E 3510-33-P

DEPARTMENT OF COMMERCE

Bureau of Industry and Security

15 CFR Parts 734, 740, 742, 772 and 774

[Docket No. 221019-0222]

RIN 0694-AI72

Implementation of 2021 Wassenaar Arrangement Decisions.

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. During the December 2021 Wassenaar Arrangement on Export Controls for Conventional Arms and Dual-Use Goods and Technologies (WA) Plenary meeting, Participating States of the WA (Participating State) made certain decisions affecting the WA control lists, which BIS is now implementing via amendments to the CCL. On August 15, 2022, BIS published a final rule that implemented some of these decisions by adding to the CCL four technologies that met the criteria for emerging or foundational technologies under Section 1758 of the Export Control Reform Act of 2018 (ECRA). This final rule implements the remaining controls agreed to during the December 2021 WA Plenary meeting by revising the CCL, as well as certain EAR provisions, including License Exception Adjusted Peak Performance (APP). This final rule also makes corrections to align the scope of Significant Item (SI) license requirements throughout the EAR and makes a revision to License Exception Strategic Trade Authorization (STA).

DATES: This rule is effective [**INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER**] except for the amendments to § 740.7(d)(3)(i) and (ii) (instruction 5) and to supplement no. 1 to part 774 ECCNs 4A003, 4D001, and 4D001 (instruction 13), which are

effective March 14, 2023**.**

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.

For technical questions contact:

Categories 0, 1 & 2: Sean Ghannadian at 202-482-3429 or Sean.Ghannadian@bis.doc.gov

Category 3: Carlos Monroy at 202-482-3246 or Carlos.Monroy@bis.doc.gov

Categories 4 & 5: Aaron Amundson or Anita Zinzuvadia 202-482-0707 or Aaron.Amundson@bis.doc.gov or Anita.Zinzuvadia@bis.doc.gov

Categories 6: John Varesi at 202-482-1114 or John.Varesi@bis.doc.gov

Categories 7: David Rosenberg at 202-482-5987, John Varesi at 202-482-1114 or David.Rosenberg@bis.doc.gov or John.Varesi@bis.doc.gov

Category 9: David Rosenberg at 202-482-5987 or David.Rosenberg@bis.doc.gov

"600 Series" (munitions items): Jeffrey Leitz at 202-482-7417 or Jeffrey.Leitz@bis.doc.gov

SUPPLEMENTARY INFORMATION:

Background

The WA (http://www.wassenaar.org/) is a group of 42 like-minded states committed to promoting responsibility and transparency in the global arms trade and preventing destabilizing accumulations of conventional weapons. As a Participating State of the WA, the United States has committed to controlling for export all items on the WA's List of Dual-Use Goods and Technologies (WA Dual-Use List) and on the WA Munitions List (together, WA control lists). The WA control lists were first established in 1996 and have been revised annually thereafter. Participating States have agreed to implement the changes to the WA control lists as soon as possible after agreed upon by the WA Plenary. The United States' implementation of WA control list changes ensures that U.S. companies have a level playing field with their competitors in other Participating States.

BIS published an interim final rule on August 15, 2022 (87 FR 49979), implementing four new controls on items meeting the criteria of Section 1758 of ECRA, which were part of the revisions to the WA control lists decided by Participating States at the December 2021 WA Plenary meeting. The changes to the CCL and related EAR parts made by this rule reflect the remaining revisions to the WA control lists decided during the December 2021 WA Plenary meeting. The rule also makes related clarifying edits to CCL entries and revisions to reflect technical advancements. Unless explicitly discussed below, the revisions made by this rule will not impact the number of license applications submitted to BIS.

Revisions to the Commerce Control List Related to WA 2021 Plenary Meeting Decisions

Revises (16) ECCNs: 1A613, 1C006, 2E003, 3A001, 3A002, 4A003, 4D001, 4E001, 5A003, 6A005, 6A008, 6D003, 7D003, 9A004, 9B001, and 9E003.

Removed (1) ECCN: 0A988

0A988 Conventional military steel helmets.

In a rule issued on January 2, 2014 (79 FR 264), effective July 1, 2014, BIS moved conventional steel helmets from ECCN 0A988 to newly added ECCN 1A613.y.1. ECCN 0A988 remained on the CCL but contained only a brief explanation that the control for these helmets had been moved to 1A613.y.1. Given the time that has elapsed since relocation of the control for these helmets, the explanation under paragraph 0A988, along with the entry itself, are no longer necessary. BIS is therefore removing ECCN 0A988 from the CCL.

1A613 Armored and protective "equipment" and related commodities

This rule revises 1A613.c "military helmets" by removing the phrase "and "specially designed" helmet shells, liners, or comfort pads therefor.", because it is duplicative of items that are already controlled under 1A613.x, specifically, any specially designed parts, components, or accessories would be controlled under 1A613.x, including the shells, liners, and pads currently specified in 1A613.c. In paragraph 1A613.c, this rule adds Note 3, which lists characteristics of items that are not controlled by 1A613.c, e.g., first manufactured before 1970. The same

language is added as a note to 1A613.y.1. The note below 1A613.x, which addresses examples of items controlled by this ECCN, is revised to improve readability.

1C006 Fluids and lubricating materials

This rule revises 1C006.b by removing paragraph b.2 (Fluorinated silicone fluids), because extensive market research submitted to the WA indicates that in the past two decades countries that are not Participating States have either developed or obtained the expertise to produce fluorinated silicone fluids. Due to the availability of this item in countries that are not Participating States, the Participating States decided to remove it from their control lists. BIS is accordingly removing the item from the CCL. Items previously controlled under 1C006.b.2 are now EAR99 and remain subject to the EAR.

ANNEX to Category 1 - List of Explosives (See ECCNs 1A004 and 1A008)

This rule revises the Annex to Category 1 of the CCL by adding two explosives under two entries, numbers 51 and 52, to the List of Explosives: EDNA (Ethylenedinitramine) (CAS 505-71-5); and TKX-50 (Dihydroxylammonium 5,5'-bistetrazole-1,1'-diolate). These two explosives were added in 2017 and 2018, respectively, to the WA Munitions List (ML 8.a.), and were added for consistency's sake to the List of Explosives set forth in the Annex of Category 1 of the WA Munitions List as part of the December 2021 WA Plenary. TKX-50 (Dihydroxylammonium 5,5'-bistetrazole-1,1'-diolate) is a high energetic material that outperforms numerous common explosives widely used today. For this reason, it was added to the WA Munitions List in 2018. EDNA is a legacy explosive standardized as a military explosive during World War II. EDNA has been studied in several countries but due to its lower energetic properties, it is not yet in full-scale use. Nevertheless, because EDNA has great potential for gun propellants applications, it was added to the WA Munitions List in 2017.

2E003 Other "technology"

This rule removes 2E003.b.2 (Technical data consisting of process methods) from the CCL. The control on the parameters described in 2E003.b.2 has remained unchanged since the

establishment of the WA Dual-Use List in 1996. Since that date, each of the four processes described in 2E003.b.2.a-d. have entered common commercial use, *e.g.*, golf clubs and automobile manufacturing. Therefore, there is no longer a reason to control the technical data specified in 2E003.b.2. on the CCL. This rule also deletes a note in the CCL related to one of the technologies in 2E003.b.2 and adds a nota bene (N.B.) regarding gas turbine engines.

Category 3 – Electronics Notes

This rule revises Note 1 to Category 3 by adding 3A001.b.12 to the list of 3A001 subparagraphs that are not within the scope of the note, i.e., if a 3A001.b.12 item is specially designed for or has the same functional characteristics as other equipment, then it remains classified as 3A001.b.12.

3A001 Electronic items & 3A002 General purpose "electronic assemblies," modules and equipment

This rule amends paragraph 3A001.b.4.b.1 by correcting the specified power output in decibel-milliwatts (dBm) from 48.54 dBm to 48.45 dBm. It also makes two additional technical corrections by adding "a" in 3A002.c.2 before "Displayed Average Noise Level" and in 3A002.d.4 before "single sideband".

This rule revises paragraphs 3A001.b.11.e ('frequency synthesizer' "electronic assemblies"), 3A002.d.3.e (signal generators with specified "frequency switching times"), and 3A002.d.5.c (signal generators with specified 'RF modulation bandwidth' of digital baseband signals) by decreasing the upper limit of the specified frequency range from 90 gigahertz (GHz) to 75 GHz. The upper limit of 75 GHz now applies to 3A001.b.11.e, 3A002.d.3.e, and 3A002.d.5.c, which have a "frequency switching time" of "less than 100 μs for any frequency change exceeding 2.2 GHz."

The Participating States decided to expand certain frequency ranges to account for higher signal generator Radio Frequency (RF) modulation bandwidth at millimeter-wave frequencies, specifically within the 60 to 90 GHz band (E-band), required for automotive anti-collision radar.

Specifically, the 76 to 81 GHz frequency band has been allocated for automotive radar in the United States and Europe. Moreover, electronic assemblies and signal generator requirements for automotive radar millimeter-wave applications will require RF modulated outputs over a bandwidth larger than the former control limit of 2.2 GHz RF modulation bandwidth.

Accordingly, 3A001.b.11.f is added as a new paragraph to control 'frequency synthesizer' "electronic assemblies" having a "frequency switching time" of "less than 100 μs for any frequency change exceeding 5.0 GHz within the synthesized frequency range exceeding 75 GHz but not exceeding 90 GHz." This rule also adds paragraph 3A002.d.3.g to control signal generators having a "frequency switching time" of "Less than 100 μs for any frequency change exceeding 5.0 GHz within the frequency range exceeding 75 GHz but not exceeding 90 GHz;" and adds paragraph 3A002.d.5.d to control signal generators with a 'RF modulation bandwidth' of digital baseband signals "Exceeding 5.0 GHz within the frequency range exceeding 75 GHz but not exceeding 90 GHz."

4A003 "Digital computers"

Prior to the publication of this rule, 4A003.b specified an APP threshold of 29 Weighted TeraFLOPS (WT) for "digital computers". However, for those Participating States that manufacture digital computer systems, including 32-socket servers that have approached this 29 WT threshold, such digital computer systems would likely exceed this APP threshold if built with the latest generation microprocessor in 2022 or in the near future. Additionally, there is an increased demand for database servers across a broad range of industries including business planning, banking/financial transactions, healthcare, genetic research, and fraud detection. To reflect these circumstances, the Participating States decided to raise the control threshold from 29 WT to 70 WT. The Participating States determined that this increase in control threshold would provide sufficient margin for a few years' growth before another adjustment would be necessary.

Accordingly, this rule raises the APP threshold for "digital computers" in 4A003.b from "exceeding 29 Weighted TeraFLOPS (WT)" to "exceeding 70 Weighted TeraFLOPS (WT)."

Consistent with this change, the Antiterrorism (AT) license requirement paragraph in the License Requirements section of 4A003 and the Note that follows the license requirement table are also amended by changing the specified APP threshold from 29 to 70 WT. The Congressional notification requirement set forth in subsection 1211(d) of the National Defense Authorization Act for Fiscal Year 1998 (Pub. L. 105–85, November 18, 1997, 111 Stat. 1629, 1932–1933, as amended; 50 U.S.C. 4604 note) provides that the President must submit a report to Congress 60 days before adjusting the composite theoretical performance level above which exports of digital computers to Tier 3 countries require a license. The submission of this report has been delegated to the Secretary of Commerce. On January 13, 2023, the Secretary of Commerce submitted to Congress a report that establishes and provides justification for the 70 WT control level using the APP formula. Therefore, this revision will become effective on March 14, 2023. BIS estimates that this revision will result in no change to license application submissions, because this revision is keeping pace with advancements in HPC technology.

This rule makes a correction by removing 4A003.e from the national security license requirements, because there currently is no paragraph 4A003.e.

4D001 "Software" & 4E001 "Technology"

In light of the change made to the APP threshold in 4A003.b, this rule makes conforming changes to the APP threshold in the License Exception Technology and Software under Restriction (TSR) eligibility paragraph and to the Special Conditions for STA paragraph under ECCNs 4D001 and 4E001 that raise the specified APP threshold from 29 WT to 70 WT. These revisions will become effective on March 14, 2023.

§ 740.7 License Exception Adjusted Peak Performance (APP)

This rule amends License Exception APP to raise the APP eligibility levels for deemed exports of "technology" and "software" source code destined to foreign nationals of Computer Tiers 1 and 3 Countries. These levels, which are recommended by industry groups in consultation with BIS, are raised to better enable the advancement of "development,"

"production," and "use" "technology" and "software" in the area of computer manufacturing, which in turn promotes advancements in military technology that bolster the national security of the United States.

Computer Tier 1 Revisions

This rule amends § 740.7(c)(3)(ii) by raising the APP from 40 WT to 175 WT for eligible deemed exports of "development" and "production" technology and source code to foreign nationals of Tier 1 countries. It also amends § 740.7(c)(3)(iii) by raising the APP from 200 WT to 500 WT for eligible deemed exports of "use" technology and source code to foreign nationals of Computer Tier 1 countries.

Computer Tier 3 Revisions

This rule amends § 740.7(d)(3)(i) by raising the APP from 16 WT to 50 WT for eligible deemed exports of "development" and "production" technology and source code to foreign nationals of Tier 3 countries. It also amends § 740.7(d)(3)(ii) by raising the APP from 32 WT to 140 WT for eligible deemed exports of "use" technology and source code to foreign nationals of Computer Tier 3 countries which becomes effective March 14, 2023.

License Exception Strategic Trade Authorization revision

This rule adds new paragraph (b)(2)(viii)(A) to § 740.20 License Exception Strategic Trade Authorization (STA) to harmonize this license exception with the STA special condition under ECCN 9B001 that states that STA may not be used for a Country Group A:6 destination. Consistent with this addition, this rule redesignates existing subparagraphs (A)-(F) as (B)-(G). This revision to STA aligns with BIS's goal to clarify restrictions on the availability of STA for the export, reexport, and transfer (in-country) of certain items controlled under the EAR as set forth in the preamble of a proposed rule published on October 22, 2021 (86 FR 58615). This revision is also generally responsive to a public comment received in response to that rule that is supportive of BIS's efforts to clarify restrictions on STA's availability. BIS is reviewing other

public comments that it received in response to that rule and will address them in a separate final rule at a future date.

As set forth below, this rule also makes certain revisions to ECCN 9B001.

5A003 "Systems," "equipment" and "components," for non-cryptographic "information security"

This rule revises 5A003.a to replace the word "using" with the words "to use," to clarify that the scope of controls applies to communication cable systems that were designed or modified to employ either mechanical, electrical or electronic means to detect surreptitious intrusion, not communication cable systems that were designed or modified by utilizing mechanical, electrical or electronic means.

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

6A005.d.1.b.1 applies to individual 'multiple-transverse mode' semiconductor "lasers" with an average or continuous wave (CW) output power exceeding 15 watts (W). This is a relatively low output power value. Multiple-transverse mode semiconductor lasers can achieve much higher powers and are now readily available outside of Participating States in an increasing number of commercial applications. For this reason, this rule revises 6A005.d.1.b.1 by increasing the average or CW output power from 15 W to 25 W for individual 'multiple-transverse mode' semiconductor "lasers."

6A008 Radar systems, equipment and assemblies

This rule revises Technical Note 1, which appears after the Note to 6A008.l, by replacing the word "used" with the word "designed" to clarify that the scope of the note applies to marine radars that are designed for civil application rather than to marine radars used for civil application.

6D003 Other "software"

This rule revises 6D003.h.1, which refers to certain Air Traffic Control "software application programs", by deleting the words "application programs," which are superfluous in this context. The word "software" sufficiently describes the scope of controlled under 6D003.h.1.

7D003 Other "software"

This rule makes an editorial revision to 7D003.e by adding a hyphen between the words "circulation" and "controlled" that appears after the word helicopter; as revised, the reference is to "helicopter circulation-controlled anti-torque or circulation-controlled direction control systems," which is a defined term in § 772.1 of the EAR.

9A004 Space launch vehicles and "spacecraft," "spacecraft buses", "spacecraft payloads", "spacecraft" on-board systems or equipment, terrestrial equipment, and air-launch platforms

This rule adds "sub-orbital craft" to the heading of ECCN 9A004 and to paragraph 9A004.g. Based on this addition, 9A004.g now controls "aircraft" "specially designed" or modified to be air-launch platforms for "sub-orbital craft." This change is being made to reflect the fact that "aircraft" "specially designed" or modified to be air-launch platforms for sub-orbital craft may be indistinguishable from "aircraft" "specially designed" or modified to be air-launch platforms for space launch vehicles.

9B001 Manufacturing equipment, tooling or fixtures

This rule revises 9B001.c by broadening the control in two respects. First, it replaces "specially designed" with "designed", and second, it replaces the phrase "manufacturing gas turbine engine blades, vanes or "tip shrouds"" with "superalloys", a broader term referring to certain highly durable materials. As revised, the text mirrors the control in 9B001.a, which covers directional solidification or single crystal casting equipment designed for "superalloys." In particular, the revised control focuses on additive-manufacturing equipment designed to work with a certain type of material ("superalloys"), rather than on the three manufactured items ("manufacturing gas turbine engine blades, vanes or "tip shrouds""). These changes are

necessary to keep pace with technology advancements and modernize controls to address new methods to manufacture gas turbine engine components (e.g., blades, vanes, "tip shrouds") using refractory metals.

9E003 Other "technology"

This rule revises the STA special conditions paragraph for ECCN 9E003 by removing paragraph a.8, and adding paragraphs .c and. i (other than technology for fan or power turbines) to match the STA limitation paragraph in § 740.20(b)(2)(viii)(D)(1) of the EAR. This revision is consistent with BIS's goal, as stated in the preamble of the October 22, 2021 rule (86 FR 58615), to clarify restrictions on the availability of STA for the export, reexport, and transfer (in-country) of certain items controlled under the EAR.

This rule also makes an editorial revision to 9E003.a.5 by removing a hyphen; as revised, the control applies to "tip shrouds."

Significant Items: hot section technology

A hot section refers to the portion of a gas turbine engine that operates at a high temperature, i.e., the combustion, turbine, and exhaust sections. This rule makes a correction to the list of items included as Significant Items (SI) in §§ 734.4(a)(4)'s de minimis rules and in 742.14(a) and (b). The list included 9E003.j wing-folding systems, which is not hot section technology, but did not include 9E003.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 USML." This revision will align these corrected sections of the EAR with the SI license requirements in 9E003.

Part 772 – Definitions of Terms

This rule amends § 772.1 by revising the definitions of the terms "compensation systems" and "diffusion bonding." The definition of "compensation systems" is clarified by adding the word "the" in the phrase "that permit reduction of [the] rigid body rotation noise of the

platform." The definition of the term "diffusion bonding" is amended by removing the reference to Category 9 in the parenthetical that lists where this term is used in the CCL, because it is not used in Category 9.

Savings 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 April 18, 2023. Any such items not actually exported, reexported or transferred (in-country) before midnight, on April 18, 2023, require a license in accordance with this final rule.

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 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.

Rulemaking Requirements

1. 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 and distributive impacts and equity). Executive Order 13563 emphasizes the importance of quantifying both costs and benefits and of reducing costs, harmonizing rules, and promoting flexibility.

This final rule has been designated a "significant regulatory action" under section 3(f) of Executive Order 12866. This rule does not contain policies with Federalism implications as that term is defined under Executive Order 13132.

2. Notwithstanding any other provision of law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.) (PRA), unless that collection of information displays a currently valid Office of Management and Budget (OMB) Control Number. Although this rule makes important changes to the EAR for items controlled for national security reasons, BIS believes that the overall increases in burdens and costs associated with the following information collections due to this rule will be minimal.

- 0694-0088, "Simplified Network Application Processing System," which carries a burden- hour estimate of 29.6 minutes for a manual or electronic submission;
- 0694-0137 "License Exceptions and Exclusions," which carries a burden-hour estimate average of 1.5 hours per submission (Note: submissions for License Exceptions are rarely required);
- 0694-0096 "Five Year Records Retention Period," which carries a burden-hour estimate of less than 1 minute; and
- 0607-0152 "Automated Export System (AES) Program," which carries a burden-hour estimate of 3 minutes per electronic submission.

Additional information regarding these collections of information – including all background materials -- can be found at https:/www.reginfo.gov/public/do/PRAMain and using the search function to enter either the title of the collection or the OMB Control Number.

3. Pursuant to Section 1762 of ECRA (50 U.S.C. 4821), this action is exempt from the Administrative Procedure Act (APA) (5 U.S.C. 553) requirements for notice of proposed rulemaking, opportunity for public participation and delay in effective date.

List of Subjects

15 CFR Part 734

Administrative practice and procedure, Exports, Inventions and patents, Research, Science and technology

15 CFR Part 740

Administrative practice and procedure, Exports, Reporting and recordkeeping requirements

15 CFR Part 742

Exports, Terrorism

15 CFR Part 772

Exports

15 CFR Part 774

Exports, Reporting and recordkeeping requirements, Terrorism.

Accordingly, parts 734, 740, 742, 772 and 774 of the Export Administration Regulations (15 CFR parts 730-774) are amended as follows:

PART 734 - SCOPE OF THE EXPORT ADMINISTRATION REGULATIONS

1. The authority citation for part 734 continues to read as follows:

Authority: 50 U.S.C. 4801-4852; 50 U.S.C. 4601 et seq.; 50 U.S.C. 1701 et seq.; E.O. 12938, 59 FR 59099, 3 CFR, 1994 Comp., p. 950; E.O. 13020, 61 FR 54079, 3 CFR, 1996 Comp., p. 219; E.O. 13026, 61 FR 58767, 3 CFR, 1996 Comp., p. 228; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; E.O. 13637, 78 FR 16129, 3 CFR, 2014 Comp., p. 223; Notice of November 10, 2021, 86 FR 62891 (November 12, 2021).

2. Effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER], amend § 734.4 by revising paragraph (a)(4) to read as follows:

§ 734.4 *De minimis* U.S. content.

(a) * * *

(4) There is no *de minimis* level for U.S.-origin technology controlled by ECCN 9E003.a.1 through a.8, h, .i, and .k, when redrawn, used, consulted, or otherwise commingled abroad.

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PART 740 – LICENSE EXCEPTIONS

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

Authority: 50 U.S.C. 4801-4852; 50 U.S.C. 4601 *et seq.*; 50 U.S.C. 1701 *et seq.*; 22 U.S.C. 7201 *et seq.*; E.O. 13026, 61 FR 58767, 3 CFR, 1996 Comp., p. 228; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783.

4. Effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER], amend § 740.7 by revising paragraphs (c)(3)(ii) and (iii) to read as follows:

§ 740.7 COMPUTERS (APP).

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(c) ***

(3) ***

(ii) "Development" and "production" technology and source code described in paragraph (a)(2) of this section for computers with a APP less than or equal to 175 Weighted TeraFLOPS (WT) are eligible for deemed exports under License Exception APP to foreign nationals of Tier 1 destinations, other than the destinations that are listed in paragraph (c)(3)(i) of this section, subject to the restrictions in paragraph (b) of this section.

(iii) "Use" technology and source code described in paragraph (a)(2) of this section for computers with a APP less than or equal to 500 WT are eligible for deemed exports under License Exception APP to foreign nationals of Tier 1 destinations, other than the destinations that are listed in paragraph (c)(3)(i) of this section, subject to the restrictions in paragraph (b) of this section.

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5. Effective March 14, 2023, § 740.7 is amended by revising paragraphs (d)(3)(i) and (ii) to read as follows:

§ 740.7 COMPUTERS (APP).

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(d) ***

(3) ***

(i) "Development" and "production" technology and source code described in paragraph (a)(2) of this section for computers with an APP less than or equal to 50 Weighted TeraFLOPs (WT) are eligible for deemed exports under License Exception APP to foreign nationals of Tier 3 destinations as described in paragraph (d)(1) of this section, subject to the restrictions in paragraph (b) of this section.

(ii) "Use" technology and source code described in paragraph (a)(2) of this section for computers with an APP less than or equal to 140 WT are eligible for deemed exports under License Exception APP to foreign nationals of Tier 3 destinations as described in paragraph (d)(1) of this section, subject to the restrictions in paragraph (b) of this section.

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6. Effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER], amend §740.20 by redesignating paragraphs (b)(2)(viii)(A) through (F) as paragraphs (b)(2)(viii)(B) through (G) and adding new paragraph (b)(2)(viii)(A) to read as follows:

§ 740.20 License Exception Strategic Trade Authorization (STA).

* * * * *

(b) * * *

(2) * * *

(viii) * * *

(A) License Exception STA may not be used for 9B001 when destined to a country in Country Group A:6.

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PART 742 - CONTROL POLICY - CCL BASED CONTROLS

7. The authority citation for part 742 continues to read as follows:

Authority: 50 U.S.C. 4801-4852; 50 U.S.C. 4601 *et seq.;* 50 U.S.C. 1701 *et seq.;* 22 U.S.C. 3201 *et seq.;* 42 U.S.C. 2139a; 22 U.S.C. 7201 *et seq.;* 22 U.S.C. 7210; Sec. 1503, Pub. L. 108-11, 117 Stat. 559; E.O. 12058, 43 FR 20947, 3 CFR, 1978 Comp., p. 179; E.O. 12851, 58 FR 33181, 3 CFR, 1993 Comp., p. 608; E.O. 12938, 59 FR 59099, 3 CFR, 1994 Comp., p. 950; E.O. 13026, 61 FR 58767, 3 CFR, 1996 Comp., p. 228; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783; Presidential Determination 2003-23, 68 FR 26459, 3 CFR, 2004 Comp., p. 320; Notice of November 10, 2021, 86 FR 62891 (November 12, 2021).

8. Effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER], amend § 742.14 by revising paragraph (a) and paragraph (b) introductory text to read as follows:

§ 742.14 Significant items: hot section technology for the development, production or overhaul of commercial aircraft engines, components, and systems.

(a) *License requirement.* Licenses are required for all destinations, except Canada, for ECCNs having an "SI" under the "Reason for Control" paragraph. These items include hot section technology for the development, production or overhaul of commercial aircraft engines controlled under ECCN 9E003.a.1 through a.8, .h, .i and .k, and related controls.

(b) *Licensing policy.* Pursuant to section 6 of the Export Administration Act of 1979, as amended, foreign policy controls apply to technology required for the development, production or overhaul of commercial aircraft engines controlled by ECCN 9E003a.1 through a.8, .h, .i, and .k, and related controls. These controls supplement the national security controls that apply to these items. Applications for export and reexport to all destinations will be reviewed on a case-by-case basis to determine whether the export or reexport is consistent with U.S. national

security and foreign policy interests. The following factors are among those that will be considered to determine what action will be taken on license applications:

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PART 772 – DEFINITIONS OF TERMS

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

Authority: 50 U.S.C. 4801-4852; 50 U.S.C. 4601 *et seq.*; 50 U.S.C. 1701 *et seq.*; E.O. 13222, 66 FR 44025, 3 CFR, 2001 Comp., p. 783.

10. Effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER], amend § 772.1 by revising the definitions of "compensation systems" and "diffusion bonding," to read as follows:

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

*****

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

*****

Diffusion bonding. (Cat 1 and 2)—A solid state joining of at least two separate pieces of metals into a single piece with a joint strength equivalent to that of the weakest material, wherein the principal mechanism is interdiffusion of atoms across the interface.

*****

PART 774 – THE COMMERCE CONTROL LIST

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

Authority: 50 U.S.C. 4801-4852; 50 U.S.C. 4601 et seq.; 50 U.S.C. 1701 et seq.; 10 U.S.C. 8720; 10 U.S.C. 8730(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. 1824; 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.

12. Effective [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER], amend supplement no. 1 to part 774 by:

a. Under Category 0 removing ECCN 0A988;

b. Under Category 1 revising ECCNs 1A613, 1C006, and Annex to Category 1;

c. Under Category 2 revising ECCN 2E003;

d. Under Category 3 revising Note 1, and ECCNs 3A001 and 3A002;

e. Under Category 5PT2 revising ECCN 5A003;

f. Under Category 6 revising ECCNs 6A005, 6A008, and 6D003;

g. Under Category 7 revising ECCN 7D003; and

h. Under Category 9, revising ECCNs 9A004, 9B001, and 9E003.

The revisions read as follows:

Supplement No. 1 to Part 774 - The Commerce Control List

* * * * *

CATEGORY 1 - SPECIAL MATERIALS AND RELATED EQUIPMENT, CHEMICALS, "MICROORGANISMS," AND "TOXINS"

* * * * *

1A613 Armored and protective "equipment" 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 1A613.y	NS Column 1

RS applies to entire entry except 1A613.y	RS Column 1
RS applies 1A613.y	China, Russia, or Venezuela (see §742.6(a)(7))
AT applies to entire entry	AT Column 1
UN applies to entire entry, except 1A613.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: Paragraph (c)(2) of License Exception STA (§ 740.20(c)(2) of the EAR) may not be used for any item in 1A613.

List of Items Controlled

Related Controls: (1) Defense articles, such as materials made from classified information, that are controlled by USML Category X or XIII of the ITAR, 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 US-origin "600 series" controlled content. (3) See ECCN 9A610.g for anti-gravity suits ("G-suits") and pressure suits capable of operating at altitudes higher than 55,000 feet above sea level. (4) For other military helmet "components" or "accessories" not specified in 1A613.c, see the relevant ECCN in the CCL or USML Entry.

Related Definitions: References to "NIJ Type" protection are to the National Institute of Justice Classification guide at NIJ Standard 0101.06, Ballistic Resistance of Body Armor, and NIJ Standard 0108.01, Ballistic Resistant Protective Materials.

Items:

a. Metallic or non-metallic armored plate "specially designed" for military use and not controlled by the USML.

Note to paragraph a: *For controls on body armor plates, see ECCN 1A613.d.2 and USML Category X(a)(1).*

b. Shelters "specially designed" to:

b.1. Provide ballistic protection for military systems; *or*

b.2. Protect against nuclear, biological, or chemical contamination.

c. Military helmets (other than helmets controlled under 1A613.y.1) providing less than NIJ Type IV or "equivalent standards" protection.

Note 1: *See ECCN 0A979 for controls on police helmets.*

Note 2: *See USML Category X(a)(5) and (a)(6) for controls on other military helmets.*

Note 3: *1A613.c does not apply to helmets that meet all the following:*

a. Were first manufactured before 1970; and

b. Are neither designed or modified to accept, nor equipped with items specified by the U.S. Munitions List (22 CFR 121) or another "600 series" ECCN.

d. Body armor and protective garments, as follows:

d.1. Soft body armor and protective garments manufactured to military standards or specifications, or to their equivalents, that provide ballistic protection equal to or less than NIJ level III (NIJ 0101.06, July 2008) or "equivalent standards"; *or*

Note: *For 1A613.d.1, military standards or specifications include, at a minimum, specifications for fragmentation protection.*

d.2. Hard body armor plates that provide ballistic protection equal to NIJ level III (NIJ 0101.06, July 2008) or "equivalent standards".

Note: *See ECCN 1A005 for controls on soft body armor not manufactured to military standards or specifications and hard body armor plates providing less than NIJ level III or "equivalent standards" protection. For body armor providing NIJ Type IV protection or greater, see USML Category X(a)(1).*

e. Atmospheric diving suits "specially designed" for rescue operations for submarines controlled by the USML or the CCL.

f. Other personal protective "equipment" "specially designed" for military applications not controlled by the USML, not elsewhere controlled on the CCL.

g. to w. [Reserved]

x. "Parts," "components," "accessories," and "attachments" that are "specially designed" for a commodity controlled by ECCN 1A613 (except for 1A613.y) or an article enumerated in USML Category X, and not controlled elsewhere in the USML.

Note: *1A613.x includes forgings, castings, and other unfinished products, such as extrusions and machined bodies, that have reached a stage in manufacturing where they are clearly identifiable by mechanical properties, material composition, geometry, or function as commodities specified in ECCN 1A613.x.*

y. Other commodities as follows:

y.1 Conventional military steel helmets.

Note: *1A613.y.1 does not apply to helmets that meet all the following:*

a. Were first manufactured before 1970; and

b. Are neither designed or modified to accept, nor equipped with items specified by the U.S. Munitions List (22 CFR 121) or another "600 series" ECCN.

N.B. to paragraph y.1: *For other military helmet "components" or "accessories," see the relevant ECCN in the CCL or USML Entry.*

y.2 [Reserved]

* * * * *

1C006 Fluids and lubricating materials, 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

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

LVS: $3000

GBS: Yes for 1C006.d

List of Items Controlled

Related Controls: See also 1C996.

Related Definitions: N/A

Items:

a. [Reserved]

b. Lubricating materials containing, as their principal ingredients, phenylene or alkylphenylene ethers or thio-ethers, or their mixtures, containing more than two ether or thio-ether functions or mixtures thereof.

c. Damping or flotation fluids having all of the following:

c.1. Purity exceeding 99.8%;

c.2. Containing less than 25 particles of 200 μm or larger in size per 100 ml; and

c.3. Made from at least 85% of any of the following:

c.3.a. Dibromotetrafluoroethane (CAS 25497- 30-7, 124-73-2, 27336-23- 8);

c.3.b. Polychlorotrifluoroethylene (oily and waxy modifications only); *or*

c.3.c. Polybromotrifluoroethylene;

d. Fluorocarbon fluids designed for electronic cooling and having all of the following:

d.1. Containing 85% by weight or more of any of the following, or mixtures thereof:

d.1.a. Monomeric forms of perfluoropolyalkylether- triazines or perfluoroaliphatic-ethers;

d.1.b. Perfluoroalkylamines;

d.1.c. Perfluorocycloalkanes; *or*

d.1.d. Perfluoroalkanes;

d.2. Density at 298 K (25°C) of 1.5 g/ml or more;

d.3. In a liquid state at 273 K (0°C); *and*

d.4. Containing 60% or more by weight of fluorine.

Note: *1C006.d does not apply to materials specified and packaged as medical products.*

* * * * *

ANNEX to Category 1

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

1. ADNBF (aminodinitrobenzofuroxan or 7 amino 4,6 dinitrobenzofurazane 1 oxide) (CAS 97096 78 1);

2. BNCP (cis bis (5 nitrotetrazolato) tetra amine cobalt (III) perchlorate) (CAS 117412 28 9);

3. CL 14 (diamino dinitrobenzofuroxan or 5,7 diamino 4,6 dinitrobenzofurazane 1 oxide) (CAS 117907 74 1);

4. CL 20 (HNIW or Hexanitrohexaazaisowurtzitane) (CAS 135285 90 4); chlathrates of CL 20;

5. CP (2 (5 cyanotetrazolato) penta amine cobalt (III) perchlorate) (CAS 70247 32 4);

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

7. DATB (diaminotrinitrobenzene) (CAS 1630 08 6);

8. DDFP (1,4 dinitrodifurazanopiperazine);

9. DDPO (2,6 diamino 3,5 dinitropyrazine 1 oxide, PZO) (CAS 194486 77 6);

10. DIPAM (3,3' diamino 2,2',4,4',6,6' hexanitrobiphenyl or dipicramide) (CAS 17215 44 0);

11. DNGU (DINGU or dinitroglycoluril) (CAS 55510 04 8);

12. Furazans as follows:

a. DAAOF (diaminoazoxyfurazan);

b. DAAzF (diaminoazofurazan) (CAS 78644 90 3);

13. HMX and derivatives, as follows:

a. HMX (Cyclotetramethylenetetranitramine, octahydro 1,3,5,7 tetranitro 1,3,5,7 tetrazine, 1,3,5,7 tetranitro 1,3,5,7 tetraza cyclooctane, octogen or octogene) (CAS 2691 41 0);

b. Difluoroaminated analogs of HMX;

c. K 55 (2,4,6,8 tetranitro 2,4,6,8 tetraazabicyclo [3,3,0] octanone 3, tetranitrosemiglycouril or keto bicyclic HMX) (CAS 130256 72 3);

14. HNAD (hexanitroadamantane) (CAS 143850 71 9);

15. HNS (hexanitrostilbene) (CAS 20062 22 0);

16. Imidazoles as follows:

a. BNNII (Octahydro 2,5 bis(nitroimino)imidazo [4,5 d]imidazole);

b. DNI (2,4 dinitroimidazole) (CAS 5213 49 0);

c. FDIA (1 fluoro 2,4 dinitroimidazole);

d. NTDNIA (N (2 nitrotriazolo) 2,4 dinitroimidazole);

e. PTIA (1 picryl 2,4,5 trinitroimidazole);

17. NTNMH (1 (2 nitrotriazolo) 2 dinitromethylene hydrazine);

18. NTO (ONTA or 3 nitro 1,2,4 triazol 5 one) (CAS 932 64 9);

19. Polynitrocubanes with more than four nitro groups;

20. PYX (2,6 Bis(picrylamino) 3,5 dinitropyridine) (CAS 38082 89 2);

21. RDX and derivatives, as follows:

a. RDX (cyclotrimethylenetrinitramine, cyclonite, T4, hexahydro 1,3,5 trinitro 1,3,5 triazine, 1,3,5 trinitro 1,3,5 triaza cyclohexane, hexogen or hexogene) (CAS 121 82 4);

b. Keto RDX (K 6 or 2,4,6 trinitro 2,4,6 triazacyclohexanone) (CAS 115029 35 1);

22. TAGN (triaminoguanidinenitrate) (CAS 4000 16 2);

23. TATB (triaminotrinitrobenzene) (CAS 3058 38 6);

24. TEDDZ (3,3,7,7 tetrabis(difluoroamine) octahydro 1,5 dinitro 1,5 diazocine);

25. Tetrazoles as follows:

a. NTAT (nitrotriazol aminotetrazole);

b. NTNT (1 N (2 nitrotriazolo) 4 nitrotetrazole);

26. Tetryl (trinitrophenylmethylnitramine) (CAS 479 45 8);

27. TNAD (1,4,5,8 tetranitro 1,4,5,8 tetraazadecalin) (CAS 135877 16 6);

28. TNAZ (1,3,3 trinitroazetidine) (CAS 97645 24 4);

29. TNGU (SORGUYL or tetranitroglycoluril) (CAS 55510 03 7);

30. TNP (1,4,5,8 tetranitro pyridazino[4,5 d]pyridazine) (CAS 229176 04 9);

31. Triazines as follows:

a. DNAM (2 oxy 4,6 dinitroamino s triazine) (CAS 19899 80 0);

b. NNHT (2 nitroimino 5 nitro hexahydro 1,3,5 triazine) (CAS 130400 13 4);

32. Triazoles as follows:

a. 5 azido 2 nitrotriazole;

b. ADHTDN (4 amino 3,5 dihydrazino 1,2,4 triazole dinitramide) (CAS 1614 08 0);

c. ADNT (1 amino 3,5 dinitro 1,2,4 triazole);

d. BDNTA ((bis dinitrotriazole)amine);

e. DBT (3,3’ dinitro 5,5 bi 1,2,4 triazole) (CAS 30003 46 4);

f. DNBT (dinitrobistriazole) (CAS 70890 46 9);

g. [Reserved]

h. NTDNT (1 N (2 nitrotriazolo) 3,5 dinitrotriazole);

i. PDNT (1 picryl 3,5 dinitrotriazole);

j. TACOT (tetranitrobenzotriazolobenzotriazole) (CAS 25243 36 1);

33. “Explosives” not listed elsewhere in this list having a detonation velocity exceeding 8,700 m/s, at maximum density, or a detonation pressure exceeding 34 GPa (340 kbar);

34. [Reserved]

35. Nitrocellulose (containing more than 12.5% nitrogen) (CAS 9004-70-0);

36. Nitroglycol (CAS 628-96-6);

37. Pentaerythritol tetranitrate (PETN) (CAS 78-11-5);

38. Picryl chloride (CAS 88-88-0);

39. 2,4,6 Trinitrotoluene (TNT) (CAS 118-96-7);

40. Nitroglycerine (NG) (CAS 55-63-0);

41. Triacetone Triperoxide (TATP) (CAS 17088-37-8);

42. Guanidine nitrate (CAS 506-93-4);

43. Nitroguanidine (NQ) (CAS 556 88 7);

44. DNAN (2,4-dinitroanisole) (CAS 119-27-7);

45. TEX (4,10-Dinitro-2,6,8,12-tetraoxa-4,10-diazaisowurtzitane);

46. GUDN (Guanylurea dinitramide) FOX-12 (CAS 217464-38-5);

47. Tetrazines as follows:

a. BTAT (Bis(2,2,2-trinitroethyl)-3,6-diaminotetrazine);

b. LAX-112 (3,6-diamino-1,2,4,5-tetrazine-1,4-dioxide);

48. Energetic ionic materials melting between 343 K (70°C) and 373 K (100°C) and with detonation velocity exceeding 6,800 m/s or detonation pressure exceeding 18 GPa (180 kbar);

49. BTNEN (Bis(2,2,2-trinitroethyl)-nitramine) (CAS 19836-28-3);

50. FTDO (5,6-(3',4'-furazano)- 1,2,3,4-tetrazine-1,3-dioxide);

51. EDNA (Ethylenedinitramine) (CAS 505-71-5);

52. TKX-50 (Dihydroxylammonium 5,5'-bistetrazole-1,1'-diolate).

CATEGORY 2 - MATERIALS PROCESSING

* * * * *

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

License Requirements

Reason for Control: NS, AT

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

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

TSR: Yes, except 2E003.b, .e and .f

List of Items Controlled

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

Related Definitions: N/A

Items:

a. [Reserved]

b. "Technology" for metal-working manufacturing processes, as follows:

b.1. "Technology" for the design of tools, dies or fixtures "specially designed" for any of the following processes:

b.1.a. "Superplastic forming";

b.1.b. "Diffusion bonding"; *or*

b.1.c. 'Direct-acting hydraulic pressing';

b.2. [Reserved]

N.B.: *For "technology" for metal-working manufacturing processes for gas turbine engines and components, see 9E003 and USML Category XIX.*

Technical Note*: 'Direct-acting hydraulic pressing' is a deformation process which uses a fluid-filled flexible bladder in direct contact with the workpiece.*

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

d. [Reserved]

e. "Technology" for the "development" of integration "software" for incorporation of expert systems for advanced decision support of shop floor operations into "numerical control" units;

f. "Technology" for the application of inorganic overlay coatings or inorganic surface modification coatings (specified in column 3 of the following table) to non-electronic substrates (specified in column 2 of the following table), by processes specified in column 1 of the following table and defined in the Technical Note.

N.B. *This table should be read to control the technology of a particular 'Coating Process' only when the resultant coating in column 3 is in a paragraph directly across from the relevant 'Substrate' under column 2. For example, Chemical Vapor Deposition (CVD) 'coating*

process' control the "technology" for a particular application of 'silicides' to 'Carbon-carbon, Ceramic and Metal "matrix" "composites" substrates, but are not controlled for the application of 'silicides' to 'Cemented tungsten carbide (16), Silicon carbide (18)' substrates. In the second case, the resultant coating is not listed in the paragraph under column 3 directly across from the paragraph under column 2 listing 'Cemented tungsten carbide (16), Silicon carbide (18)'.

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CATEGORY 3 - ELECTRONICS

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

Note 1: *The control status of equipment and "components" described in 3A001 or 3A002, other than those described in 3A001.a.3 to 3A001.a.10, 3A001.a.12 to 3A001.a.14, or 3A001.b.12, 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.*

*****

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	NS Column 1

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 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	RS Column 1

telecommunications applications	
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 3A001.e.2 and superconducting solenoidal electromagnets in 3A001.e.3 that meet or exceed the technical parameters	NP Column 1

in 3A201.a and 3A201.b, respectively	
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, and .i.

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, 5×10^3 Gy(Si) = 5×10^5 Rads (Si); 5×10^6 Gy (Si)/s = 5×10^8 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 x 10^3 Gy (Si), or higher;

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

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

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

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

Technical Note: *'Non-volatile memories' are memories with data retention over a period of time after a power shutdown.*

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 a "sample 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 a "sample 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 a "sample rate" greater than 400 MSPS;

a.5.a.4. A resolution of 14 bit or more, but less than 16 bit, with a "sample rate" greater than 250 MSPS; *or*

a.5.a.5. A resolution of 16 bit or more with a "sample rate" greater than 65 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 resolution of the ADC is the number of bits of the digital output that represents the measured analog input. Effective Number of Bits (ENOB) is not used to determine the resolution of the ADC.

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

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

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

a.5.b.1. A resolution of 10-bit or more 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 arrive at or within 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:

-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 or are programmable to perform all of the following:

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

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

a.14.a.2. A resolution of 10 bit or more, but less than 12 bit, with a "sample rate" greater than 1.0 GSPS;

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

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

a.14.a.5. A resolution of 16 bit or more with a "sample rate" greater than 180 MSPS; *and*

a.14.b. Any of the following:

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

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

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

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

Technical Notes:

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

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

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

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

b. Microwave or millimeter wave items, as follows:

***Technical Note**: 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; and*

***b**. Is "allocated by the ITU" for radio-communications services, but not for radio-determination.*

***Note 2**: 3A001.b.1 does not control non-"space-qualified" "vacuum electronic devices" having all the following:*

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

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

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

***2**. Is "allocated by the ITU" for radio-communications services, but not for radio-determination.*

b.1.a. Traveling-wave "vacuum electronic devices," pulsed or continuous wave, as follows:

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

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

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

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

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

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

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

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

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

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

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

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

b.1.b. Crossed-field amplifier "vacuum electronic devices" with a gain of more than 17 dB;

b.1.c. Thermionic cathodes, designed for "vacuum electronic devices," producing an emission current density at rated operating conditions exceeding 5 A/cm^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 (48.45 dBm) at any frequency exceeding 6.8 GHz up to and including 8.5 GHz;

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

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

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

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

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

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

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

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

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

b.4.f. [Reserved]

***N.B.*:**

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

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

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

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

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

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

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 75 GHz;

b.11.f. Less than 100 μs for any frequency change exceeding 5.0 GHz within the synthesized frequency range exceeding 75 GHz but not exceeding 90 GHz; *or*

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

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

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

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

b.12.a. A peak saturated power output (in watts), P_{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.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 any of the following at 20ºC:

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

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

e.1.b. 'Secondary cells' having an 'energy density' exceeding 350 Wh/kg at 20ºC;

***Technical Note*s:**

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

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

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

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

5. *For the purpose of 3A001.e.1.a, 'continuous power density' (W/kg) is calculated from the nominal voltage multiplied by the specified maximum continuous discharge current in*

amperes (A) divided by the mass in kilograms. 'Continuous power density' is also referred to as specific power.

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

e.2. High energy storage capacitors as follows:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

i.1.a. A 'half-wave voltage' ('Vπ') less than 2.7 V when measured at a frequency of 1 GHz or below; *or*

i.1.b. A 'Vπ' of less than 4 V when measured at a frequency of more than 1 GHz; *or*

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

i.2.a. A 'Vπ' less than 3.3 V when measured at a frequency of 1 GHz or below; *or*

i.2.b. A 'Vπ' less than 5 V when measured at a frequency of more than 1 GHz.

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

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

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 40 MHz anywhere within the frequency range exceeding 31.8 GHz but not exceeding 37 GHz;

c.2. "Signal analyzers" having a 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. 'Real-time bandwidth' is the widest frequency range for which the analyzer can continuously transform time-domain data entirely into frequency-domain results, using a Fourier or other discrete time transform that processes every incoming time point, without a reduction of measured amplitude of more than 3 dB below the actual signal amplitude caused by gaps or windowing effects, while outputting or displaying the transformed data.

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

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

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

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

c.5. [Reserved]

d. Signal generators having any of the following:

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

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

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

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

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

d.3.a. [Reserved]

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

d.3.c. [Reserved]

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

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 75 GHz; *or*

d.3.f. [Reserved]

d.3.g. Less than 100 μs for any frequency change exceeding 5.0 GHz within the frequency range exceeding 75 GHz but not exceeding 90 GHz.

d.4. A 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;

d.5.c. Exceeding 2.2 GHz within the frequency range exceeding 37 GHz but not exceeding 75 GHz;

d.5.d. Exceeding 5.0 GHz within the frequency range exceeding 75 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 1×10^{-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 1×10^{-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 a "sample rate" greater than 1.3 Giga Samples Per Second (GSPS);

h.1.b. A resolution of 10 bit or more, but less than 12 bit, with a “sample rate” greater than 1.0 GSPS;

h.1.c. A resolution of 12 bit or more, but less than 14 bit, with a “sample rate” greater than 1.0 GSPS;

h.1.d. A resolution of 14 bit or more but less than 16 bit, with a “sample rate” greater than 400 Mega Samples Per Second (MSPS); *or*

h.1.e. A resolution of 16 bit or more with a “sample rate” greater than 180 MSPS; *and*

h.2. Any of the following:

h.2.a. Output of digitized data;

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

h.2.c. Processing of digitized data;

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

Technical Notes:

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

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

3. *For non-interleaved multiple-channel “electronic assemblies”, modules, or equipment, the “sample rate” is not aggregated and the “sample rate” is the maximum rate of any single channel.*

4. For interleaved channels on multiple-channel “electronic assemblies”, modules, or equipment, the “sample rates” are aggregated and the “sample rate” is the maximum combined total rate of all the interleaved channels.

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

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CATEGORY 5 - TELECOMMUNICATIONS AND "INFORMATION SECURITY"

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II. NON-CRYPTOGRAPHIC "INFORMATION SECURITY"

5A003 "Systems," "equipment" and "components," for non-cryptographic "information security," 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

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

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

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

Note: *5A003.a applies only to physical layer security. For the purpose of 5A003.a, the physical layer includes Layer 1 of the Reference Model of Open Systems Interconnection (OSI) (ISO/IEC 7498-1).*

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

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CATEGORY 6 - SENSORS AND LASERS

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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. Output power exceeding 1,000 W; *or*

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

a.6.a.2.a. 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; <u>and</u>

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 25 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 6A005.d.1.d, having all of the following:

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

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

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

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

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

Technical Notes:

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

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

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

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

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

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

d.3. Carbon dioxide (CO_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.*

* * * * *

6A008 Radar systems, equipment and assemblies, having any of the following (see List of Items Controlled), and "specially designed" "components" therefor.

License Requirements

Reason for Control: NS, MT, RS, AT

Control(s)	*Country Chart (See Supp. No. 1 to part 738)*
NS applies to entire entry	NS Column 2
MT applies to items that are designed for airborne applications and that are usable in systems controlled for MT reasons	MT Column 1
RS applies to 6A008.j.1	RS Column 1
AT applies to entire entry	AT Column 1

Reporting Requirements

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

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

LVS: $5000; N/A for MT and for 6A008.j.1.

GBS: Yes, for 6A008.b, .c, and l.1 only

Special Conditions for STA

STA: License Exception STA may not be used to ship any commodity in 6A008.d, 6A008.h or 6A008.k to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: (1) See also ECCNs 6A108 and 6A998. ECCN 6A998 controls, inter alia, the Light Detection and Ranging (LIDAR) equipment excluded by the note to paragraph j of this ECCN (6A008). (2) See USML Category XII(b) for certain LIDAR, Laser Detection and Ranging (LADAR), or range-gated systems subject to the ITAR.

Related Definitions: N/A

Items:

Note: *6A008 does not control:*

- *Secondary surveillance radar (SSR);*
- *Civil Automotive Radar;*
- *Displays or monitors used for air traffic control (ATC);*
- *Meteorological (weather) radar;*
- *Precision Approach Radar (PAR) equipment conforming to ICAO standards and employing electronically steerable linear (1-dimensional) arrays or mechanically positioned passive antennas.*

a. Operating at frequencies from 40 GHz to 230 GHz and having any of the following:

a.1. An average output power exceeding 100 mW; *or*

a.2. Locating "accuracy" of 1 m or less (better) in range and 0.2 degree or less (better) in azimuth;

b. A tunable bandwidth exceeding ±6.25% of the 'center operating frequency';

Technical Note: *The 'center operating frequency' equals one half of the sum of the highest plus the lowest specified operating frequencies*.

c. Capable of operating simultaneously on more than two carrier frequencies;

d. Capable of operating in synthetic aperture (SAR), inverse synthetic aperture (ISAR) radar mode, or sidelooking airborne (SLAR) radar mode;

e. Incorporating electronically scanned array antennae;

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

f. Capable of heightfinding non-cooperative targets;

g. "Specially designed" for airborne (balloon or airframe mounted) operation and having Doppler "signal processing" for the detection of moving targets;

h. Employing processing of radar signals and using any of the following:

h.1. "Radar spread spectrum" techniques; *or*

h.2. "Radar frequency agility" techniques;

i. Providing ground-based operation with a maximum 'instrumented range' exceeding 185 km;

Note: *6A008.i does not control:*

a. Fishing ground surveillance radar;

b. Ground radar equipment "specially designed" for en route air traffic control, and having all of the following:

1. A maximum 'instrumented range' of 500 km or less;

2. Configured so that radar target data can be transmitted only one way from the radar site to one or more civil ATC centers;

3. Contains no provisions for remote control of the radar scan rate from the en route ATC center; and

4. Permanently installed;

c. Weather balloon tracking radars.

Technical Note: *For the purposes of 6A008.i, 'instrumented range' is the specified unambiguous display range of a radar.*

j. Being “laser” radar or Light Detection and Ranging (LIDAR) equipment and having any of the following:

j.1. “Space-qualified”;

j.2. Employing coherent heterodyne or homodyne detection techniques and having an angular resolution of less (better) than 20 μrad (microradians); *or*

j.3. Designed for carrying out airborne bathymetric littoral surveys to International Hydrographic Organization (IHO) Order 1a Standard (5th Edition February 2008) for Hydrographic Surveys or better, and using one or more “lasers” with a wavelength exceeding 400 nm but not exceeding 600 nm;

Note 1: *LIDAR equipment “specially designed” for surveying is only specified by 6A008.j.3*.

Note 2: *6A008.j does not apply to LIDAR equipment “specially designed” for meteorological observation*.

Note 3: *Parameters in the IHO Order 1a Standard 5th Edition February 2008 are summarized as follows:*

Horizontal Accuracy (95% Confidence Level)= 5 m + 5% of depth.

Depth Accuracy for Reduced Depths (95 % confidence level) $= \pm\sqrt{(a^2+(b*d)^2)}$ *where:*

a = 0.5 m = constant depth error, i.e. the sum of all constant depth errors

b = 0.013 = factor of depth dependent error

*b*d = depth dependent error, i.e. the sum of all depth dependent errors*

d = depth

Feature Detection = Cubic features > 2 m in depths up to 40 m; 10% of depth beyond 40 m.

k. Having “signal processing” sub-systems using “pulse compression” and having any of the following:

k.1. A “pulse compression” ratio exceeding 150; *or*

k.2. A compressed pulse width of less than 200 ns; *or*

***Note**: 6A008.k.2 does not apply to two dimensional 'marine radar' or 'vessel traffic service' radar, having all of the following:*

a. "Pulse compression" ratio not exceeding 150;

b. Compressed pulse width of greater than 30 ns;

c. Single and rotating mechanically scanned antenna;

d. Peak output power not exceeding 250 W; and

e. Not capable of "frequency hopping".

l. Having data processing sub-systems and having any of the following:

l.1. 'Automatic target tracking' providing, at any antenna rotation, the predicted target position beyond the time of the next antenna beam passage; or

***Note**: 6A008.l.1 does not control conflict alert capability in ATC systems, or 'marine radar'.*

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

l.2. [Reserved]

l.3. [Reserved]

l.4. Configured to provide superposition and correlation, or fusion, of target data within six seconds from two or more 'geographically dispersed' radar sensors to improve the aggregate performance beyond that of any single sensor specified by 6A008.f, or 6A008.i.

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

***N.B**.: See also the U.S. Munitions List (22 CFR part 121).*

***Note**: 6A008.l does not apply to systems, equipment and assemblies designed for 'vessel traffic services'.*

Technical Notes:

1. For the purposes of 6A008, 'marine radar' is a radar that is designed to navigate safely at sea, inland waterways or near-shore environments.

2. For the purposes of 6A008, 'vessel traffic service' is a vessel traffic monitoring and control service similar to air traffic control for "aircraft."

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6D003 Other "software" as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, RS, AT

Control(s)	*Country Chart (See Supp. No. 1 to part 738)*
NS applies to entire entry	NS Column 1
RS applies to paragraph c	RS Column 1
AT applies to entire entry	AT Column 1

Reporting Requirements

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

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

TSR: Yes, except for 6D003.c and exports or reexports to destinations outside of those countries listed in Country Group A:5 (See Supplement No. 1 to part 740 of the EAR) of "software" for items controlled by 6D003.a.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit software in 6D003.a to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: See also ECCNs 6D103, 6D991, and 6D993.

Related Definitions: N/A

Items:

ACOUSTICS

a. "Software" as follows:

a.1. "Software" "specially designed" for acoustic beam forming for the "real-time processing" of acoustic data for passive reception using towed hydrophone arrays;

a.2. "Source code" for the "real-time processing" of acoustic data for passive reception using towed hydrophone arrays;

a.3. "Software" "specially designed" for acoustic beam forming for the "real-time processing" of acoustic data for passive reception using bottom or bay cable systems;

a.4. "Source code" for the "real-time processing" of acoustic data for passive reception using bottom or bay cable systems;

a.5. "Software" or "source code", "specially designed" for all of the following:

a.5.a. "Real-time processing" of acoustic data from sonar systems controlled by 6A001.a.1.e; *and*

a.5.b. Automatically detecting, classifying and determining the location of divers or swimmers;

N.B.: *For diver detection "software" or "source code", "specially designed" or modified for military use, see the U.S. Munitions List of the International Traffic in Arms Regulations (ITAR) (22 CFR part 121).*

b. Optical sensors. None.

CAMERAS

c. "Software" designed or modified for cameras incorporating "focal plane arrays" specified by 6A002.a.3.f and designed or modified to remove a frame rate restriction and allow the camera to exceed the frame rate specified in 6A003.b.4 Note 3.a;

OPTICS

d. "Software" specially designed to maintain the alignment and phasing of segmented mirror systems consisting of mirror segments having a diameter or major axis length equal to or larger than 1 m;

e. Lasers. None.

MAGNETIC AND ELECTRIC FIELD SENSORS

f. "Software" as follows:

f.1. "Software" "specially designed" for magnetic and electric field "compensation systems" for magnetic sensors designed to operate on mobile platforms;

f.2. "Software" "specially designed" for magnetic and electric field anomaly detection on mobile platforms;

f.3. "Software" "specially designed" for "real-time processing" of electromagnetic data using underwater electromagnetic receivers specified by 6A006.e;

f.4. "Source code" for "real-time processing" of electromagnetic data using underwater electromagnetic receivers specified by 6A006.e;

GRAVIMETERS

g. "Software" "specially designed" to correct motional influences of gravity meters or gravity gradiometers;

RADAR

h. "Software" as follows:

h.1. Air Traffic Control (ATC) "software" designed to be hosted on general purpose computers located at Air Traffic Control centers and capable of accepting radar target data from more than four primary radars;

h.2. "Software" for the design or "production" of radomes having all of the following:

h.2.a. "Specially designed" to protect the "electronically scanned array antennae" specified by 6A008.e; *and*

h.2.b. Resulting in an antenna pattern having an 'average side lobe level' more than 40 dB below the peak of the main beam level.

Technical Note: *'Average side lobe level' in 6D003.h.2.b is measured over the entire array excluding the angular extent of the main beam and the first two side lobes on either side of the main beam*.

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Category 7 - Navigation and Avionics

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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	MT Column 1

equipment controlled for MT reasons. MT does not apply to "software" for equipment controlled by 7A008.	
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.

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CATEGORY 9 - AEROSPACE AND PROPULSION

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9A004 Space launch vehicles and "spacecraft," "spacecraft buses", "spacecraft payloads", "spacecraft" on-board systems or equipment, terrestrial equipment, air-launch platforms, and "sub-orbital craft", as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS and AT

Control(s)	*Country Chart*

	(See Supp. No. 1 to part 738)
NS applies to 9A004.g, .u, .v, .w and .x	NS Column 1
AT applies to 9A004.g, .u, .v, .w, .x and .y	AT Column 1

License Requirement Note*: 9A004.b through .f, and .h are controlled under ECCN 9A515.*

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

LVS: N/A

GBS: N/A

List of Items Controlled

Related Controls: (1) See also 9A104, 9A515, and 9B515. (2) See ECCNs 9E001 ("development") and 9E002 ("production") for technology for items controlled by this entry. (3) See USML Categories IV for the space launch vehicles and XV for other spacecraft that are "subject to the ITAR" (see 22 CFR parts 120 through 130).

Related Definition: N/A

Items:

a. Space launch vehicles;

b. "Spacecraft";

c. "Spacecraft buses";

d. “Spacecraft payloads” incorporating items specified by 3A001.b.1.a.4, 3A002.g, 5A001.a.1, 5A001.b.3, 5A002.c, 5A002.e, 6A002.a.1, 6A002.a.2, 6A002.b, 6A002.d, 6A003.b, 6A004.c, 6A004.e, 6A008.d, 6A008.e, 6A008.k, 6A008.l or 9A010.c;

e. On-board systems or equipment, specially designed for “spacecraft” and having any of the following functions:

e.1. ‘Command and telemetry data handling’;

***Note**: For the purpose of 9A004.e.1, ‘command and telemetry data handling’ includes bus data management, storage, and processing.*

e.2. ‘Payload data handling’; *or*

***Note:** For the purpose of 9A004.e.2, ‘payload data handling’ includes payload data management, storage, and processing.*

e.3. ‘Attitude and orbit control’;

***Note:** For the purpose of 9A004.e.3, ‘attitude and orbit control’ includes sensing and actuation to determine and control the position and orientation of a “spacecraft”.*

***N.B.:** Equipment specially designed for military use is “subject to the ITAR”. See 22 CFR parts 120 through 130.*

f. Terrestrial equipment specially designed for “spacecraft”, as follows:

f.1. Telemetry and telecommand equipment “specially designed” for any of the following data processing functions:

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

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

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

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

1. Command sequence confirmation;

2. Operational training;

3. Operational rehearsals; or

4. Operational analysis.

g. "Aircraft" "specially designed" or modified to be air-launch platforms for space launch vehicles or "sub-orbital craft".

h. "Sub-orbital craft".

i. through t. [RESERVED]

u. The James Webb Space Telescope (JWST) being developed, launched, and operated under the supervision of the U.S. National Aeronautics and Space Administration (NASA).

v. "Parts," "components," "accessories" and "attachments" that are "specially designed" for the James Webb Space Telescope and that are *not*:

v.1. Enumerated or controlled in the USML;

v.2. Microelectronic circuits;

v.3. Described in ECCN 7A004 or 7A104; *or*

v.4. Described in an ECCN containing "space-qualified" as a control criterion (*See* ECCN 9A515.x.4).

w. The International Space Station being developed, launched, and operated under the supervision of the U.S. National Aeronautics and Space Administration.

x. "Parts," "components," "accessories" and "attachments" that are "specially designed" for the International Space Station.

y. Items that would otherwise be within the scope of ECCN 9A004.v or .x but that have been identified in an interagency-cleared commodity classification (CCATS) pursuant to § 748.3(e) as warranting control in 9A004.y.

* * * * *

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 designed for "superalloys".

* * * * *

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 to a.5, 9E003.c., 9E003.h, or 9E003.i (other than technology for fan or power turbines), to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: (1) Hot section "technology" specifically designed, modified, or equipped for military uses or purposes, or developed principally with U.S. Department of Defense funding, is "subject to the ITAR" (see 22 CFR parts 120 through 130). (2) "Technology" is subject to the EAR when actually applied to a commercial "aircraft" engine program. Exporters may seek to establish commercial application either on a case-by-case basis

through submission of documentation demonstrating application to a commercial program in requesting an export license from the Department of Commerce in respect to a specific export, or in the case of use for broad categories of "aircraft," engines, "parts" or "components," a commodity jurisdiction determination from the Department of State.

Related Definitions: N/A

Items:

a. "Technology" "required" for the "development" or "production" of any of the following gas turbine engine "parts," "components" or systems:

a.1. Gas turbine blades, vanes or "tip shrouds", made from Directionally Solidified (DS) or Single Crystal (SC) alloys and having (in the 001 Miller Index Direction) a stress-rupture life exceeding 400 hours at 1,273 K (1,000°C) at a stress of 200 MPa, based on the average property values;

***Technical Note**: For the purposes of 9E003.a.1, stress-rupture life testing is typically conducted on a test specimen.*

a.2. Combustors having any of the following:

a.2.a. 'Thermally decoupled liners' designed to operate at 'combustor exit temperature' exceeding 1,883 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 Note*: ‘Gas path temperature’ is the bulk average gas path total (stagnation) temperature at the leading-edge plane of the turbine component when the engine is running in a “steady state mode” of operation at the certificated or specified maximum continuous operating temperature.*

a.6. Airfoil-to-disk blade combinations using solid state joining;

a.7. [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. ‘Fan blades’ having all of the following:

a.11.a. 20% or more of the total volume being one or more closed cavities containing vacuum or gas only; *and*

a.11.b. One or more closed cavities having a volume of 5 cm^3 or larger;

Technical Note: *For the purposes of 9E003.a.11, a ‘fan blade’ is the aerofoil portion of the rotating stage or stages, which provide both compressor and bypass flow in a gas turbine engine.*

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 prop-fans, 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**:*

1. For the purposes of 9E003.c, the ‘cross-sectional area’ is the area of the hole in the plane perpendicular to the hole axis.

2. For the purposes of 9E003.c, ‘hole shape ratio’ is the nominal length of the axis of the hole divided by the square root of its minimum 'cross-sectional area'.

3. For the purposes of 9E003.c, 'incidence angle' is the acute angle measured between the plane tangential to the airfoil surface and the hole axis at the point where the hole axis enters the airfoil surface.

4. Techniques for manufacturing holes in 9E003.c include "laser" beam machining, water jet machining, Electro-Chemical Machining (ECM) or Electrical Discharge Machining (EDM).

d. "Technology" "required" for the "development" or "production" of helicopter power transfer systems or tilt rotor or tilt wing "aircraft" power transfer systems;

e. "Technology" for the "development" or "production" of reciprocating diesel engine ground vehicle propulsion systems having all of the following:

e.1. 'Box volume' of 1.2 m^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.

* * * * *

13. Effective March 14, 2023, amend supplement no. 1 to part 774 under Category 4, by revising ECCNs 4A003, 4D001, and 4E001 to read as follows:

Supplement No. 1 to Part 774 - The Commerce Control List

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CATEGORY 4 – COMPUTERS

* * * * *

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

License Requirements

***Reason for Control*:** NS, CC, AT

Control(s)	*Country Chart (See Supp. No. 1 to part 738)*
NS applies to 4A003.b and .c	NS Column 1
NS applies to 4A003.g	NS Column 2
CC applies to "digital computers" for computerized finger-print equipment	CC Column 1
AT applies to entire entry (refer to 4A994 for controls on "digital computers" with a APP > 0.0128 but ≤ 70 WT)	AT Column 1

Note: *For all destinations, except those countries in Country Group E:1 or E:2 of Supplement No. 1 to part 740 of the EAR, no license is required (NLR) for computers with an "Adjusted Peak Performance" ("APP") not exceeding 70 Weighted TeraFLOPS (WT) and for "electronic assemblies" described in 4A003.c that are not capable of exceeding an "Adjusted Peak Performance" ("APP") exceeding 70 Weighted TeraFLOPS (WT) in aggregation, except certain transfers as set forth in § 746.3 (Iraq).*

Reporting Requirements

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

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

LVS: $5000; N/A for 4A003.b and .c.

GBS: Yes, for 4A003.g and "specially designed" "parts" and "components" therefor, exported separately or as part of a system.

APP: Yes, for computers controlled by 4A003.b, and "electronic assemblies" controlled by 4A003.c, to the exclusion of other technical parameters. See §740.7 of the EAR.

List of Items Controlled

Related Controls: See also 4A994 and 4A980

Related Definitions: N/A

Items:

Note 1: *4A003 includes the following:*

- 'Vector processors' (as defined in Note 7 of the "Technical Note on "Adjusted Peak Performance" ("APP")");

- Array processors;

- Digital signal processors;

- Logic processors;

- Equipment designed for "image enhancement."

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

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

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

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

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

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

a. [Reserved]

b. "Digital computers" having an "Adjusted Peak Performance" ("APP") exceeding 70 Weighted TeraFLOPS (WT);

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

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

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

d. to f. [Reserved]

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

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

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

* * * * *

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

License Requirements

Reason for Control: NS, CC, AT

Control(s)	*Country Chart (See Supp. No. 1 to part 738)*
NS applies to entire entry	NS Column 1
CC applies to "software" for computerized finger-print equipment controlled by 4A003 for CC reasons	CC Column 1
AT applies to entire entry	AT Column 1

Reporting Requirements

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

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

TSR: Yes, except for "software" for the "development" or "production" of commodities with an "Adjusted Peak Performance" ("APP") exceeding 70 WT.

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

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "software" "specially designed" for the "development" or "production" of equipment specified by ECCN 4A001.a.2 or for the "development" or "production" of "digital computers" having an 'Adjusted Peak Performance' ('APP') exceeding 70 Weighted TeraFLOPS (WT) to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

a. "Software" "specially designed" or modified for the "development" or "production", of equipment or "software" controlled by 4A001, 4A003, 4A004, or 4D (except 4D090, 4D980, 4D993 or 4D994).

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

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

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

* * * * *

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

License Requirements

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

Control(s)	*Country Chart (See Supp. No. 1 to part 738)*
NS applies to entire entry, except 4A090 or "software" specified by 4D090.	NS Column 1.
MT applies to "technology" for items	MT Column 1.

controlled by 4A001.a and 4A101 for MT reasons	
RS applies to "technology" for commodities controlled by 4A090 or "software" specified by 4D090.	China and Macau (See § 742.6(a)(6)).
CC applies to "software" for computerized finger-print equipment controlled by 4A003 for CC reasons	CC Column 1.
AT applies to entire entry	AT Column 1.

Reporting Requirements

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

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

TSR: Yes, except for "technology" for the "development" or "production" of commodities with an "Adjusted Peak Performance" ("APP") exceeding 70 WT.

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

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit "technology" according to the General Technology Note for the "development" or "production" of any of the following equipment or "software": a. Equipment specified by ECCN 4A001.a.2; b. "Digital computers" having an 'Adjusted Peak Performance' ('APP') exceeding 70 Weighted TeraFLOPS (WT); or c. "software" specified in the License Exception STA paragraph found in the License Exception

section of ECCN 4D001 to any of the destinations listed in Country Group A:6 (See Supplement No. 1 to part 740 of the EAR).

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

Items:

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

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

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

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

c. "Technology" for the "development" of "intrusion software."

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

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

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Matthew S. Borman,

Deputy Assistant Secretary for Export Administration.

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