditions described in Note 4 above.*

b.5. Imaging cameras incorporating solid-state detectors specified by 6A002.a.1.

28. 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

$3000 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 2 kW, 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; $CO_2$ or $CO/CO_2$ "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; and $CO_2$ "lasers" controlled by 6A005.d.3 that operate in CW multiple-transverse mode, and having a CW output power not exceeding 15 kW.

**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*:

***Notes:***

***1.*** *Pulsed "lasers" include those that run in a continuous wave (CW) mode with pulses superimposed.*

***2.*** *Excimer, semiconductor, chemical, CO, $CO_2$, 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*.

*6. For the purposes of 6A005.a and 6A005.b, 'single transverse mode' refers to "lasers" with a beam profile having an $M^2$-factor of less than 1.3, while 'multiple transverse mode' refers to "lasers" with a beam profile having an $M^2$-factor of 1.3 or higher.*

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 any of the following:

a.6.a.1. Average output power exceeding 1,000 W; *or*

a.6.a.2. Having all of the following:

a.6.a.2.a. Average output power exceeding 500 W; *and*

a.6.a.2.b. Spectral bandwidth less than 40 GHz; *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 1,000 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 2 kW 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. [Reserved];*

*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 6 kW and having a BPP exceeding 3.5 mm•mrad;*

*f. [Reserved]*

*g. [Reserved]*

*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;*

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 1W;

***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:

***Notes:***

*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$^2$;

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$^2$;

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$^2$; *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/cm2;

d.1.d.2.b. Average or CW total output power equal to or exceeding 250 W but less than or equal to 500 W, and having average or CW output ‘power density’ greater than 50W/$cm^2$;

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/$cm^2$; *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/$cm^2$;

d.1.d.3.b. Average or CW output power greater than 10 W; *or*

d.1.d.3.c. Spatially coherent average or CW total output power, exceeding 1.5 W; *or*

d.1.d.4. At least one "laser" 'bar' specified by 6A005.d.1.c;

***Technical Note:*** *For the purposes of 6A005.d.1.d, 'power density' means the total "laser" output power divided by the emitter surface area of the 'stacked array'.*

d.1.e. Semiconductor "laser" 'stacked arrays', other than those specified by 6.A005.d.1.d, having all of the following:

d.1.e.1. "Specially designed" or modified to be combined with other 'stacked arrays' to form a larger 'stacked array'; *and*

d.1.e.2. Integrated connections, common for both electronics and cooling;

***Note 1****: 'Stacked arrays', formed by combining semiconductor "laser" 'stacked arrays' specified by 6A005.d.1.e, that are not designed to be further combined or modified are specified by 6A005.d.1.d.*

***Note 2:*** *'Stacked arrays', formed by combining semiconductor "laser" 'stacked arrays' specified by 6A005.d.1.e, that are designed to be further combined or modified are specified by 6A005.d.1.e.*

***Note 3:*** *6A005.d.1.e does not apply to modular assemblies of single 'bars' designed to be fabricated into end to end stacked linear arrays.*

***Technical Notes:***

*1. Semiconductor "lasers" are commonly called "laser" diodes.*

*2. A 'bar' (also called a semiconductor "laser" 'bar', a "laser" diode 'bar' or diode 'bar') consists of multiple semiconductor "lasers" in a one dimensional array.*

*3. A 'stacked array' consists of multiple 'bars' forming a two dimensional array of semiconductor "lasers".*

d.2. Carbon monoxide (CO) "lasers" having any of the following:

d.2.a. Output energy exceeding 2 J per pulse and "peak power" exceeding 5 kW; *or*

d.2.b. Average or CW output power, exceeding 5 kW;

d.3. Carbon dioxide ($CO_2$) “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 ($O_2$-I) “lasers”;

d.5.c.2. Deuterium Fluoride-Carbon dioxide (DF-$CO_2$) “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

$kW/cm^2$;

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 $10^3$.

***Technical Note**: ‘Laser acoustic detection equipment’ is sometimes referred to as a “Laser” Microphone or Particle Flow Detection Microphone.*

29. In Supplement No. 1 to Part 774, Category 6, ECCN 6B002 is added to read as follows:

**6B002 Masks and reticles, “specially designed” for optical sensors specified by 6A002.a.1.b or 6A002.a.1.d.**

**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:* $5000

*GBS:* Yes

**List of Items Controlled**

*Related Controls*: N/A

*Related Definitions*: N/A

*Items*:

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

30. 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

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|
| NS applies to "technology" for items controlled by 6A001 to 6A008, 6B002 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 |
| 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) 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)

*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.

31. 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

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|
| NS applies to "technology" for equipment controlled by 6A001 to 6A008, 6B002 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) 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)

*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.

32. In Supplement No. 1 to Part 774, Category 7, ECCN 7A002 is revised to read as follows:

**7A002 Gyros or angular rate sensors, having any of the following, and "specially designed" "components" therefor.**

**License Requirements**

*Reason for Control*: NS, MT, AT

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|
| NS applies to entire entry | NS Column 1 |
| MT applies to commodities that meet or exceed the parameters of 7A102. | MT Column 1 |

| | |
|---|---|
| AT applies to entire entry | AT Column 1 |

***License Requirement Note:*** *For the purpose of MT controls only, the term 'stability' is defined as a measure of the ability of a specific mechanism or performance coefficient to remain invariant when continuously exposed to a fixed operating condition. (This definition does not refer to dynamic or servo stability.) (IEEE STD 528-2001 paragraph 2.247)*

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

*LVS:* N/A

*GBS:* N/A

**List of Items Controlled**

*Related Controls:* (1) See USML Category XII(e) for gyros or angular rate sensors subject to the ITAR. (2) See also ECCNs 7A102, 7A611, and 7A994. (3) For angular or rotational accelerometers, see ECCN 7A001.b.

*Related Definitions*: N/A

*Items*:

a. Specified to function at linear acceleration levels less than or equal to 100 g and having any of the following:

a.1. An angular rate range of less than 500 degrees per second and having any of the following:

a.1.a. A “bias” “stability” of less (better) than 0.5 degree per hour, when measured in a 1 g environment over a period of one month, and with respect to a fixed calibration value; *or*

a.1.b. An “angle random walk” of less (better) than or equal to 0.0035 degree per square root hour; *or*

***Note**: 7A002.a.1.b does not control “spinning mass gyros”.*

a.2. An angular rate range greater than or equal to 500 degrees per second and having any of the following:

a.2.a. A “bias” “stability” of less (better) than 4 degrees per hour, when measured in a 1 g environment over a period of three minutes, and with respect to a fixed calibration value; *or*

a.2.b. An “angle random walk” of less (better) than or equal to 0.1 degree per square root hour; *or*

***Note**: 7A002.a.2.b does not apply to “spinning mass gyros”.*

b. Specified to function at linear acceleration levels exceeding 100 g.

33. In Supplement No. 1 to Part 774, Category 7, ECCN 7A003 is revised to read as follows:

**7A003 'Inertial measurement equipment or systems', having any of the following.**

**License Requirements**

*Reason for Control*: NS, MT, AT

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1 |
| MT applies to commodities in 7A003.d that meet or exceed the parameters of 7A103 | 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

**List of Items Controlled**

*Related Controls:* (1) See also ECCNs 7A103, 7A611, and 7A994. (2) See USML Category XII(d) for guidance or navigation systems subject to the ITAR.

*Related Definitions:* N/A

*Items*:

***Note 1:*** *'Inertial measurement equipment or systems' incorporate accelerometers or gyroscopes to measure changes in velocity and orientation in order to determine or maintain heading or position without requiring an external reference once aligned. 'Inertial measurement equipment or systems' include:*

- *Attitude and Heading Reference Systems (AHRSs);*
- *Gyrocompasses;*
- *Inertial Measurement Units (IMUs);*
- *Inertial Navigation Systems (INSs);*
- *Inertial Reference Systems (IRSs);*
- *Inertial Reference Units (IRUs).*

***Note 2:*** *7A003 does not apply to 'inertial measurement equipment or systems' which are certified for use on "civil aircraft" by civil aviation authorities of one or more Wassenaar Arrangement Participating States, see Supplement No. 1 to part 743 of the EAR..*

***Technical Note:*** *'Positional aiding references' independently provide position, and include:*

*a. "Satellite navigation system";*

*b."Data-Based Referenced Navigation" ("DBRN").*

a. Designed for "aircraft", land vehicles or vessels, providing position without the use of 'positional aiding references', and having any of the following "accuracies" subsequent to normal alignment:

a.1.0.8 nautical miles per hour (nm/hr) "Circular Error Probable" ("CEP") rate or less (better);

a.2.0.5% distanced travelled "CEP" or less (better); <u>or</u>

a.3.Total drift of 1 nautical mile "CEP" or less (better) in a 24 hr period;

***Technical Note****: The performance parameters in 7A003.a.1, 7A003.a.2 and 7A003.a.3 typically apply to 'inertia measurement equipment or systems' designed for "aircraft", vehicles and vessels, respectively. These parameters result from the utilization of specialized non-*

*positional aiding references (e.g., altimeter, odometer, velocity log). As a consequence, the specified performance values cannot be readily converted between these parameters. Equipment designed for multiple platforms are evaluated against each applicable entry 7A003.a.1, 7A003.a.2, or 7A003.a.3.*

b. Designed for "aircraft", land vehicles or vessels, with an embedded 'positional aiding reference' and providing position after loss of all 'positional aiding references' for a period of up to 4 minutes, having an "accuracy" of less (better) than 10 meters "CEP";

***Technical Note**: 7A003.b refers to systems in which 'inertial measurement equipment or systems' and other independent 'positional aiding references' are built into a single unit (i.e., embedded) in order to achieve improved performance.*

c. Designed for "aircraft", land vehicles or vessels, providing heading or True North determination and having any of the following:

c.1. A maximum operating angular rate less (lower) than 500 deg/s and a heading "accuracy" without the use of 'positional aiding references' equal to or less (better) than 0.07 deg sec (Lat) (equivalent to 6 arc minutes rms at 45 degrees latitude); *or*

c.2. A maximum operating angular rate equal to or greater (higher) than 500 deg/s and a heading "accuracy" without the use of 'positional aiding references' equal to or less (better) than 0.2 deg sec (Lat) (equivalent to 17 arc minutes rms at 45 degrees latitude);

d. Providing acceleration measurements or angular rate measurements, in more than one dimension, and having any of the following:

d.1. Performance specified by 7A001 or 7A002 along any axis, without the use of any aiding references; *or*

d.2. Being "space-qualified" and providing angular rate measurements having an "angle random walk" along any axis of less (better) than or equal to 0.1 degree per square root hour.

***Note**: 7A003.d.2 does not apply to 'inertial measurement equipment or systems' that contain "spinning mass gyros" as the only type of gyro.*

34. In Supplement No. 1 to Part 774, Category 7, ECCN 7A005 is revised to read as follows:

**7A005 "Satellite navigation system" receiving equipment having any of the following and "specially designed" "components" therefor.**

**License Requirements**

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

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to 7A005.b | NS Column 1 |
| MT applies to commodities in 7A005.b that meet or exceed the parameters of 7A105. | MT Column 1 |
| AT applies to 7A005.b | 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 also ECCNs 7A105, 7A611 and 7A994. Commercially available "satellite navigation system" receivers do not typically employ decryption or adaptive antennae and are classified as 7A994. (2) See USML Category XII(d) for "satellite navigation system" receiving equipment subject to the ITAR and USML Category XI(c)(10) for antennae that are subject to the ITAR. (3) Items that otherwise would be covered by ECCN 7A005.a are "subject to the ITAR" (see 22 CFR parts 120 through 130).

*Related Definitions:* N/A

*Items:*

a. Employing a decryption algorithm "specially designed" or modified for government use to access the ranging code for position and time; *or*

b. Employing 'adaptive antenna systems'.

***Note:*** *7A005.b does not apply to "satellite navigation system" receiving equipment that only uses "components" designed to filter, switch, or combine signals from multiple omni-directional antennas that do not implement adaptive antenna techniques.*

***Technical Note:*** *For the purposes of 7A005.b 'adaptive antenna systems' dynamically generate one or more spatial nulls in an antenna array pattern by signal processing in the time domain or frequency domain.*

35. In Supplement No. 1 to Part 774, Category 7, ECCN 7D003 is revised to read as follows:

**7D003 Other "software" as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control*: NS, MT, AT

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1 |
| MT applies to "software" for equipment controlled for MT reasons. MT does not apply to "software" for equipment controlled by 7A008. | MT Column 1 |
| AT applies to entire entry | AT Column 1 |

**Reporting Requirements**

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

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

*TSR:* N/A

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship or transmit software in 7D003.a or .b to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part

740 of the EAR).

**List of Items Controlled**

*Related Controls*: See also 7D103 and 7D994.

*Related Definitions*: 'Data-Based Referenced Navigation' ('DBRN') systems are systems which use various sources of previously measured geo-mapping data integrated to provide accurate navigation information under dynamic conditions. Data sources include bathymetric maps, stellar maps, gravity maps, magnetic maps or 3-D digital terrain maps.

*Items*:

a. "Software" "specially designed" or modified to improve the operational performance or reduce the navigational error of systems to the levels controlled by 7A003, 7A004 or 7A008;

b. "Source code" for hybrid integrated systems which improves the operational performance or reduces the navigational error of systems to the level controlled by 7A003 or 7A008 by continuously combining heading data with any of the following:

b.1. Doppler radar or sonar velocity data;

b.2. "Satellite navigation system" reference data; *or*

b.3. Data from 'Data-Based Referenced Navigation' ('DBRN") systems;

c. [Reserved]

d. [Reserved]

***N.B.*** *For flight control "source code," see 7D004.*

e. Computer-Aided-Design (CAD) "software" "specially designed" for the "development" of "active flight control systems", helicopter multi-axis fly-by-wire or fly-by-light controllers or helicopter "circulation controlled anti-torque or circulation-controlled direction control systems", whose "technology" is controlled by 7E004.b.1, 7E004.b.3 to b.5, 7E004.b.7 to b.8, 7E004.c.1 or 7E004.c.2.

36. In Supplement No. 1 to Part 774, Category 7, ECCN 7D005 is revised to read as follows:

**7D005 "Software" "specially designed" to decrypt "Satellite navigation system" ranging signals designed for government use.**

**License Requirements**

*Reason for Control*: NS, AT

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1 |
| AT applies to entire entry | AT Column 1 |

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

*TSR:* N/A

**List of Items Controlled**

*Related Controls*: N/A

*Related Definitions*: N/A

*Items*:

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

37. In Supplement No. 1 to Part 774, Category 8, ECCN 8A001 is revised to read as follows:

**8A001 Submersible vehicles and surface vessels, as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control*: NS, AT

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 2 |
| AT applies to entire entry | AT Column 1 |

**Reporting Requirements**

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

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

*LVS:* $5000; N/A for 8A001.b and .c.1

*GBS:* N/A

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship any commodity in 8A001.b, or 8A001.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*: For the control status of equipment for submersible vehicles, see: Category 6 for sensors; Categories 7 and 8 for navigation equipment; Category 8A for underwater equipment.

*Related Definitions*: N/A

*Items*:

a. Manned, tethered submersible vehicles designed to operate at depths exceeding 1,000 m;

b. Manned, untethered submersible vehicles having any of the following:

b.1. Designed to 'operate autonomously' and having a lifting capacity of all the following:

b.1.a. 10% or more of their weight in air; *and*

b.1.b. 15 kN or more;

b.2. Designed to operate at depths exceeding 1,000 m; *or*

b.3. Having all of the following:

b.3.a. Designed to continuously 'operate autonomously' for 10 hours or more; *and*

b.3.b. 'Range' of 25 nautical miles or more;

***Technical Notes:***

*1. For the purposes of 8A001.b, 'operate autonomously' means fully submerged, without snorkel, all systems working and cruising at minimum speed at which the submersible can safely control its depth dynamically by using its depth planes only, with no need for a support vessel or support base on the surface, sea-bed or shore, and containing a propulsion system for submerged or surface use.*

*2. For the purposes of 8A001.b, 'range' means half the maximum distance a submersible vehicle can 'operate autonomously'.*

c. Unmanned submersible vehicles as follows:

c.1. Unmanned submersible vehicles having any of the following:

c.1.a. Designed for deciding a course relative to any geographical reference without real-time human assistance;

c.1.b. Acoustic data or command link; *or*

c.1.c. Optical data or command link exceeding 1,000 m;

c.2. Unmanned, submersible vehicles, not specified in 8A001.c.1, having all of the following:

c.2.a. Designed to operate with a tether;

c.2.b. Designed to operate at depths exceeding 1,000 m; *and*

c.2.c. Having any of the following:

c.2.c.1. Designed for self-propelled maneuver using propulsion motors or thrusters specified by 8A002.a.2; *or*

c.2.c.2. Fiber optic data link;

d. [Reserved]

e. Ocean salvage systems with a lifting capacity exceeding 5 MN for salvaging objects from depths exceeding 250 m and having any of the following:

e.1. Dynamic positioning systems capable of position keeping within 20 m of a given point provided by the navigation system; *or*

e.2. Seafloor navigation and navigation integration systems, for depths exceeding 1,000 m and with positioning “accuracies” to within 10 m of a predetermined point.

38. In Supplement No. 1 to Part 774, Category 8, ECCN 8A002 is revised to read as follows:

**8A002 Marine systems, equipment, "parts" and "components," as follows (see List of Items Controlled).**

**License Requirements**

*Reason for Control*: NS, AT

| 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 |

**Reporting Requirements**

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

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

*LVS:* $5000; N/A for 8A002.o.3.b

*GBS:* Yes for manipulators for civil end uses (*e.g.*, underwater oil, gas or mining operations) controlled by 8A002.i.2 and having 5 degrees of freedom of movement; and 8A002.r.

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship any commodity in 8A002.b, h, j, o.3, or p to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls*: (1) See also 8A992 and for underwater communications systems, see Category 5, Part I - Telecommunications. (2) See also 8A992 for self-contained underwater breathing apparatus that is not controlled by 8A002 or released for control by the 8A002.q Note. (3) For electronic imaging systems "specially designed" or modified for underwater use incorporating image intensifier tubes specified by 6A002.a.2.a or 6A002.a.2.b, see 6A003.b.3. (4) For electronic imaging systems "specially designed" or modified for underwater use incorporating "focal plane arrays" specified by 6A002.a.3.g, see 6A003.b.4.c. (5) Section 744.9 imposes a license requirement on commodities described in 8A002.d if being exported, reexported, or transferred (in-country) for use by a military end-user or for incorporation into an item controlled by ECCN 0A919.

*Related Definitions*: N/A

*Items*:

a. Systems, equipment, "parts" and "components," "specially designed" or modified for submersible vehicles and designed to operate at depths exceeding 1,000 m, as follows:

a.1. Pressure housings or pressure hulls with a maximum inside chamber diameter exceeding 1.5 m;

a.2. Direct current propulsion motors or thrusters;

a.3. Umbilical cables, and connectors therefor, using optical fiber and having synthetic strength members;

a.4. "Parts" and "components" manufactured from material specified by ECCN 8C001;

***Technical Note:*** *The objective of 8A002.a.4 should not be defeated by the export of 'syntactic foam' controlled by 8C001 when an intermediate stage of manufacture has been performed and it is not yet in its final component form.*

b. Systems "specially designed" or modified for the automated control of the motion of submersible vehicles controlled by 8A001, using navigation data, having closed loop servo-

controls and having any of the following:

b.1. Enabling a vehicle to move within 10 m of a predetermined point in the water column;

b.2. Maintaining the position of the vehicle within 10 m of a predetermined point in the water column; *or*

b.3. Maintaining the position of the vehicle within 10 m while following a cable on or under the seabed;

c. Fiber optic pressure hull penetrators;

d. Underwater vision systems having all of the following:

d.1. "Specially designed" or modified for remote operation with an underwater vehicle; *and*

d.2. Employing any of the following techniques to minimize the effects of back scatter:

d.2.a. Range-gated illuminators; *or*

d.2.b. Range-gated "laser" systems;

e. [Reserved]

f. [Reserved]

g. Light systems "specially designed" or modified for underwater use, as follows:

g.1. Stroboscopic light systems capable of a light output energy of more than 300 J per flash and a flash rate of more than 5 flashes per second;

g.2. Argon arc light systems “specially designed” for use below 1,000 m;

h. “Robots” “specially designed” for underwater use, controlled by using a dedicated computer and having any of the following:

h.1. Systems that control the “robot” using information from sensors which measure force or torque applied to an external object, distance to an external object, or tactile sense between the “robot” and an external object; *or*

h.2. The ability to exert a force of 250 N or more or a torque of 250 Nm or more and using titanium based alloys or “composite” “fibrous or filamentary materials” in their structural members;

i. Remotely controlled articulated manipulators “specially designed” or modified for use with submersible vehicles and having any of the following:

i.1. Systems which control the manipulator using information from sensors which measure any of the following:

i.1.a. Torque or force applied to an external object; *or*

i.1.b. Tactile sense between the manipulator and an external object; *or*

i.2. Controlled by proportional master-slave techniques and having 5 degrees of 'freedom of movement' or more;

***Technical Note:*** *Only functions having proportionally related motion control using positional feedback are counted when determining the number of degrees of 'freedom of movement'.*

j. Air independent power systems "specially designed" for underwater use, as follows:

j.1. Brayton or Rankine cycle engine air independent power systems having any of the following:

j.1.a. Chemical scrubber or absorber systems, "specially designed" to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;

j.1.b. Systems "specially designed" to use a monoatomic gas;

j.1.c. Devices or enclosures, "specially designed" for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *or*

j.1.d. Systems having all of the following:

j.1.d.1. “Specially designed” to pressurize the products of reaction or for fuel reformation;

j.1.d.2. “Specially designed” to store the products of the reaction; *and*

j.1.d.3. “Specially designed” to discharge the products of the reaction against a pressure of 100 kPa or more;

j.2. Diesel cycle engine air independent systems having all of the following:

j.2.a. Chemical scrubber or absorber systems, “specially designed” to remove carbon dioxide, carbon monoxide and particulates from recirculated engine exhaust;

j.2.b. Systems “specially designed” to use a monoatomic gas;

j.2.c. Devices or enclosures, “specially designed” for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *and*

j.2.d. “Specially designed” exhaust systems that do not exhaust continuously the products of combustion;

j.3. “Fuel cell” air independent power systems with an output exceeding 2 kW and having any

of the following:

j.3.a. Devices or enclosures, “specially designed” for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *or*

j.3.b. Systems having all of the following:

j.3.b.1. “Specially designed” to pressurize the products of reaction or for fuel reformation;

j.3.b.2. “Specially designed” to store the products of the reaction; *and*

j.3.b.3. “Specially designed” to discharge the products of the reaction against a pressure of 100 kPa or more;

j.4. Stirling cycle engine air independent power systems having all of the following:

j.4.a. Devices or enclosures, “specially designed” for underwater noise reduction in frequencies below 10 kHz, or special mounting devices for shock mitigation; *and*

j.4.b. “Specially designed” exhaust systems which discharge the products of combustion against a pressure of 100 kPa or more;

k. [Reserved]

l. [Reserved]

m. [Reserved]

n. [Reserved]

o. Propellers, power transmission systems, power generation systems and noise reduction systems, as follows:

o.1. [Reserved]

o.2. Water-screw propeller, power generation systems or transmission systems, designed for use on vessels, as follows:

o.2.a. Controllable-pitch propellers and hub assemblies, rated at more than 30 MW;

o.2.b. Internally liquid-cooled electric propulsion engines with a power output exceeding 2.5 MW;

o.2.c. “Superconductive” propulsion engines or permanent magnet electric propulsion engines, with a power output exceeding 0.1 MW;

o.2.d. Power transmission shaft systems incorporating “composite” material “parts” or “components” and capable of transmitting more than 2 MW;

o.2.e. Ventilated or base-ventilated propeller systems, rated at more than 2.5 MW;

o.3. Noise reduction systems designed for use on vessels of 1,000 tonnes displacement or more, as follows:

o.3.a. Systems that attenuate underwater noise at frequencies below 500 Hz and consist of compound acoustic mounts for the acoustic isolation of diesel engines, diesel generator sets, gas turbines, gas turbine generator sets, propulsion motors or propulsion reduction gears, “specially designed” for sound or vibration isolation and having an intermediate mass exceeding 30% of the equipment to be mounted;

o.3.b. ‘Active noise reduction or cancellation systems’ or magnetic bearings, “specially designed” for power transmission systems;

***Technical Note**: 'Active noise reduction or cancellation systems' incorporate electronic control systems capable of actively reducing equipment vibration by the generation of anti-noise or anti-vibration signals directly to the source.*

p. Pumpjet propulsion systems having all of the following:

p.1. Power output exceeding 2.5 MW; *and*

p.2. Using divergent nozzle and flow conditioning vane techniques to improve propulsive efficiency or reduce propulsion-generated underwater-radiated noise;

q. Underwater swimming and diving equipment as follows;

q.1. Closed circuit rebreathers;

q.2. Semi-closed circuit rebreathers;

***Note:*** *8A002.q does not control individual rebreathers for personal use when accompanying their users.*

***N.B.*** *For equipment and devices "specially designed" for military use see ECCN 8A620.f.*

r. Diver deterrent acoustic systems "specially designed" or modified to disrupt divers and having a sound pressure level equal to or exceeding 190 dB (reference 1 μPa at 1 m) at frequencies of 200 Hz and below.

***Note 1:*** *8A002.r does not apply to diver deterrent systems based on under-water-explosive devices, air guns or combustible sources.*

***Note 2:*** *8A002.r includes diver deterrent acoustic systems that use spark gap sources, also known as plasma sound sources.*

39. In Supplement No. 1 to Part 774, Category 8, ECCN 8B001 is revised to read as follows:

**8B001 Water tunnels designed to have a background noise of less than 100 dB (reference 1 μPa, 1 Hz) within the frequency range exceeding 0 Hz but not exceeding to 500 Hz and designed for measuring acoustic fields generated by a hydro-flow around propulsion system models.**

**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:* $3000

*GBS:* N/A

**List of Items Controlled**

*Related Controls*: N/A

*Related Definitions*: N/A

*Items*:

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

40. In Supplement No. 1 to Part 774, Category 8, ECCN 8D001 is revised to read as follows:

**8D001 "Software" "specially designed" or modified for the "development," "production" or "use" of equipment or materials, controlled by 8A (except 8A992), 8B or 8C.**

**License Requirements**

*Reason for Control*: NS, AT

| Control(s) | Country Chart (see Supp. No. 1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1 |
| AT applies to entire entry | AT Column 1 |

**Reporting Requirements**

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

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

*TSR:* Yes, except for 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" "specially designed" for the "development" or "production" of equipment controlled by 8A001.b, 8A001.c.1, or 8A002.o.3.b.

**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 in 8A001.b, 8A001.c, 8A002.b, 8A002.h, 8A002.j, 8A002.o.3 or 8A002.p to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

*Related Controls*: N/A

*Related Definitions*: N/A

*Items*:

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

41. In Supplement No. 1 to Part 774, Category 8, ECCN 8E001 is revised to read as follows:

**8E001 "Technology" according to the General Technology Note for the "development" or "production" of equipment or materials, controlled by 8A (except 8A992), 8B or 8C.**

**License Requirements**

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

| Control(s) | Country Chart |
|---|---|

| | |
|---|---|
| | **(see Supp. No. 1 to part 738)** |
| NS applies to entire entry | NS Column 1 |
| AT applies to entire entry | AT Column 1 |

**Reporting Requirements**

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

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

***TSR:*** Yes, except for exports or reexport to destinations outside of those countries listed in Country Group A:5 (Supplement No. 1 to part 740 of the EAR) of "technology" for items controlled by 8A001.b, 8A001.c.1 or 8A002.o.3.b.

**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 8A001.b, 8A001.c, 8A002.b, 8A002.h, 8A002.j, 8A002.o.3 or 8A002.p to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

**List of Items Controlled**

***Related Controls*:** N/A

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

***Items*:**

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

**Category 9 - Aerospace and Propulsion**

42. In Supplement No. 1 to Part 774, Category 9, ECCN 9A010 is revised to read as follows:

**9A010 "Specially Designed" "Parts," "Components," Systems and Structures, for Launch Vehicles, Launch Vehicle Propulsion Systems or "Spacecraft". (See Related Controls paragraph.)**

**List of Items Controlled**

*Related Controls*: (1) See USML Category IV of the International Traffic in Arms Regulations (ITAR) (22 CFR parts 120 through 130) and ECCN 9A604 for paragraphs 9A010.a, .b and .d. (2) See USML Category XV of the ITAR and ECCN 9A515 for paragraph 9A010.c. (3) See Supplement No. 4 to part 774, Order of Review for guidance on the process for determining classification of items.

*Related Definitions:* N/A

*Items*:

a. “Parts”, “components” and structures, each exceeding 10 kg and “specially designed” for launch vehicles manufactured using any of the following:

a.1. “Composite” materials consisting of “fibrous or filamentary materials” specified by 1C010.e and resins specified by 1C008 or 1C009.b;

a.2. Metal “matrix” “composites” reinforced by any of the following:

a.2.a. Materials specified by 1C007;

a.2.b. “Fibrous or filamentary materials” specified by 1C010; *or*

a.2.c. Aluminides specified by 1C002.a; *or*

a.3. Ceramic “matrix” “composite” materials specified by 1C007;

***Note:*** *The weight cut-off is not relevant for nose cones.*

b. “Parts”, “components” and structures, “specially designed” for launch vehicle propulsion systems specified by 9A005 to 9A009, manufactured using any of the following:

b.1. “Fibrous or filamentary materials” specified by 1C010.e and resins specified by 1C008 or

1C009.b;

b.2. Metal “Matrix “composites” reinforced by any of the following:

b.2.a. Materials specified by 1C007;

b.2.b. “Fibrous or filamentary materials” specified by 1C010; *or*

b.2.c. Aluminides specified by 1C002.a; *or*

b.3. Ceramic “matrix” “composite” materials specified by 1C007;

c. Structural components and isolation systems, specially designed to control actively the dynamic response or distortion of “spacecraft” structures;

d. Pulsed liquid rocket engines with thrust-to-weight ratios equal to or more than 1 kN/kg and a ‘response time’ of less than 30 ms.

***Technical Note:*** *For the purposes of 9A010.d, ‘response time’ means the time required to achieve 90% of total rated thrust from start-up.*

43. In Supplement No. 1 to Part 774, Category 9, ECCN 9A610 is revised to read as follows:

**9A610 Military aircraft and related commodities, other than those enumerated in 9A991.a**

**(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 except:<br>9A610.b; parts and components controlled in 9A610.x if being exported or reexported for use in an aircraft controlled in 9A610.b; and 9A610.y. | NS Column 1 |
| RS applies to entire entry except:<br>9A610.b; parts and components controlled in 9A610.x if being exported or reexported for use in an aircraft controlled in 9A610.b; and 9A610.y. | RS Column 1 |
| RS applies to 9A610.y | China, Russia, or Venezuela (see §742.6(a)(7)) |
| MT applies to 9A610.t, .u, .v, and .w | MT Column 1 |
| AT applies to entire entry | AT Column 1 |
| UN applies to entire entry except 9A610.y. | See § 746.1(b) for UN controls |

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

*LVS*: $1500

*GBS*: N/A

**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 any item in 9A610.a (i.e., "end item" military aircraft), unless determined by BIS to be eligible for License Exception STA in accordance with §740.20(g) (License Exception STA eligibility requests for 9x515 and "600 series" items). (2) Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2) of the EAR) may not be used for any item in 9A610.

**List of Items Controlled**

*Related Controls:* (1) Military aircraft and related articles that are enumerated in USML Category VIII, and technical data (including software) directly related thereto, are subject to the ITAR. (2) See ECCN 0A919 for controls on foreign-made "military commodities" that incorporate more than a de minimis amount of U.S.-origin "600 series" controlled content. (3) See USML Category XIX and ECCN 9A619 for controls on military aircraft gas turbine engines and related items.

*Related Definitions*: In paragraph .y of this entry, the term 'fluid' includes liquids and gases.

*Items*:

a. 'Military Aircraft' "specially designed" for a military use that are not enumerated in USML paragraph VIII(a).

***Note 1****: For purposes of paragraph .a the term 'military aircraft' means the LM-100J aircraft and any aircraft "specially designed" for a military use that are not enumerated in USML paragraph VIII(a). The term includes: Trainer aircraft; cargo aircraft; utility fixed wing aircraft; military helicopters; observation aircraft; military non-expansive balloons and other lighter-than-air aircraft; and unarmed military aircraft, regardless of origin or designation. Aircraft with modifications made to incorporate safety of flight features or other FAA or NTSB modifications such as transponders and air data recorders are "unmodified" for the purposes of this paragraph .a.*

***Note 2****: 9A610.a does not control 'military aircraft' or "lighter-than-air vehicles" that:*

*a. Were first manufactured before 1946;*

*b. Do not incorporate defense articles enumerated or otherwise described on the U.S. Munitions List, unless the items are required to meet safety or airworthiness standards of civil aviation authorities of a Wassenaar Arrangement Participating State; and*

*c. Do not incorporate weapons enumerated or otherwise described on the U.S. Munitions List, unless inoperable and incapable of being returned to operation.*

b. L-100 aircraft manufactured prior to 2013.

c. - d. [Reserved]

e. Mobile aircraft arresting and engagement runway systems for aircraft controlled by either USML Category VIII(a) or ECCN 9A610.a.

f. Pressure refueling equipment and equipment that facilitates operations in confined areas, "specially designed" for aircraft controlled by either USML paragraph VIII(a) or ECCN 9A610.a.

g. Aircrew life support equipment, aircrew safety equipment and other devices for emergency escape from aircraft controlled by either USML paragraph VIII(a) or ECCN 9A610.a.

h. Parachutes, paragliders, complete parachute canopies, harnesses, platforms, electronic release mechanisms, "specially designed" for use with aircraft controlled by either USML paragraph VIII(a) or ECCN 9A610.a, and "equipment" "specially designed" for military high altitude parachutists, such as suits, special helmets, breathing systems, and navigation equipment.

i. Controlled opening equipment or automatic piloting systems, designed for parachuted loads.

j. Ground effect machines (GEMS), including surface effect machines and air cushion vehicles, "specially designed" for use by a military.

k. through s. [Reserved]

t. Composite structures, laminates, and manufactures thereof "specially designed" for unmanned aerial vehicles controlled under USML Category VIII(a) with a range equal to or greater than 300 km.

***Note to paragraph .t****: Composite structures, laminates, and manufactures thereof "specially designed" for unmanned aerial vehicles controlled under USML Category VIII(a) with a maximum range less than 300 km are controlled in paragraph .x of this entry.*

u. Apparatus and devices "specially designed" for the handling, control, activation and non-ship-based launching of UAVs controlled by either USML paragraph VIII(a) or ECCN 9A610.a, and capable of a range equal to or greater than 300 km.

***Note to paragraph .u****: Apparatus and devices "specially designed" for the handling, control, activation and non-ship-based launching of UAVs controlled by either USML paragraph VIII(a) or ECCN 9A610.a with a maximum range less than 300 km are controlled in paragraph .x of this entry.*

v. Radar altimeters designed or modified for use in UAVs controlled by either USML paragraph

VIII(a) or ECCN 9A610.a., and capable of delivering at least 500 kilograms payload to a range of at least 300 km.

***Note to paragraph .v**: Radar altimeters designed or modified for use in UAVs controlled by either USML paragraph VIII(a) or ECCN 9A610.a. that are not capable of delivering at least 500 kilograms payload to a range of at least 300 km are controlled in paragraph .x of this entry.*

w.1. Pneumatic hydraulic, mechanical, electro-optical, or electromechanical flight control systems (including fly-by-wire and fly-by-light systems) and attitude control equipment designed or modified for UAVs controlled by either USML paragraph VIII(a) or ECCN 9A610.a., and capable of delivering at least 500 kilograms payload to a range of at least 300 km.

***Note to paragraph .w.1**: Pneumatic, hydraulic, mechanical, electro-optical, or electromechanical flight control systems (including fly-by-wire and fly-by-light systems) and attitude control equipment designed or modified for UAVs controlled by either USML paragraph VIII(a) or ECCN 9A610.a., not capable of delivering at least 500 kilograms payload to a range of at least 300 km are controlled in paragraph .x of this entry.*

w.2. Flight control servo valves designed or modified for the systems in 9A610.w.1. and designed or modified to operate in a vibration environment greater than 10g rms over the entire range between 20Hz and 2 kHz.

***Note to paragraph .w:** Paragraphs 9A610.w.1. and 9A610.w.2. include the systems,*

*equipment and valves designed or modified to enable operation of manned aircraft as unmanned aerial vehicles.*

x. "Parts," "components," "accessories," and "attachments" that are "specially designed" for a commodity enumerated or otherwise described in ECCN 9A610 (except for 9A610.y) or a defense article enumerated or otherwise described in USML Category VIII and not elsewhere specified on the USML or in 9A610.y, 9A619.y, or 3A611.y.

y. Specific "parts," "components," "accessories," and "attachments" "specially designed" for a commodity subject to control in this entry, ECCN 9A619, or for a defense article in USML Categories VIII or XIX and not elsewhere specified in the USML or the CCL, and other aircraft commodities "specially designed" for a military use, as follows, and "parts," "components," "accessories," and "attachments" "specially designed" therefor:

y.1. Aircraft tires;

y.2. Analog gauges and indicators;

y.3. Audio selector panels;

y.4. Check valves for hydraulic and pneumatic systems;

y.5. Crew rest equipment;

y.6. Ejection seat mounted survival aids;

y.7. Energy dissipating pads for cargo (for pads made from paper or cardboard);

y.8. Fluid filters and filter assemblies;

y.9. Galleys;

y.10. Fluid hoses, straight and unbent lines (for a commodity subject to control in this entry or defense article in USML Category VIII), and fittings, couplings, clamps (for a commodity subject to control in this entry or defense article in USML Category VIII) and brackets therefor;

y.11. Lavatories;

y.12. Life rafts;

y.13. Magnetic compass, magnetic azimuth detector;

y.14. Medical litter provisions;

y.15. Cockpit or cabin mirrors;

y.16. Passenger seats including palletized seats;

y.17. Potable water storage systems;

y.18. Public address (PA) systems;

y.19. Steel brake wear pads (does not include sintered mix or carbon/carbon materials);

y.20. Underwater locator beacons;

y.21. Urine collection bags/pads/cups/pumps;

y.22. Windshield washer and wiper systems;

y.23. Filtered and unfiltered panel knobs, indicators, switches, buttons, and dials;

y.24. Lead-acid and Nickel-Cadmium batteries;

y.25. Propellers, propeller systems, and propeller blades used with reciprocating engines;

y.26. Fire extinguishers;

y.27. Flame and smoke/$CO_2$ detectors;

y.28. Map cases;

y.29. 'Military Aircraft' that were first manufactured from 1946 to 1955 that do not incorporate defense articles enumerated or otherwise described on the U.S. Munitions List, unless the items are required to meet safety or airworthiness standards of a Wassenaar Arrangement Participating State; and do not incorporate weapons enumerated or otherwise described on the U.S. Munitions List, unless inoperable and incapable of being returned to operation;

y.30. "Parts," "components," "accessories," and "attachments," other than electronic items or navigation equipment, for use in or with a commodity controlled by ECCN 9A610.h;

y.31. Identification plates and nameplates; *and*

y.32. Fluid manifolds.

44. In Supplement No. 1 to Part 774, Category 9, ECCN 9B001 is revised to read as follows:

**9B001 Manufacturing equipment, tooling or fixtures, as follows (See List of Items Controlled).**

**License Requirements**

*Reason for Control*: NS, MT, AT

| Control(s) | Country Chart (see Supp. No.1 to part 738) |
|---|---|
| NS applies to entire entry | NS Column 1 |
| MT applies to equipment for engines controlled under 9A001 for MT reasons and for engines controlled under 9A101 | MT Column 1 |
| AT applies to entire entry | AT Column 1 |

**Reporting Requirements**

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

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

*LVS*: $5000, except N/A for MT

*GBS*: Yes, except N/A for MT

**Special Conditions for STA**

*STA:* License Exception STA may not be used to ship commodities in 9B001 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*: For "specially designed" production equipment of systems, sub-systems, "parts" and "components" controlled by 9A005 to 9A009, 9A011, 9A101, 9A105 to 9A109, 9A111, and 9A116 to 9A119 usable in "missiles" see 9B115. See also 9B991.

*Related Definitions*: N/A

*Items*:

a. Directional solidification or single crystal casting equipment designed for "superalloys";

b. Casting tooling, "specially designed" for manufacturing gas turbine engine blades, vanes or "tip shrouds", manufactured from refractory metals or ceramics, as follows:

b.1. Cores;

b.2. Shells (moulds);

b.3. Combined core and shell (mould) units;

c. Directional-solidification or single-crystal additive-manufacturing equipment, "specially designed" for manufacturing gas turbine engine blades, vanes or "tip shrouds".

45. 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

| **Control(s)** | **Country Chart (see Supp. No. 1 to part 738)** |
|---|---|
| NS applies to entire entry | NS Column 1 |
| SI applies to 9E003.a.1 through a.8,.h, .i, and .k. | See §742.14 of the EAR for additional |

| | |
|---|---|
| | information. |
| AT applies to entire entry | AT Column 1 |

**Reporting Requirements**

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

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

*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 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 1,883 K (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 1,883 K (1,610°C) and having holes that meet the parameters specified by 9E003.c;

***Note**: The "required" "technology" for holes in 9E003.a.2 is limited to the derivation of the geometry and location of the holes.*

***Technical Notes:***

*1. 'Thermally decoupled liners' are liners that feature at least a support structure designed to carry mechanical loads and a combustion facing structure designed to protect the support structure from the heat of combustion. The combustion facing structure and support structure have independent thermal displacement (mechanical displacement due to thermal load) with respect to one another, i.e. they are thermally decoupled.*

*2. 'Combustor exit temperature' is the bulk average gas path total (stagnation) temperature between the combustor exit plane and the leading edge of the turbine inlet guide vane (i.e.,*

*measured at engine station T40 as defined in SAE ARP 755A) when the engine is running in a 'steady state mode' of operation at the certificated maximum continuous operating temperature.*

***N.B.**: See 9E003.c for "technology" "required" for manufacturing cooling holes.*

a.3. "Parts" or "components," that are any of the following:

a.3.a. Manufactured from organic "composite" materials designed to operate above 588 K (315 °C);

a.3.b. Manufactured from any of the following:

a.3.b.1. Metal "matrix" "composites" reinforced by any of the following:

a.3.b.1.a. Materials controlled by 1C007;

a.3.b.1.b. "Fibrous or filamentary materials" specified by 1C010; *or*

a.3.b.1.c. Aluminides specified by 1C002.a; *or*

a.3.b.2. Ceramic "matrix" "composites" specified by 1C007; *or*

a.3.c. Stators, vanes, blades, tip seals (shrouds), rotating blings, rotating blisks or 'splitter

ducts', that are all of the following:

a.3.c.1. Not specified in 9E003.a.3.a;

a.3.c.2. Designed for compressors or fans; *and*

a.3.c.3. Manufactured from material controlled by 1C010.e with resins controlled by 1C008;

***Technical Note****: A 'splitter duct' performs the initial separation of the air-mass flow between the bypass and core sections of the engine.*

a.4. Uncooled turbine blades, vanes or "tip shrouds" designed to operate at a 'gas path temperature' of 1,373 K (1,100 °C) or more;

a.5. Cooled turbine blades, vanes or "tip-shrouds", other than those described in 9E003.a.1, designed to operate at a 'gas path temperature' of 1,693 K (1,420°C) or more;

***Technical Notes****:*

*1. 'Gas path temperature' is the bulk average gas path total (stagnation) temperature at the leading edge plane of the turbine component when the engine is running in a 'steady state mode' of operation at the certificated or specified maximum continuous operating temperature.*

*2. The term 'steady state mode' defines engine operation conditions, where the engine parameters, such as thrust/power, rpm and others, have no appreciable fluctuations, when the ambient air temperature and pressure at the engine inlet are constant.*

a.6. Airfoil-to-disk blade combinations using solid state joining;

a.7. [Reserved]

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 $mm^2$;

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 $mm^2$;

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**:*

*46. For the purposes of 9E003.c, the 'cross-sectional area' is the area of the hole in the plane perpendicular to the hole axis.*

*2. For the purposes of 9E003.c, 'hole shape ratio' is the nominal length of the axis of the hole divided by the square root of its minimum 'cross-sectional area'.*

*3. For the purposes of 9E003.c, 'incidence angle' is the acute angle measured between the plane tangential to the airfoil surface and the hole axis at the point where the hole axis enters the airfoil surface.*

*4. Techniques for manufacturing holes in 9E003.c include “laser”, water jet, Electro-*

*Chemical Machining (ECM) or Electrical Discharge Machining (EDM) methods.*

d. "Technology" "required" for the "development" or "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems;

e. "Technology" for the "development" or "production" of reciprocating diesel engine ground vehicle propulsion systems having all of the following:

e.1. 'Box volume' of 1.2 $m^3$ 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/$m^3$ 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 center-line 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 $mm^3$ per injection per cylinder; *and*

f.3.b. Electronic control features “specially designed” for switching governor characteristics automatically depending on fuel property to provide the same torque characteristics by using the appropriate sensors;

g. “Technology” “required” for the development” or “production” of ‘high output diesel engines’ for solid, gas phase or liquid film (or combinations thereof) cylinder wall lubrication and permitting operation to temperatures exceeding 723 K (450°C), measured on the cylinder wall at the top limit of travel of the top ring of the piston;

***Technical Note****: ‘High output diesel engines’ are diesel engines with a specified brake mean effective pressure of 1.8 MPa or more at a speed of 2,300 r.p.m., provided the rated speed is 2,300 r.p.m. or more.*

h. “Technology” for gas turbine engine “FADEC systems” as follows:

h.1. “Development” “technology” for deriving the functional requirements for the “parts” or “components” necessary for the “FADEC system” to regulate engine thrust or shaft power (e.g., feedback sensor time constants and accuracies, fuel valve slew rate);

h.2. “Development” or “production” “technology” for control and diagnostic “parts” or “components” unique to the “FADEC system” and used to regulate engine thrust or shaft power;

h.3. “Development” “technology” for the control law algorithms, including “source code”, unique to the “FADEC system” and used to regulate engine thrust or shaft power;

***Note****: 9E003.h does not apply to technical data related to engine-“aircraft” integration*

*required by civil aviation authorities of one or more Wassenaar Arrangement Participating States (See Supplement No. 1 to part 743 of the EAR) to be published for general airline use (e.g., installation manuals, operating instructions, instructions for continued airworthiness) or interface functions (e.g., input/output processing, airframe thrust or shaft power demand).*

i. "Technology" for adjustable flow path systems designed to maintain engine stability for gas generator turbines, fan or power turbines, or propelling nozzles, as follows:

i.1. "Development" "technology" for deriving the functional requirements for the "parts" or "components" that maintain engine stability;

i.2. "Development" or "production" "technology" for "parts" or "components" unique to the adjustable flow path system and that maintain engine stability;

i.3. "Development" "technology" for the control law algorithms, including "source code", unique to the adjustable flow path system and that maintain engine stability;

***Note:*** *9E003.i does not apply to "technology" for any of the following:*

*a. Inlet guide vanes;*

*b. Variable pitch fans or prop-fans;*

*c. Variable compressor vanes;*

*d. Compressor bleed valves; or*

*e. Adjustable flow path geometry for reverse thrust.*

j. "Technology" "required" for the "development" of wing-folding systems designed for fixed-wing "aircraft" powered by gas turbine engines.

***N.B.:*** *For "technology" "required" for the "development" of wing-folding systems designed for fixed-wing "aircraft" specified in USML Category VIII (a), see USML Category VIII (i).*

k. "Technology" not otherwise controlled in 9E003.a.1 through a.8, a.10, and .h and used in the "development", "production", or overhaul of hot section "parts" or "components" of civil derivatives of military engines controlled on the U.S. Munitions List.

47. Supplement No. 6 to part 774 is amended by revising paragraphs (3), (6)(xiii), and (8)(i) and (ii), (vi), and (viii) to read as follows:

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

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*(3) Category 3*

(i) 3A001.b.2 - "Monolithic Microwave Integrated Circuit" ("MMIC") amplifiers that are any of the following:

(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:

(A.1.) A peak saturated power output greater than *300 W (54.8 dBm)* at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;

(A.2.) A peak saturated power output greater than *300 W (54.8 dBm)* at any frequency exceeding 2.9 GHz up to and including 3.2 GHz;

(A.3.) A peak saturated power output greater than *300 W (54.8 dBm)* at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; or

(A.4.) A peak saturated power output greater than *120 W (50.8 dBm)* at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

(B) Rated for operation at frequencies exceeding 6.8 GHz up to and including *12 GHz* with a "fractional bandwidth" greater than 10%, and having any of the following:

(B.1) A peak saturated power output greater than *25 W (44 dBm)* at any frequency exceeding 6.8 GHz up to and including 8.5 GHz; or

(B.2.) A peak saturated power output greater than *25 W (44 dBm)* at any frequency exceeding 8.5 GHz up to and including *12 GHz*.

(ii) 3A001.b.3 - Discrete microwave transistors that are any of the following:

(A) Rated for operation at frequencies exceeding 2.7 GHz up to and including 6.8 GHz and having any of the following:

(A.1.) A peak saturated power output greater than *600 W (57.8 dBm)* at any frequency exceeding 2.7 GHz up to and including 2.9 GHz;

(A.2.) A peak saturated power output greater than *600 W (57.8 dBm)* at any frequency

exceeding 2.9 GHz up to and including 3.2 GHz;

(A.3.) A peak saturated power output greater than *600 W (57.8 dBm)* at any frequency exceeding 3.2 GHz up to and including 3.7 GHz; or

(A.4.) A peak saturated power output greater than *130 W (51.2 dBm)* at any frequency exceeding 3.7 GHz up to and including 6.8 GHz;

(B) Rated for operation at frequencies exceeding 6.8 GHz up to and including *12 GHz* and having any of the following:

(B.1.) A peak saturated power output greater than *130 W (51.2 dBm)* at any frequency exceeding 6.8 GHz up to and including 8.5 GHz;

(B.2.) A peak saturated power output greater than *60 W (47.8 dBm)* at any frequency exceeding 8.5 GHz up to and including 12 GHz.

(iii) 3A002.g.1.

(iv) 3D001 – "Software" "specially designed" for the "development" or "production" of equipment controlled under 3A001.b.2, 3A001.b.3, and 3A002.g.1.

(v) 3E001 – "Technology" according to the General Technology Note for the "development" or "production" of equipment controlled under 3A001.b.2, 3A001.b.3, and .3A002.g.1.

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*(6) Category 6*

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(xiii) 6A002.a.3 – Subject to the following additional notes:

***Note 1****: 6A002.a.3 does not apply to the following "focal plane arrays" in this Supplement:*

*a. Platinum Silicide (PtSi) "focal plane arrays" having less than 10,000 elements;*

*b. Iridium Silicide (IrSi) "focal plane arrays".*

***Note 2**: 6A002.a.3 does not apply to the following "focal plane arrays" in this Supplement:*

*a. Indium Antimonide (InSb) or Lead Selenide (PbSe) "focal plane arrays" having less than 256 elements;*

*b. Indium Arsenide (InAs) "focal plane arrays";*

*c. L Lead Sulphide (PbS) "focal plane arrays";*

*d. Indium Gallium Arsenide (InGaAs) "focal plane arrays".*

***Note 3**: 6A002.a.3 does not apply to Mercury Cadmium Telluride (HgCdTe) "focal plane arrays" as follows in this Supplement:*

*a. 'Scanning Arrays' having any of the following:*

*1. 30 elements or less; or*

*2. Incorporating time delay-and-integration within the element and having 2 elements or less;*

*b. 'Staring Arrays' having less than 256 elements.*

***Technical Notes:***

*a. 'Scanning Arrays' are defined as "focal plane arrays" designed for use with a scanning optical system that images a scene in a sequential manner to produce an image;*

*b. 'Staring Arrays' are defined as "focal plane arrays" designed for use with a nonscanning optical system that images a scene.*

***Note 6**: 6A002.a.3 does not apply to the following "focal plane arrays" in this List:*

*a. Gallium Arsenide (GaAs) or Gallium Aluminum Arsenide (GaAlAs) quantum well*

*"focal plane arrays" having less than 256 elements;*

b. Microbolometer "focal plane arrays" having less than 8,000 elements.

***Note 7**: 6A002.a.3.g does not apply to "focal plane arrays", "specially designed" or modified to achieve 'charge multiplication', as follows:*

*a. Linear (1-dimensional) arrays having 4,096 elements or less.*

*b. Non-linear (2-dimensional) arrays having all of the following;*

*b.1. A total of 250,000 elements or less; and*

*b.2. A maximum of 4,096 elements in each dimension.*

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*(8) Category 8*

(i) 8A001.b to .c.

(ii) 8A002.b – Systems specially designed or modified for the automated control of the motion of submersible vehicles specified by 8A001.b through .c using navigation data having closed loop servo-controls and having any of the following:

(A) Enabling a vehicle to move within 10 m of a predetermined point in the water column;

(B) Maintaining the position of the vehicle within 10 m of a predetermined point in the water column; or

(C) Maintaining the position of the vehicle within 10 m while following a cable on or under the seabed.

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(vi) 8D001 – "Software" specially designed for the "development" or "production" of equipment in 8A001.b to .c, 8A002.b (as described in this Supplement), 8A002.h, 8A002.j, 8A002.o.3, or

8A002.p.

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(viii) 8E001 – "Technology" according to the General Technology Note for the "development" or "production" of equipment specified by 8A001.b to .c, 8A002.b (as described in this Supplement), 8A002.h, 8A002.j, 8A002.o.3, or 8A002.p.

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48. Supplement No. 7 to part 774 is amended by revising paragraph (5) to read as follows:

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

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*(5) Category 8*

(i) 8A001.b.

(ii) 8A001.c.1.

(iii) 8A002.o.3.b.

(iv) 8D001 – "Software" specially designed for the "development" or "production" of equipment specified by 8A001.b, 8A001.c.1, or 8A002.o.3.b.

(v) 8E001 – "Technology" according to the General Technology Note for the "development" or "production" of equipment specified by 8A001.b, 8A001.c.1, or 8A002.o.3.b.

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Matthew S. Borman

Deputy Assistant Secretary for Export Administration

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