

DEPARTMENT OF COMMERCE

Bureau of Industry and Security

15 CFR Parts 736, 738, 740, 742, 743, 772, and 774

[Docket No. 240813–0217]

RIN 0694–AJ60

Commerce Control List Additions and Revisions; Implementation of Controls on Advanced Technologies Consistent With Controls Implemented by International Partners

AGENCY: Bureau of Industry and Security, Department of Commerce.

ACTION: Interim final rule; request for comments.

SUMMARY: The Bureau of Industry and Security (BIS) is implementing export controls on several semiconductor, quantum, and additive manufacturing items for national security and foreign policy reasons. This rule adds new Export Control Classification Numbers (ECCNs) to the Commerce Control List, revises existing ECCNs, adds a new license exception to authorize exports and reexports to and by countries that have implemented equivalent technical controls for these newly added items, and adds two new worldwide license requirements to the national security and regional stability controls in the Export Administration Regulations (EAR). These controls are the product of extensive discussions with international partners.

DATES:

Effective date: This rule is effective September 6, 2024. The incorporation by reference of certain publications listed in the rule is approved by the Director of the Federal Register as of September 6, 2024.

Compliance dates: Although this rule is effective on September 6, 2024, exporters, reexporters, and transferors of quantum items specified in ECCNs 3A901, 3A904, 3B904, 3C907, 3C908, 3C909, 3D901 (for 3A901.b, 3B904), 3E901 (for 3A901, 3A904, 3B904, 3C907, 3C908, 3C909), 4A906, 4D906, or 4E906 to destinations specified in Country Group A:1 in supplement no. 1 to part 740 are not required to comply with the license requirements in § 742.4(a)(5)(i) or § 742.6(a)(10)(i) of the EAR until November 5, 2024. If no compliance date is provided, then parties must comply with the requirements set forth in this rule as of the effective date of this rule.

Comment due date: Comments on revisions and additions in this rule, as well as comments responding to the

possibility of a different licensing policy or procedures for quantum deemed exports and reexports, must be received by BIS no later than November 5, 2024.

ADDRESSES: Comments on this rule may be submitted to the Federal rulemaking portal (www.regulations.gov). The www.regulations.gov ID for this rule is: BIS–2024–0020. Please refer to RIN 0694–AJ60 in all comments.

All filers using the portal should use the name of the person or entity submitting the comments as the name of their files, in accordance with the instructions below. Anyone submitting business confidential information should clearly identify the business confidential portion at the time of submission, file a statement justifying nondisclosure and referring to the specific legal authority claimed, and provide a non-confidential version of the submission.

For comments submitted electronically containing business confidential information, the file name of the business confidential version should begin with the characters “BC.” Any page containing business confidential information must be clearly marked “BUSINESS CONFIDENTIAL” on the top of that page. The corresponding non-confidential version of those comments must be clearly marked “PUBLIC.” The file name of the non-confidential version should begin with the character “P.” Any submissions with file names that do not begin with either a “BC” or a “P” will be assumed to be public and will be made publicly available through <https://www.regulations.gov>. Commenters submitting business confidential information are encouraged to scan a hard copy of the non-confidential version to create an image of the file, rather than submitting a digital copy with redactions applied, to avoid inadvertent redaction errors which could enable the public to read business confidential information.

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SUPPLEMENTARY INFORMATION:

I. Background

In remarks made on February 4, 2021, regarding America’s place in the world, President Biden noted that America’s alliances are some of our greatest assets and that leading with diplomacy means standing shoulder to shoulder and working closely with our allies and key partners, thereby protecting the world against those who do not share our values. This is especially true in export controls, as controls adopted by supplier countries, working together, are typically the most effective path to protect our national security and advance our foreign policy objectives. This is reflected in the Statement of Policy in the Export Control Reform Act of 2018 (ECRA): export controls that are multilateral are the most effective (50 U.S.C. 4811(5)).

BIS seeks to achieve these objectives by harmonizing controls with like-minded countries. Accordingly, the United States is implementing new controls, including a limited number of deemed export requirements in the sectors of quantum computers, materials, and related electronic assemblies; aerospace technology; and integrated circuit “development” or “production.” With this rule, BIS imposes controls on items in these categories that warrant export controls because of national security concerns. Given the national security basis for these controls, BIS is implementing them immediately through an interim final rule. These controls are consistent with controls implemented by several international partners. While not currently controlled by the relevant multilateral regime, pursuant to ECRA Section 1758(c)(1), the United States shall pursue addition of these technologies to the list of items controlled by the relevant multilateral export control regime.

To identify items for which controls are harmonized with the Implemented Export Controls (IEC) of international partners, and to distinguish between such items and those items controlled through multilateral regimes, BIS is establishing a new framework in the EAR.

- IEC items will be identified in the 900 series of the CCL, *i.e.*, in Export Control Classification Numbers (ECCNs) for which the third digit is a 9 and the fourth digit is a number from 0 to 7 (*e.g.*, 3A901). Such items have worldwide license requirements and more limited license exception availability as compared to the ECCNs implementing multilateral regime controls.

- License Exception IEC will authorize exports and reexports to

specified destinations whose governments have implemented equivalent controls on the same items as the United States.

- Finally, this rule amends certain existing ECCNs where the proposal applied to an existing ECCN and it would have been more confusing to the public to create a separate ECCN, e.g., ECCN 3B001. For these items, rather than establish new ECCNs, BIS is revising the item's current ECCN, even if such entry was initially adopted as a multilateral ECCN.

BIS encourages the public to comment on: (1) this framework for IEC, especially as it may impact supply chains and compliance programs; (2), the scope and clarity of the new ECCNs; and (3) the scope of the license exceptions.

BIS also seeks public comment on the deemed export requirements in this rule and the potential impacts that a deemed export control would have if it was applied to the quantum items and the General License in General Order no. 6 in paragraph (f)(3) in supplement no. 1 to part 736 were removed in this rule or at a future date. Specific illustrative questions are included below in section II.G.vii.

II. Details of Revisions to the EAR

A. Supplement No. 1 to Part 736—General Order No. 6—General License

BIS adds General Order No. 6 to implement three authorizations in paragraph (f) of supplement no. 1 to part 736 of the EAR.

A GAAFET General License (GL) is implemented in paragraphs (f)(1) and (f)(2) to support the U.S. technology leadership through ongoing collaboration with established partners in allied countries, i.e., when that “development” or “production” began to be performed on or prior to September 6, 2024. In paragraph (f)(1), this GL authorizes exports, reexports, and transfers (in-country) to certain end users in destinations specified in Country Groups A:5 and A:6 in supplement no. 1 to part 740 of the EAR. The GL does not authorize deemed exports and reexports, because deemed exports and reexports to these countries are excluded from NS and RS controls under §§ 742.4(a)(5) and 742.6(a)(10) of the EAR.

In paragraph (f)(2), the GL does, however, authorize deemed exports or deemed reexports of “technology” specified in ECCN 3E905 (including for future advancements or versions of the same “technology”) to foreign person employees or contractors already employed by entities as of September 6,

2024 whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5, and who are not prohibited persons under part 744 of the EAR.

In paragraph (f)(3), the General License authorizes deemed exports or deemed reexports of quantum “technology” and “software” to foreign persons whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5 and who are not prohibited persons under part 744 of the EAR.

These authorizations in paragraph (f) are subject to annual reporting requirements in (f)(4), end-use and end-user restrictions in paragraph (f)(5), and recordkeeping requirements in paragraph (f)(6).

B. § 738.2 Commerce Control List (CCL) Structure

BIS is revising paragraph (d) to revise the explanation of the composition of an Export Control Classification Number (ECCN), especially focusing on the meaning of the digits in the ECCN. The 500 series is currently being utilized to cover firearms in the 0x5xx ECCNs and “Spacecraft” in 9x515 ECCNs. The new ECCNs that establish controls implemented by partners are now being placed in the 900 series ECCNs. Crime control and short supply controls have long shared the 980–989 series of ECCNs. Lastly, the 990–999 series ECCNs are being used for unilateral Anti-terrorism (AT), Regional Stability (RS), and United Nations Sanctions (UN) controls. BIS notes that while this is the overall structure of an ECCN, there will be the rare exception, e.g., ECCN 3B001, because there are some items mirroring controls by allies rather than pursuant to the formal multilateral regime controls.

C. § 740.2 Restrictions on all License Exceptions

BIS is amending § 740.2 by adding paragraph (a)(22) to restrict the use of all license exceptions other than License Exceptions IEC, TMP, RPL, GOV, and TSU for the items described herein. License Exception IEC is available for exports, reexports, or transfers (in-country) of eligible items (currently ECCNs 2B910, 2D910, 2E903, 2E910, 3A901, 3A904, 3B001.c.1.a, 3B001.c.1.c, 3B001.q, 3B903, 3B904, 3C907, 3C908, 3C909, 3D001 (for 3B001.c.1.a, 3B001.c.1.c, 3B001.q), 3D002 (for 3B001.c.1.a, 3B001.c.1.c), 3D901, 3D907, 3E001 (for 3B001.c.1.a, 3B001.c.1.c, 3B001.q), 3E901, 3E905, 4A906, 4D906, and 4E906) to the eligible destinations specified in § 740.24 of the EAR. Section

740.2(a)(22) further specifies that such items may only be exported to other destinations pursuant to TMP, restricted to eligibility under the provisions of § 740.9(a)(3) and (6); RPL, under the provisions of § 740.10; GOV, restricted to eligibility under the provisions of § 740.11(b); or TSU under the provisions of § 740.13(a) and (c).

D. § 740.24 Implemented Export Controls (IEC)

i. Country Scope

BIS is implementing license exception eligibility for specified countries that have implemented equivalent technical national controls for specific items, in accordance with *License Exception IEC Eligible Items and Destinations* which is incorporated by reference into this section with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. This material is available for inspection on the BIS website.

This authorization supports collaboration and innovation in those technologies for countries that have implemented equivalent technical parameters for these items in their export controls.

ii. Product Scope

Therefore, BIS is adding License Exception IEC to authorize exports and reexports to and among, and transfers (in-country) within, specified countries that have implemented export controls for items subject to the NS worldwide controls in newly added § 742.4(a)(5) and the RS worldwide controls in newly added § 742.6(a)(10). See description below in the national security and regional stability sections about these newly added paragraphs. Currently these items include the following ECCNs: 2B910, 2D910, 2E903, 2E910, 3A901, 3A904, 3B001.c.1.a, 3B001.c.1.c, 3B001.q, 3B903, 3B904, 3C907, 3C908, 3C909, 3D001 (for 3B001.c.1.a, 3B001.c.1.c, 3B001.q), 3D002 (for 3B001.c.1.a, 3B001.c.1.c), 3D901, 3D907, 3E001 (for 3B001.c.1.a, 3B001.c.1.c, 3B001.q), 3E901, 3E905, 4A906, 4D906, and 4E906. For ease of reference, the CCL entry for each of these ECCNs indicates “IEC: Yes” in the respective license exception section and references § 740.2(a)(22) and § 740.24 of the EAR. *License Exception IEC Eligible Items and Destinations* will be revised on the BIS website as additional countries implement these controls.

ECCNs eligible for License Exception IEC state “IEC: Yes” in the List-based License Exception paragraph of the ECCN. These items are controlled for export and reexport worldwide for

national security reasons under § 742.4(a)(5), for regional stability reasons under § 742.6(a)(10), and for anti-terrorism reasons to destinations specified in AT column 1 in supplement no. 1 to part 738 of the EAR.

iii. Incorporation by Reference: Eligibility Table Entitled “License Exception IEC Eligible Items and Destinations”

License Exception IEC eligibility is based on implementation of export controls for the items described in *License Exception IEC Eligible Items and Destinations* (incorporated by reference and available on the BIS website at <https://www.bis.gov/articles/license-exceptions#license-exception-IEC-eligibility>) by specified countries that have implemented equivalent technical parameters for these items in their export controls that substantially align with those implemented by the United States. *License Exception IEC Eligible Items and Destinations* identifies the items authorized under License Exception IEC to be exported, reexported, or transferred (in-country) to, among, or within the countries that have implemented export controls for these items. See paragraph § 740.24(c) for specific information about the incorporate by reference approval.

E. § 742.4 National Security

BIS adds paragraph (a)(5) to set forth a worldwide license requirement for national security reasons when an ECCN references § 742.4(a)(5) in an NS license requirement paragraph in the license requirement table of the ECCN. This rule also adds paragraph (b)(10) to set forth the license review policy for the items in paragraph (a)(5), which is a presumption of approval when the export or reexport is to a country in Country Group A:1 of supplement no. 1 to part 740 of the EAR. For exports or reexports of such items to destinations specified in Country Group D:1 or D:5, license applications will be reviewed with a presumption of denial. A case-by-case review policy will be applied for such items to all other destinations, to assess the risk that the export or reexport would contribute to the military potential of a country specified in Country Group D:1 or D:5 or to the destabilization of the region to which the item is destined. These items are also subject to regional stability and anti-terrorism controls. ECCNs currently subject to this NS control are: 2B910, 2D910, 2E903, 2E910, 3A901, 3A904, 3B001.c.1.a, 3B001.c.1.c, 3B001.q, 3B903, 3B904, 3C907, 3C908, 3C909, 3D001 (for 3B001.c.1.a, 3B001.c.1.c, 3B001.q), 3D002 (for 3B001.c.1.a,

3B001.c.1.c), 3D901, 3D907, 3E001 (for 3B001.c.1.a, 3B001.c.1.c, 3B001.q), 3E901, 3E905, 4A906, 4D906, and 4E906.

There is a 60-day delayed compliance for exports, reexports, and transfers (in-country) for quantum items specified in ECCNs 3A901, 3A904, 3B904, 3C907, 3C908, 3C909, 3D901 (for 3A901.b, 3B904), 3E901 (for 3A901, 3A904, 3B904, 3C907, 3C908, 3C909), 4A906, 4D906, or 4E906 controls to destinations in Country Group A:1; see compliance date at the beginning of the rule. This delay in compliance is to allow for submission and processing of license applications or implementation of internal compliance procedures on items covered by these ECCNs.

License requirements for deemed exports and deemed reexports for national security and regional stability controls are discussed in Section G of this rule, as the license requirements are identical for both.

F. § 742.6 Regional Stability

Generally, regional stability controls are not added in conjunction with national security controls for conventional weapons-related items, because the controls are agreed upon unanimously by a multilateral regime. However, the additional CCL controls BIS is implementing in this rule have not yet been adopted by the relevant multilateral regime. Therefore, BIS is also unilaterally controlling these items for regional stability reasons at this time. Exporters should also note 50 U.S.C. 4565(a)(6), which defines “critical technologies” for purposes of the jurisdiction of the Committee on Foreign Investment in the United States (CFIUS). Additional information about CFIUS can be found on Treasury’s website at: <https://home.treasury.gov/policy-issues/international/the-committee-on-foreign-investment-in-the-united-states-cfius>.

This rule adds paragraph (a)(10) to set forth a worldwide license requirement for regional stability reasons when an ECCN references § 742.6(a)(10) in an RS license requirement in the license requirement table of the ECCN. This rule also adds paragraph (b)(11) to set forth the license review policy for the items in paragraph (a)(10), which is a presumption of approval for destinations specified in Country Group A:1. For exports or reexports of such items to destinations specified in Country Groups D:1 or D:5 of supplement no. 1 to part 740 of the EAR, license applications will be reviewed under a presumption of denial. A case-by-case review policy will be applied for such items to all

other destinations, to assess the risk the export or reexport would contribute significantly to the destabilization of the region to which the equipment is destined. These items are also subject to national security and anti-terrorism controls. ECCNs currently subject to this RS control are: 2B910, 2D910, 2E903, 2E910, 3A901, 3A904, 3B001.c.1.a, 3B001.c.1.c, 3B001.q, 3B903, 3B904, 3C907, 3C908, 3C909, 3D001 (for 3B001.c.1.a, 3B001.c.1.c, 3B001.q), 3D002 (for 3B001.c.1.a, 3B001.c.1.c), 3D901, 3D907, 3E001 (for 3B001.c.1.a, 3B001.c.1.c, 3B001.q), 3E901, 3E905, 4A906, 4D906, and 4E906.

There is a 60-day delayed compliance for exports, reexports, and transfers (in-country) for quantum items specified in ECCNs 3A901, 3A904, 3B904, 3C907, 3C908, 3C909, 3D901 (for 3A901.b, 3B904), 3E901 (for 3A901, 3A904, 3B904, 3C907, 3C908, 3C909), 4A906, 4D906, or 4E906 controls to destinations in Country Group A:1; see compliance date at the beginning of the rule. This delay in compliance is to allow for submission and processing of license applications or implementation of internal compliance procedures on items covered by these ECCNs.

License requirements for deemed exports and deemed reexports are discussed in the section below, as the license requirements are identical to the national security controls.

G. Deemed Export and Deemed Reexport Controls

i. Grandfathering Clauses

This rule includes grandfathering clauses, allowing the continued and future access to “technology” and “software” (including for future advancements or versions of the same “technology” and “software”) that require a license for national security or regional stability reasons in § 742.4(a)(5)(i) and § 742.6(a)(10)(i) of the EAR for foreign person employees and contractors that already have access to such “technology” or “software” and are employed by an entity as of the effective date of this rule. The only exception to these grandfathering clauses is for GAAFET “technology” specified in ECCN 3E905 to foreign persons whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5. However, this rule implements authorization for employees and contractors to continue access to GAAFET technology under General License in General Order no. 6, paragraph (f) of supplement no. 1 to part 736 of the EAR subject to reporting requirements and conditions.

ii. Full Deemed Export and Deemed Reexport Exclusion

This rule implements a full deemed export and deemed reexport license requirement exclusion from license requirements imposed under the national security and regional stability control in § 742.4(a)(5)(i) and § 742.6(a)(10)(i) of the EAR for “technology” and “software” in ECCNs 3D001, 3D002, and 3E001 for anisotropic dry plasma etch equipment and isotropic dry etch equipment in 3B001.c.1.a and c.1.c. This is in alignment with the full deemed export and deemed reexport exclusion that is already in place for this “technology” and “software” that was established by the rule entitled “Export Controls on Semiconductor Manufacturing Items” published in the **Federal Register** on October 25, 2023 (88 FR 73424).

iii. Limited Deemed Export and Deemed Reexport Exclusion

For specified items, this rule implements a limited deemed export and deemed reexport license requirement exclusion from license requirements imposed under the national security and regional stability control in § 742.4(a)(5)(i) and § 742.6(a)(10)(i) of the EAR, except to foreign persons whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5. The specified items include “software” or “technology” ECCNs: ECCNs 2D910; 2E910; 3D001 (“software” for “EUV” masks and reticles in ECCN 3B001.q); 3D901 (for “software” for quantum items in ECCNs 3A901.b, 3B904 and scanning electron microscopes (SEM) in ECCN 3B903); 3D907 (“software” designed to extract “GDSII” or equivalent data); 3E001 (“technology” for “EUV” masks and reticles in ECCN 3B001.q); 3E901 (for “technology” for quantum items in 3A901, 3A904, 3B904, 3C907, 3C908, and 3C909, and for SEMs in ECCN 3B903); 3E905 “technology” according to the General Technology Note for the “development” or “production” of integrated circuits or devices, using “Gate all-around Field-Effect Transistor” (“GAAFET”) structures; and “technology” for quantum items in ECCNs 4D906 or 4E906.

iv. Quantum Technology

U.S. technology leadership is based in part upon the ability of U.S. companies to benefit from the expertise of foreign persons. While this is true in many technology sectors, access to foreign expertise is particularly necessary in

quantum computing. Quantum computing research and development is substantially a global endeavor, with major innovation occurring in academic labs, small companies, large companies, and national laboratories distributed throughout the world. Key foundational concepts, capabilities, and discoveries from one side of the globe are often borrowed, improved, and/or incorporated to advance efforts on the other side of the world. In this dynamic environment, the entities that can access and incorporate new technology developments quickly will have a major advantage over those who cannot. In addition, many leading quantum computing companies have built deep and enduring relationships with academics from around the world to facilitate the influx of technology. At the same time, there is a global shortage of quantum computing expertise, with demand currently outstripping supply. This has led to a substantial world-wide competition to attract the top talent. Academia and industry have described the talent bottleneck as one of the largest impediments to acceleration.

The domestic development of quantum information science and technology (QIST) experts, including in quantum computing, is insufficient to fill the United States’ QIST strategic goals. The United States will continue to rely on foreign talent to fill critical workforce gaps. Currently, much of the QIST talent developed in the U.S. are foreign persons. Foreign persons are subject to visa requirements as administered by the Department of State. More than half of QIST-related degrees conferred in the U.S. are awarded to temporary U.S. residents. Additionally, stakeholders report that offshore companies are becoming increasingly attractive places to pursue a career in quantum computing, driven both by increases in public and private investments internationally, but also uncertainty in the ability to work in the United States due to immigration policies.

While the license requirements for deemed exports and deemed reexports of quantum technology and software only apply to foreign persons whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5, this hardship would be devastating to the continued progress of future developments in the quantum field, which depends on foreign person employees from these destinations. Therefore, this rule is implementing a new General License (GL) in General Order no 6 paragraph (f)(3) of supplement no. 1 to part 736 that

authorizes deemed exports and deemed reexports of quantum technology and software to foreign persons whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5. This GL authorization will be subject to annual reporting requirements in new § 743.8 in this rule. Annual reports will allow for visibility to ensure access is consistent with U.S. national security and foreign policy interests. When access appears inconsistent with U.S. national security and foreign policy interests, BIS has the authority to impose a license requirement on the foreign national’s continued access to the relevant technology. Not complying with the reporting requirement or falsifying or omitting information required by the reporting requirement would be a violation of the EAR.

BIS is adding § 743.8 to set forth provisions for a report of release under the General License in General Order no. 6 in paragraph (f)(3) in supplement no. 1 to part 736 of the EAR of quantum “software” or “technology” to foreign persons from destinations specified in Country Group D:1 or D:5 for the “development” or “production” of items controlled by ECCNs 3A901, 3A904, 3B904, 3C907, 3C908, 3C909, or 4A906. The report must include information typically included in a deemed export license application, see guidelines for deemed export license applications under the learn and support tab of the BIS website at www.bis.gov. The first report is due 60 days after the publication of this rule, then it will be required annually thereafter. In addition to the annual report, the host entity must report to BIS the voluntary or involuntary termination of a foreign person’s employment at the host entity within 30 days of the termination. This approach supports U.S. technology leadership by authorizing continued collaboration on quantum technology development and production, while providing BIS with the necessary visibility for national security oversight.

v. Technology Related to Gate-All-Around Field-Effect Transistor and Semiconductor Manufacturing Equipment

U.S. companies designing and producing semiconductor manufacturing equipment as well as integrated circuits with Gate-All-Around Field-Effect Transistor (GAAFET) technology (ECCN 3E905) face challenges regarding the ability to hire and retain foreign persons with substantial expertise.

To ensure continued technology leadership of U.S. companies and prevent disruption of the current semiconductor manufacturing supply chain, BIS has added two authorizations in General License to supplement no. 1 to part 736 General Order no. 4 for GAAFET exports, reexports, and transfers (in-country) to entities currently in collaboration with U.S. industry in destinations specified in Country Group A:5 or A:6 of the EAR and deemed exports and deemed reexports of “technology” and “software” for GAAFET “technology” specified in ECCN 3E905 to foreign person employees or contractors already employed by entities as of [September 6, 2024] whose most recent citizenship or permanent residency is a destination specified in Country Group D:1 or D:5, including for future advancements or versions of the same “technology”. This authorization includes a reporting requirement that is added to § 743.7 of the EAR, and the first report is due 60 days after the publication of this rule on November 5, 2024, thereby followed by annual reporting to BIS.

BIS is adding § 743.7 to set forth provisions for an annual report of any export, reexport, or transfer (in-country) of “technology” specified in ECCN 3E905 that is not authorized by an individual validated license but is authorized pursuant to the GAAFET General License in General Order No. 6 in paragraph (f)(1) or (f)(2) in supplement no. 1 to part 736 of the EAR. The first report is due 60 days after the publication of this rule, then it will be required annually thereafter.

BIS and its interagency partners made this assessment to avoid undercutting U.S. technology leadership and in recognition that software and technology related to semiconductor items is generally proprietary information, which companies have a strong incentive to protect by utilizing substantial internal controls, including imposing limitations on access, vetting employees, and executing non-disclosure agreements. This approach supports U.S. technology leadership by authorizing continued collaboration on GAAFET technology development and production, while providing BIS with the necessary visibility for national security oversight. BIS assesses that this approach enables continued U.S. technology leadership while providing the U.S. government visibility into foreign persons working in this technology.

vi. ECCN 2B910 Additive Manufacturing Equipment

Lacking comparable information on the remaining technology, BIS is implementing deemed export and reexport controls for foreign persons for “technology” and “software” in ECCNs 2D910 and 2E910 for additive manufacturing equipment (2B910).

vii. Request for Public Comments Regarding Deemed Exports

BIS is seeking to understand the potential impacts that a deemed export control would have if the General License in General Order no. 6 in paragraph (f)(3) in supplement no. 1 to part 736 were removed in this rule or at a future date. BIS is also seeking public input and suggestions on how U.S. national security concerns could be addressed in the absence of a quantum technology deemed export licensing requirement. BIS encourages consideration of the following list of questions when preparing input, but also welcomes any other relevant input and suggestions.

A. Anticipated challenges associated with compliance with deemed-export restrictions:

1. Do you already implement deemed export controls for other technologies?
2. Do you have the necessary staff with appropriate training to manage deemed export controls for these items? If not, how many additional staff would you expect to need to hire?

3. Approximately how many individuals, including external consultants and subject matter experts, would require licenses if deemed export controls were implemented? What approximate percentage of your total workforce does that constitute and how do you anticipate that changing in the future? Are there particular countries from which a significant fraction of relevant individuals come? How do you anticipate deemed exports altering future hiring practices?

4. If deemed export controls are implemented, how would that impact future siting decisions for R&D and manufacturing?

5. Are there other anticipated challenges or impacts to competitiveness associated with deemed exports on the quantum items not covered in the above questions? How would the implementation of deemed exports on these items alter R&D activities?

b. Anticipated aspects of technology development and interactions relevant for potential deemed-export restrictions:

1. For the quantum items, is your development or use of those items not

related to quantum computers? If so, which items?

2. For which quantum items are deemed exports potentially relevant because you develop or produce those items? For which are deemed exports potentially relevant only because you use or operate those items?

3. Are there quantum items you develop or produce as part of basic scientific research for which deemed exports would be potentially relevant? Is this true for research that is intended for open publication, research for which details will be kept restricted or proprietary, or both?

Comments received will be used to contemplate future imposition of deemed export requirements.

H. Part 772—Definitions of Terms

This rule adds a definition for “GDSII” or “Graphic Design System II” to § 772.1 “Definitions of terms as used in the Export Administration Regulations (EAR).” GDSII is a database file format for data exchange of integrated circuit artwork or integrated circuit layout artwork. This term is used in ECCNs in Category 3 of the CCL, e.g., ECCN 3D907.

I. Specific Changes to the Commerce Control List in Supplement No. 1 to Part 774 of the EAR

Adds the following 18 ECCNs: 2B910, 2D910, 2E903, 2E910, 3A901, 3A904, 3B903, 3B904, 3C907, 3C908, 3C909, 3D901, 3D907, 3E901, 3E905, 4A906, 4D906, and 4E906.

Revises the following 9 ECCNs: 2E003, 3A001, 3B001, 3C001, 3D001, 3D002, 3E001, 4D001, and 4E001.

2B910 Additive manufacturing equipment, designed to produce metal or metal alloy components.

The current state-of-the-art additive manufacturing (AM) technology builds upon more than 30 years of research and development. Today, metal AM equipment is used to produce parts and components in military devices, such as aircraft, missiles and propulsion systems. Ultimately, next-generation metal AM equipment with high levels of precision and control will enable significant improvements in part performance properties and advanced military capabilities not yet realistically achievable with current standard metal AM equipment.

For these reasons, BIS is adding ECCN 2B910 to the CCL to control specified AM equipment designed to produce metal or metal alloy components, and “specially designed” “components” therefor for national security, regional stability, and anti-terrorism reasons. A

license is required to export or reexport AM equipment, designed to produce metal or metal alloy components, having all of the specified parameters in the List of Items Controlled of ECCN 2B910, and “specially designed” “components” therefor to all destinations as specified pursuant to the national security controls and reviewed under the licensing policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and reviewed under the licensing policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

2D910 “Software”, not specified elsewhere, “specially designed” or modified for the “development” or “production” of equipment specified in ECCN 2B910.

BIS is adding ECCN 2D910 to the CCL to control “software”, not specified elsewhere, “specially designed” or modified for the “development,” “production,” operation, or maintenance of equipment specified in ECCN 2B910.

A license is required to export or reexport ECCN 2D910 “software” to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

2E003 Other “technology”.

ECCN 2E003 is amended by adding a Related Control note to reference ECCN 2E903 for “technology”, not specified elsewhere, for the “development” or “production” of coating systems (as defined in 2E903).

2E903 “Technology”, not specified elsewhere, for the “development” or “production” of ‘coating systems’.

While current gas turbine engines that propel aircraft and generate electricity are highly efficient, there is always demand for even higher performance, better fuel efficiency, and lower air polluting emissions. Ceramic matrix composites (CMCs) are used in gas turbine engines, aircraft and missile structures, radomes and hypersonics. CMCs have two main benefits over nickel alloys: higher temperature capability and lower density.

For these reasons, BIS is adding ECCN 2E903 to the CCL to control “technology”, not specified elsewhere,

for the “development” or “production” of ‘coating systems.’ This addition also includes a technical note to explain that ‘coating systems’ consist of one or more layers (e.g., bond, interlayer, top coat) of material deposited on the substrate. These coatings are designed to protect substrates made from CMC materials from water vapor or corrosive gases generated during combustion reactions. This corrosiveness results in rapid surface recession, which erodes structural integrity and mechanical strength.

A license is required to export or reexport ECCN 2E903 “technology”, not specified elsewhere, for the “development” or “production” of ‘coating systems’ to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

2E910 “Technology”, not specified elsewhere, “specially designed” or modified for the “development” or “production” of equipment specified in ECCN 2B910.

BIS is adding ECCN 2E910 to the CCL to control “technology”, not specified elsewhere, “specially designed” or modified for the “development” or “production” of equipment specified in ECCN 2B910.

A license is required to export or reexport ECCN 2E910 “technology” to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

Category 3, Product Group A: Notes.

This rule revises Note 1 by moving the list of 3A001 paragraphs into a parenthetical that is now located after 3A001. This rule adds 3A001.z within the parenthetical, which means that if an item specified in 3A001.z is “specially designed” for or has the same functional characteristics as other equipment, that it will still be classified and treated as an item specified in 3A001.z instead of as that equipment. This rule also adds ECCN 3A901 to Note 1, which means that if a 3A901 electronic item, such as a cryogenic CMOS or cryo-CMOS chip or a

parametric signal amplifier were “specially designed” or had the same function as other equipment, then it would be classified and treated as that other equipment.

BIS is adding 3A001.z and 3A901 to Note 2, which means that if these integrated circuits “are unalterably programmed or designed for a specific function for other equipment” then it would be classified and treated as the other equipment.

BIS is also adding 3A001.z and 3A901 to the Nota Bene (N.B.), which means that “When the manufacturer or applicant cannot determine the control status [classification] of the other equipment” then the ICs would be classified as 3A001.z or 3A901, respectively.

3A001 Electronic items.

BIS adds a nota bene (N.B.) before 3A001.a.3 that states, “For cryogenic Complementary Metal Oxide Semiconductor (CMOS) integrated circuits not specified by 3A001.a.2, see 3A901.a.” The same note is added to the Related Controls notes.

Paragraph 3A001.a.9 neural network integrated circuits is removed and reserved, because of the addition of ECCN 3A090, which controls integrated circuits that may be used for machine learning of artificial intelligence systems, to the CCL.

BIS adds a nota bene (N.B.) after 3A001.b that states, “For parametric signal amplifiers or Quantum-limited amplifiers (QLAs) not specified by 3A001.b, see ECCN 3A901.b.” The same note is added to the Related Controls notes.

3A901 Electronic items not specified by 3A001.

Quantum processors based on superconducting arrays must operate at extremely low temperatures (typically 20 mK or below), and other quantum computing implementations require cooling below 200 mK. To allow conventional complimentary metal-oxide semiconductor (CMOS) memory and logic circuits to operate, and to avoid them heating the cryogenically cooled components, the controls are placed some distance away from the cryogenic features and are linked by multiple cables. The amount of cabling required for all the qubits presents a significant barrier to scaling up quantum bit (qubit) capacity as well as causing high processing latencies.

As larger quantum computers with more qubits are developed, the control circuitry must be moved inside the cryostat to reduce these latencies. Currently, conventional CMOS devices have a general lower temperature limit

of -40°C (233K). CMOS designs are currently being developed that are suitable for operating around 4K temperatures or below for the purposes of quantum computing.

For these reasons, BIS adds 3A901.a to the CCL to control CMOS integrated circuits, not specified by 3A001.a.2, designed to operate at an ambient temperature equal to or less (better) than 4.5 K (-268.65°C). A technical note accompanies this addition stating that “CMOS integrated circuits are also referred to as cryogenic CMOS or cryo-CMOS integrated circuits.”

A critical function in quantum computing projects is the ability to read out very weak signals. To perform that function, the qubit and signal amplifiers need to be cooled down to a very low temperature to suppress the noise. For this reason, BIS adds 3A901.b to the CCL to control parametric signal amplifiers that operate at very low temperatures, at specified frequencies, and a noise figure parameter. A note and a technical note are also added stating, “parametric signal amplifiers include Travelling Wave Parametric Amplifiers (TWPAs)” and “parametric signal amplifiers may also be referred to as Quantum-limited amplifiers (QLAs).”

CMOS integrated circuits specified in 3A901.a and parametric signal amplifiers specified in 3A901.b require a license to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

3A904 Cryogenic cooling systems and components.

The cooling power limit for complete cryogenic systems is the focus of this control and is based on the currently commercially available cooling systems. The systems with the smallest cooling power tend to be used for basic research, whereas development of larger quantum computers is typically done using systems with the highest cooling power. However, this distinction is not clear-cut. This control focuses on items that are relevant for research on quantum systems with a larger quantity of physical qubits. This type of cryogenic cooling system warrants national security, regional stability, and anti-terrorism controls.

For these reasons, BIS is adding ECCN 3A904 to the CCL to control cryogenic cooling systems and specified components. ECCN 3A904 controls

“systems rated to provide a cooling power greater than or equal to $600\text{ }\mu\text{W}$ at or below a temperature of 0.1 K (-273.05°C) for a period of greater than 48 hours,” as well as specified two-stage pulse tube cryocoolers.

Items specified in ECCN 3A904 are controlled for NS and RS to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

3B001 Equipment for the manufacturing of semiconductor devices, materials, or related equipment, as specified and “specially designed” “components” and “accessories” therefor.

GAAFETs and similar 3D structures with different brand names require lateral etching with high selectivity. Isotropic dry etching is required for lateral etching.

Anisotropic dry plasma etching can only etch vertically. Atomic layer etching, enhanced by the features described in 3B001.c.1.a and c.1.c, produces the vertical edges required in high-quality, leading-edge advanced devices and structures, including GAAFET and similar 3D structures. These tools precisely remove monolayers without damaging other layers.

Anisotropic dry etching is critical for GAAFET and similar 3D structure fabrication. It is also an important tool for Fin-shaped Field Effect Transistor (FinFET) fabrication. As taller and straighter fins are required for scaling, anisotropic dry etching is used by FinFET manufacturers to uniformly scale the critical dimension of the Fin, improving its profile and thus enhancing its performance. Anisotropic dry etching is also used for self-aligned contact and minimum pitch via etching. Polysilicon dummy gate patterning, and its removal in a Replacement Metal Gate (RMG) process for FinFETs and GAAFET, are also enabled by anisotropic etching. Highly selective isotropic/anisotropic etching is routinely used in multi-patterning applications such as hard-mask.

Masks and reticles are each made from complex multiple layer mask blanks. They have to be designed for “extreme ultraviolet” (“EUV”) lithography. As masks and reticles are critical components for EUV lithography, BIS is adding 3B001.q to

control “EUV” masks and “EUV” reticles designed for integrated circuits, not specified by 3B001.g, and having a mask “substrate blank” specified by 3B001.j.” A technical note is added to clarify that masks or reticles with a mounted pellicle are considered masks and reticles.

For the reasons stated above, BIS is adding worldwide NS and RS license requirements to the license requirement table for 3B001.c.1.a isotropic dry etching equipment, c.1.c anisotropic dry etching equipment and 3B001.q (“EUV” masks and “EUV” reticles designed for integrated circuits, not specified by 3B001.g, and having a mask “substrate blank” specified by 3B001.j). Items specified in ECCN 3B001.c.1.a, 3B001.c.1.c, and 3B001.q are newly controlled for NS and RS to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and have an existing control for Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

BIS is removing License Exception GBS eligibility for 3B001.c.1.a (Equipment designed or modified for isotropic dry etching), 3B001.c.1.c (Equipment designed or modified for anisotropic dry etching), and 3B001.q (“EUV” masks and “EUV” reticles designed for integrated circuits, not specified by 3B001.g, and having a mask “substrate blank” specified by 3B001.j). BIS is adding License Exception IEC to the List-based License Exceptions section of 3B001.

BIS adds a reference to ECCN 3B903 in the Related Controls paragraph of the List of Items Controlled section.

3B903 Scanning Electron Microscope (SEM) equipment designed for imaging semiconductor devices or integrated circuits.

This rule adds ECCN 3B903 to control Scanning Electron Microscopes (SEM) designed for imaging of semiconductor devices or integrated circuits for national security, regional stability, and anti-terrorism reasons. A specialized SEM can be used to reverse engineer integrated circuits and perform chip design recovery and for this reason warrants national security controls to protect innovation in integrated circuit development of the United States and other supplier countries.

Therefore, BIS is adding ECCN 3B903 to the CCL to control SEM designed for imaging of semiconductor devices or

integrated circuits. Items specified in ECCN 3B903 are controlled for NS and RS to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

3B904 Cryogenic wafer probing equipment.

Cryogenic wafer probers are targeted to scaling up quantum computing based on solid-state qubits, among other types of qubits. Development of cryogenic quantum devices, electronics, and detectors can benefit from better device characterization offered by a cryogenic wafer prober. Certain cryogenic wafer probers will speed up the testing and characterization (collection of high-volume data) from qubit devices under test. This offers a distinct advantage during development which has traditionally taken much more time for low temperature testing. For this reason, BIS believes this equipment warrants export controls for national security, regional stability, and anti-terrorism reasons.

Therefore, BIS is adding ECCN 3B904 to the CCL to control specified cryogenic wafer probing equipment. Items specified in ECCN 3B904 are controlled for NS and RS to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

3C001 Hetero-epitaxial materials consisting of a “substrate” having stacked epitaxially grown multiple layers.

ECCN 3C001 is revised by adding a new Related Control note paragraph 2 to reference ECCNs 3C907, 3C908, and 3C909. In addition, a new nota bene (N.B.) is added after paragraph 3C001.f to reference ECCN 3C907.

3C907 Epitaxial materials consisting of a “substrate” having at least one epitaxially grown layer and containing other specified materials.

3C908 Fluorides, hydrides, chlorides, of silicon or germanium, containing other specified materials.

3C909 Silicon, silicon oxides, germanium or germanium oxides,

containing any other specified materials.

Semiconducting qubits consisting of certain silicon (Si) or germanium (Ge) isotopes, which have no nuclear spin, or mixture thereof, are one of the key technologies to develop spin-based quantum computers. Therefore, this rule adds three ECCNs for controlling these materials: 3C907, 3C908, and 3C909. ECCN 3C907 controls “Epitaxial materials consisting of a “substrate” having at least one epitaxially grown layer” of silicon or germanium containing a specified percentage of silicon or germanium isotopes. ECCN 3C908 controls “Fluorides, hydrides, chlorides, of silicon or germanium” containing a specified percentage of silicon or germanium isotopes. ECCN 3C909 controls “Silicon, silicon oxides, germanium or germanium oxides” containing a specified percentage of silicon or germanium isotopes. Isotopic enriched Si and Ge are exported with certificates which indicate isotopic distribution or combination, regardless of their chemical forms, by commercial practice. Those documents would facilitate examination of whether isotopic purity of the exported item is below or above the control threshold.

Therefore, BIS is adding ECCNs 3C907, 3C908, and 3C909 to the CCL because semiconducting qubits consisting of certain silicon (Si) or germanium (Ge) isotopes, which have no nuclear spin, or a mixture thereof are key materials needed to develop spin-based quantum computers. Materials specified in ECCNs 3C907, 3C908, and 3C909 are controlled for NS and RS to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

3D001 “Software”.

ECCN 3D001 is amended by revising the heading to add ECCN 3B903 and 3B904 to the exception parenthetical for 3B. In addition, BIS is adding to the license requirement table two new rows for NS and RS worldwide controls for “software” “specially designed” for the “development” or “production” of commodities controlled by 3B001.c.1.a, 3B001.c.1.c, and 3B001.q. Such “software” controlled by commodities in ECCN 3B001.c.1.a, 3B001.c.1.c, or 3B001.q are controlled for NS and RS to all destinations as specified pursuant to the national security controls and

license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

BIS is also adding an STA restriction for “software” “specially designed” for the “development” or “production” of equipment specified by 3B001.c.1.a, 3B001.c.1.c, or 3B001.q to any of the destinations listed in Country Group A:5.

3D002 “Software” “specially designed” for the “use” of equipment controlled by 3B001.a to .f and .j to .p, or 3B002.

BIS is adding to the license requirement table two new rows for NS and RS worldwide controls for “software” “specially designed” for “use” of equipment controlled by 3B001.c.1.a and c.1.c. Such “software” is controlled for NS and RS to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

BIS is also adding an STA restriction for “software” “specially designed” for the “development” or “production” of equipment specified by 3B001.c.1.a or c.1.c to any of the destinations listed in Country Group A:5.

3D901 “Software”, not specified elsewhere, “specially designed” or modified for the “development,” “production,” of items controlled in ECCN 3A901.b, 3B903, or 3B904.

BIS is adding ECCN 3D901 to control “software” not specified elsewhere, “specially designed” or modified for the “development,” “production,” operation, or maintenance of items controlled in ECCNs 3A901.b, 3B903, or 3B904.

“Software” specified in ECCN 3D901 is controlled for NS and RS reasons to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

3D907 “Software” designed to extract “GDSII” or equivalent standard

layout data and perform layer-to-layer alignment from SEM images, and generate multi-layer “GDSII” data or the circuit netlist.

BIS is adding ECCN 3D907 to control “software” designed to extract “Graphic Design System II” (“GDSII”) or equivalent standard layout data and perform layer-to-layer alignment from SEM images, as well as having the ability to generate multi-layer “GDSII” data or the circuit netlist. “GDSII” is an industry standard binary file format representing wire paths, boundaries, structures, arrays, text labels and other information about the layout of an integrated circuit in hierarchical form for Electronic Design Automation (EDA) data exchange of integrated circuit or IC layout artwork. This type of software aids in the reverse engineering of integrated circuits and warrants national security controls to protect the innovation of integrated circuits by the U.S. and other supplier countries. An example of an equivalent standard to “GDSII” would be Open Artwork System Interchange Standard (OASIS).

Therefore, BIS is adding ECCN 3D907 to the CCL to control “software” designed to extract “GDSII” or equivalent standard layout data and perform layer-to-layer alignment from SEM images, as well as having the ability to generate multi-layer “GDSII” data or the circuit netlist. BIS is also adding to the Related Controls paragraph, “An example of an equivalent standard to “GDSII” would be Open Artwork System Interchange Standard (OASIS).” “Software” specified in ECCN 3D907 is controlled for NS and RS reasons to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

3E001 “Technology” according to the General Technology Note for the “development” or “production” of commodities controlled by 3A (except 3A901, 3A904, 3A980, 3A981, 3A991, 3A992, or 3A999), 3B (except 3B903, 3B904, 3B991 or 3B992) or 3C (except 3C907, 3C908, 3C909, or 3C992).

The heading of 3E001 is amended by adding to the exception parentheticals ECCNs 3A901, 3A904, 3B903, 3B904, 3C907, 3C908, and 3C909.

In addition, BIS is adding to the license requirement table two new rows

for NS and RS worldwide controls for “technology” for equipment controlled by 3B001.c.1.a, 3B001.c.1.c, and 3B001.q. “Technology” for equipment controlled by ECCN 3B001.c.1.a, 3B001.c.1.c, or 3B001.q is controlled for NS and RS to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

ECCN 3E001 is amended by removing Note 3 and the Technical Note that follows it related to Process Design Kits (PDKs). In addition, this rule adds a Note 1 to Category 3, Product Group E to inform the exporting community that the controls in ECCN 3E001 and new ECCN 3E905 do not apply to PDKs unless they include libraries implementing functions or technologies for items specified by 3A001. The Technical Note that defined ‘PDK’ that was formerly in ECCN 3E001 is moved to Cat. 3 Product Group E.

3E901 “Technology” according to the General Technology Note for the “development” or “production” of items controlled by 3A901, 3A904, 3B903, 3B904, 3C907, 3C908, or 3C909.

BIS is adding ECCN 3E901 to control “technology” for items controlled by 3A901, 3A904, 3B903, 3B904, 3C907, 3C908, or 3C909.

“Technology” specified in ECCN 3E901 is controlled for NS and RS reasons to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

3E905 “Technology” according to the General Technology Note for the “development” or “production” of integrated circuits or devices, using “Gate all-around Field-Effect Transistor (“GAAFET”) structures.

BIS adds ECCN 3E905 to the CCL to control “technology” according to the General Technology Note for the “development” or “production” of integrated circuits or devices, using GAAFET structures. Integrated circuits produced with GAAFET technology are more efficient and capable than those produced with earlier architectures. It is

expected that the scaled and dense microchips produced with GAAFET technology will also be more tolerant to the effects of radiation. The greater efficiency and lower power consumption of GAAFET-produced chips enable faster and more robust artificial intelligence and other military and commercial applications.

ECCN 3E905 focuses on the “technology” (“required”) for the “development” and “production” of GAAFET structures, while existing technology controls in ECCNs 3E001 and 3E002 focus on integrated circuits and devices regardless of the transistor structure used, *i.e.*, the transistor structure is not a “required” element of the 3E001 or 3E002 controls. The items paragraph includes a note that states that “3E905 includes ‘process recipes’,” which are defined in a technical note as “a set of conditions and parameters for a particular process step.” BIS is adding a note to the Related Control paragraph to assist industry in applying the controls of this ECCN. The text in Related Control Note 1 reads, “ECCN 3E905 applies to process “technology” exclusively for the “development” or “production” of GAAFET structures of integrated circuits at a semiconductor wafer production facility. ECCN 3E905 does not, for example, control an integrated circuit design such as the physical layout file in GDSII format or EDA tools, or any other technology used to produce the physical layout file for integrated circuit design.” For these reasons, BIS does not believe there is an overlap of controls between ECCN 3E905 and 3E001 or 3E002. Industry is invited to submit comments on the clarity of the control text of this ECCN, as well as the clarification statement BIS input in the Related Control paragraph.

Because ECCN 3E905 was never intended to control GAAFET architecture for 3D NAND, *i.e.*, vertical GAAFET architecture, note 2 is added to the Related Controls paragraph to state: “2. ECCN 3E905 does not apply to vertical GAAFET architectures, *e.g.*, those used for 3D NAND.”

A license is required to export, reexport, or transfer (in-country) “technology” specified in ECCN 3E905 to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

4A906 Quantum computers and related “electronic assemblies” and “components” therefor.

The addition of controls in ECCN 4A906 relies on two main criteria: first, the number of physical qubits that are connected and fully controllable, and second, the average error rate of the Controlled NOT (C–NOT) gate. The first is a measure of engineering advances in component design and system integration that will enable scaling of quantum computers to very large systems. To reach a scale in the hundreds to thousands of qubits requires many advances in the design, manufacturing, and integration of the main components of the system such as the qubit processor, readout, qubit control, etc. The second criterion is a measure of the quality of the qubits. The combination of both metrics is more indicative of technological advances in the development of quantum computers of concern than either criterion on its own. For example, very advanced systems that have extremely good quality qubits and gates, but a relatively small qubit count, could be more scalable than systems with a higher qubit count but lower quality qubits and gates and are captured by the thresholds for the C–NOT gate error rates. However, this second metric still depends on the number of qubits. Systems with a higher number of qubits can tolerate higher error rates but still support error rate mitigation or error correction techniques. The physical error rate needed to support these operations increases (*i.e.*, can tolerate higher error rates) with increased qubit count and plateaus around 2,000 qubits at an error rate at 10^{-2} .

BIS has determined that a near-term generation of quantum computers will support 34 or more ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’ at the specified error rates, and that this number of qubits and error rate represents a high level of technological sophistication warranting national security, regional stability, and anti-terrorism controls.

For these reasons, BIS adds ECCN 4A906 to the CCL to control quantum computers and related “electronic assemblies” and “components” therefor. Paragraph 4A906.a controls specified quantum computers. Paragraph 4A906.b controls qubit devices and qubit circuits, containing or supporting arrays of ‘physical qubits’, and “specially designed” for items specified by 4A906.a. Paragraph 4A906.c controls quantum control components and quantum measurement devices, “specially designed” for items specified

by 4A906.a. ECCN 4A906 includes several notes that should assist the public in determining the application of these controls. The technical notes to ECCN 4A906 include definitions for terms such as ‘physical qubit,’ ‘fully controlled,’ ‘connected,’ ‘working,’ ‘C–NOT error,’ as well as an explanation of the phrase “‘fully controlled’, ‘connected’, ‘working’ ‘physical qubits’.”

Items specified in ECCN 4A906 are controlled for national security reasons to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

4D001 “Software”.

Paragraph 4D001.a is revised by adding ECCN 4A906 to the exception parenthetical for 4D.

4D906 “Software” “specially designed” or modified for the “development” or “production”, of commodities controlled by 4A906.b or 4A906.c.

BIS is adding ECCN 4D906 to the CCL to control “software” “specially designed” or modified for the “development” or “production” of commodities controlled by 4A906.b or 4A906.c.

“Software” specified in ECCN 4D906 is controlled for national security reasons to all destinations as specified pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

4E001 “Technology”.

Paragraph 4E001.a is amended by adding 4A906 and 4D906 to the exception parentheticals of 4A and 4D, respectively.

4E906 “Technology” according to the General Technology Note.

BIS adds ECCN 4E906 to the CCL to control in 4E906.a “technology” for the “development” or “production” of items controlled by 4A906.b, 4A906.c, or 4D906; and to control in 4E906.b “technology” for the “use” of “software” controlled by 4D906.

“Technology” specified in ECCN 4E906 is controlled for national security reasons to all destinations as specified

pursuant to the national security controls and license review policy set forth in § 742.4(a)(5) and (b)(10) of the EAR, and regional stability controls and license review policy set forth in § 742.6(a)(10) and (b)(11) of the EAR, and Anti-terrorism (AT) column 1 of the Commerce Country Chart in supplement no. 1 to part 738 of the EAR.

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 ECRA (codified, as amended, at 50 U.S.C. 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 12866, 13563, and 14094 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 interim final rule has been designated a “significant regulatory action” under section 3(f) of Executive Order 12866, as amended by Executive Order 14094.

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 are estimated to increase the number of submissions by 800 which is not expected to exceed the current approved estimates.

- 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. This rule does not contain policies with federalism implications as that term is defined in Executive Order 13132.

4. 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.

5. Because a notice of proposed rulemaking and an opportunity for public comment are not required to be given for this rule by 5 U.S.C. 553, or by any other law, the analytical requirements of the Regulatory Flexibility Act, 5 U.S.C. 601, *et seq.*, are not applicable. Accordingly, no regulatory flexibility analysis is required, and none has been prepared.

List of Subjects

15 CFR Part 736 and 772

Exports

15 CFR Part 738

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

15 CFR Part 740

Administrative practice and procedure, Exports, Incorporation by reference, Reporting and recordkeeping.

15 CFR Part 742.

Exports, Terrorism

15 CFR Part 743

Administrative practice and procedure, Exports, Reporting and recordkeeping.

15 CFR Part 774

Exports, Reporting and recordkeeping requirements.

Accordingly, parts 736, 738, 740, 742, 743, 772, and 774 of the Export Administration Regulations (15 CFR

parts 730 through 774) are amended as follows:

PART 736—GENERAL PROHIBITIONS

- 1. The authority citation for part 736 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. 13338, 69 FR 26751, 3 CFR, 2004 Comp., p. 168; Notice of November 8, 2022, 87 FR 68015, 3 CFR, 2022 Comp., p. 563; Notice of May 8, 2023, 88 FR 30211 (May 10, 2023).

- 2. Supplement No. 1 is amended by adding paragraph (f) to read as follows:

Supplement No. 1 to Part 736—General Orders

* * * * *

(f) *General Order No. 6.* General Order No. 6 of September 6, 2024.

(1) *GAAFET exports, reexports, and transfers (in-country).* This General License (GL) authorizes the export, reexport, or transfer (in-country) of GAAFET “technology” specified in ECCN 3E905 for the “development” or “production” of integrated circuits to end users located in a destination specified in Country Group A:5 or A:6 of supplement no. 1 to part 740 of the EAR when that “development” or “production” began to be performed on or prior to September 6, 2024.

(2) *GAAFET grandfather clause for deemed exports and deemed reexports.* This GL authorizes deemed exports or deemed reexports of GAAFET “technology” specified in ECCN 3E905 (including for future advancements or versions of the same “technology”) to foreign person employees or contractors already employed by entities as of September 6, 2024 whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5, and who are not prohibited persons under part 744 of the EAR, *e.g.*, not listed on the Entity List (supplement no. 4 to part 744), Unverified List (supplement no. 6 to part 744), Military End-User List (supplement no. 7 to part 744), or listed on the Denied Persons List (<https://www.bis.gov>). BIS notes that for purposes of §§ 742.4(a)(5) and 742.6(a)(10), the employee need not be a permanent and regular employee as that term is defined in § 734.20(d), *e.g.*, they may be newly hired.

(3) *Quantum deemed exports and deemed reexports.* This GL authorizes deemed exports or deemed reexports of quantum “technology” and “software” in ECCNs 3D901 (for “software” for quantum items in ECCNs 3A901.b, 3B904), 3E901 (for “technology” for quantum items in 3A901, 3A904, 3B904, 3C907, 3C908, 3C909), and “technology” for quantum items in ECCNs 4D906 or 4E906, to foreign persons whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5 and

who are not prohibited persons under part 744 of the EAR, *e.g.*, not listed on the Entity List (supplement no. 4 to part 744), Unverified List (supplement no. 6 to part 744), Military End-User List (supplement no. 7 to part 744), or listed on the Denied Persons List (<https://www.bis.gov>). BIS notes that for purposes of §§ 742.4(a)(5) and 742.6(a)(10), the employee need not be a permanent and regular employee as that term is defined in § 734.20(d), *e.g.*, they may be newly hired.

(4) *Reporting requirements.* Exports, reexports, and transfers (in-country), including deemed exports and deemed reexports, under this GL are subject to annual reporting requirements in accordance with § 743.7 of the EAR for GAAFET items in paragraph (f)(1) and (f)(2) of this general order and § 743.8 for quantum items in paragraph (f)(3) of this general order.

(5) *End-use and end-user restrictions—(i) Restrictions related to part 744 of the EAR.* The GL under paragraph (f) of this supplement does not overcome the license requirements of § 744.11 or § 744.21 of the EAR when an entity listed in supplements no. 4 or 7 to part 744 of the EAR is a party to the transaction as described in § 748.5(c) through (f) of the EAR, or when there is knowledge of any other prohibited end use or end user (other than the provisions of § 744.23 of the EAR).

(ii) *End-user restriction.* The GL under paragraph (f)(1) or (f)(2) of this supplement cannot be used for the “development” or “production” of any item identified under paragraph (d)(2)(i) of this supplement where the “part,” “component,” or “equipment” is “developed” or “produced” at the direction of an entity that is headquartered in, or whose ultimate parent company is headquartered in a destination specified in Country Group D:1 or D:5 in supplement no. 1 to part 740 of the EAR.

(6) *Recordkeeping requirement.* All exports, reexports, transfer (in-country), and exports from abroad shipped under the authorization of this GL, including deemed exports and deemed reexports of “technology” and “software,” are subject to the recordkeeping requirements of part 762 of the EAR.

PART 738—COMMERCE CONTROL LIST OVERVIEW AND THE COUNTRY CHART

- 3. The authority citation for part 738 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. 2151 note; 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.

- 4. Section 738.2 is amended by revising paragraph (d)(1) to read as follows:

§ 738.2 Commerce Control List (CCL) structure.

* * * * *

(d) *Entries*—(1) *Composition of an entry*. Within each group, individual items are identified by an Export Control Classification Number (ECCN). Each number consists of a set of digits and a letter. The first digit identifies the

general category within which the entry falls (e.g., 3A001). The letter immediately following this first digit identifies under which of the five groups the item is listed (e.g., 3A001). The second and third digits differentiate

individual entries by identifying the type of controls associated with the items contained in the entry (e.g., 3A001). Table 1 lists the Reasons for Control associated with this second and third digits.

TABLE 1 TO PARAGRAPH (d)(1) INTRODUCTORY TEXT

Last 3 digits of an ECCN	Reason for control
000–099	National Security (NS).
100–199	Missile Technology (MT).
200–299	Nuclear Nonproliferation (NP).
300–399	Chemical and Biological (CB).
500–599	Firearms, “Spacecraft,” and related commodities controlled for NS and other reasons.
600–699	Wassenaar Arrangement Munitions List (WAML) or former U.S. Munitions List (USML) controlled for NS and other reasons.
900–979	Plurilateral NS and Regional Stability (RS) and other reasons.
980–989	Crime Control (CC), Short Supply (SS).
990–999	Anti-terrorism (AT), RS, United Nations Sanctions (UN).

(i) Reasons for Control are not mutually exclusive and numbers are assigned in order of precedence. As an example, if an item is controlled for both National Security and Missile Technology reasons, the entry’s third alphanumeric character will be a “0”. If the item is controlled only for Missile Technology the third alphanumeric character will be “1”.

(ii) The numbers in either the second or third digit (e.g., 3A001) serve to differentiate between multilateral, plurilateral, and unilateral entries. For example, an entry with the number “99” as the second and third digit, identifies the entire entry as controlled for a unilateral concern (e.g., 2B991 for anti-terrorism reasons). If the second digit is a “2” and the third digit is a “9”, the item is controlled for unilateral purposes based on a nuclear proliferation concern (e.g., 2A290 is controlled for unilateral purposes based on nuclear nonproliferation concerns).

(iii) The last digit within each entry (e.g., 3A001) is used for the sequential numbering of ECCNs to differentiate between entries on the CCL.

(iv) Last two characters in a “600 series” ECCN. The last two characters of each “600 series” ECCN generally track the Wassenaar Arrangement Munitions List (WAML) categories for the types of items at issue. The WAML ML21 (“software”) and ML22 (“technology”) are, however, included in D (“software”) and E (“technology”) CCL product groups to remain consistent with the structure of the CCL.

* * * * *

PART 740—LICENSE EXCEPTIONS

■ 5. 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.

■ 6. Section 740.2 is amended by adding paragraph (a)(22) to read as follows:

§ 740.2 Restrictions on all License Exceptions.

* * * * *

(a) * * *

(22) The item being exported, reexported, or transferred (in-country) is eligible for § 740.24 and the license exception is other than IEC, TMP, RPL, GOV, or TSU, subject to the limitations in this paragraph (a)(22). License Exception IEC is available as specified in § 740.24. License Exception TMP is restricted to eligibility under the provisions of § 740.9(a)(3) and (a)(6); RPL is restricted to eligibility under the provisions of § 740.10; GOV is restricted to eligibility under the provisions of § 740.11(b); and TSU is restricted to eligibility under the provisions of § 740.13(a) and (c).

* * * * *

■ 7. Part 740 is amended by adding § 740.24 to read as follows:

§ 740.24 Implemented Export Control (IEC).

(a) *Scope*. License Exception Implemented Export Controls (IEC) authorizes exports, reexports, and transfers (in-country) in accordance with *License Exception IEC Eligible Items and Destinations*, see paragraphs (b) and (c) of this section.

(b) *Eligible items and destinations*. License Exception IEC authorizes specified items to be exported, reexported, or transferred (in-country) to, among, or within specified destinations, as identified for each

respective item, in accordance with *License Exception IEC Eligible Items and Destinations*. See paragraph (c) of this section.

(c) *Incorporation by reference*. *License Exception Implemented Export Controls (IEC) Eligible Items and Destinations*, last modified August 27, 2024, is incorporated by reference into this section with the approval of the Director of the **Federal Register** under 5 U.S.C. 552(a) and 1 CFR part 51. This material is available for inspection at the BIS and at the National Archives and Records Administration (NARA). Contact BIS at: BIS Office of National Security Controls, phone: 202–482–0092; email: LicenseExceptionIEC@bis.doc; website: www.bis.gov. For information on the availability of this material at NARA, visit www.archives.gov/federal-register/cfr/ibr-locations or email fr.inspection@nara.gov. The material may be obtained from BIS and is available for inspection on the BIS website at <https://www.bis.gov/articles/license-exceptions#license-exception-IEC>.

PART 742—CONTROL POLICY—CCL BASED CONTROLS

■ 8. 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 1, 2023, 88 FR 75475 (November 3, 2023).

■ 9. Section 742.4 is amended by adding paragraphs (a)(5) and (b)(10) to read as follows:

§ 742.4 National security.

(a) * * *

(5)(i) *Scope*. A license is required for national security reasons to export or reexport any item subject to the EAR and specified on the Commerce Control List (supplement no. 1 to part 774) to any destination worldwide when the ECCN includes an NS license requirement that references this paragraph (a)(5) in the license requirement table of the ECCN.

(ii) *Deemed export and deemed reexport exclusions*. The license requirements in paragraph (a)(5)(i) of this section do not apply to deemed exports or deemed reexports of “technology” or “software” to the extent consistent with paragraphs (a)(5)(ii)(A) and (B) of this section.

(A) *Grandfather Exclusion*. Except for deemed exports or deemed reexports of “technology” in ECCN 3E905 to foreign persons whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5 in supplement no. 1 to part 740 of the EAR (see GAAFET General License in supplement no. 1 to part 736 general order no. 4), the license requirements in paragraph (a)(5)(i) of this section do not apply to deemed exports or deemed reexports of “technology” or “software,” including for future advancements or versions of the same “technology” or “software,” to employees or contractors already employed by entities subject to this control as of September 6, 2024, and who are not prohibited persons under part 744 of the EAR, e.g., not listed on the Entity List (supplement no. 4 to part 744), Unverified List (supplement no. 6 to part 744), Military End-User List (supplement no. 7 to part 744) or listed on the Denied Persons List (<https://www.bis.doc.gov>). For purposes of this paragraph (a)(5)(ii), the employee need not be a permanent and regular employee as that term is defined in § 734.20(d), e.g., they may be newly hired.

(B) *Deemed export and deemed reexport exclusion*—(i) *Limited exclusion*. There is a limited deemed export or deemed reexport exclusion from the license requirements in this paragraph (a)(5)(i) of this section for the following “software” or “technology” ECCNs unless for foreign persons whose most recent citizenship or permanent residency is a destination specified in Country Group D:1 or D:5: ECCNs 2D910; 2E910; 3D001 (“software” for “EUV” masks and reticles in ECCN

3B001.q); 3D901 (for “software” for quantum items in ECCNs 3A901.b and 3B904 and for scanning electron microscopes (SEM) in ECCN 3B903); 3D907 “software” designed to extract “GDSII” or equivalent data; 3E001 (“technology” for “EUV” masks and reticles in ECCN 3B001.q); and 3E901 (for “technology” for quantum items in 3A901, 3A904, 3B904, 3C907, 3C908, and 3C909, and for SEMs in ECCN 3B903); 3E905 (“technology” according to the General Technology Note for the “development” or “production” of integrated circuits or devices, using “Gate all-around Field-Effect Transistor” (“GAAFET”) structures); and “technology” (for quantum items in ECCNs 4D906 or 4E906).

(ii) *Full exclusion*. There is a full deemed export or deemed reexport exclusion from the license requirement in this paragraph (a)(5)(i) for “technology” and “software” in ECCNs 3D001, 3D002, and 3E001 for anisotropic dry plasma etch equipment and isotropic dry etch equipment in 3B001.c.1.a and c.1.c.

(b) * * *

(10) *License review policy for items specified in paragraph (a)(5)*. License applications to export or reexport items described in paragraph (a)(5)(i) of this section to destinations specified in Country Group A:1, A:5, and A:6, see supplement no. 1 to part 740 of the EAR, will be reviewed with a presumption of approval. License applications to export or reexport items described in paragraph (a)(5)(i) of this section to destinations specified in Country Groups D:1 or D:5 of supplement no. 1 to part 740 of the EAR will be reviewed under a presumption of denial. License applications to export or reexport items described in paragraph (a)(5)(i) of this section to any other destination will be reviewed on a case-by-case basis, unless subject to a more restrictive NS policy in this section.

* * * * *

■ 10. Section 742.6 is amended by adding paragraphs (a)(10) and (b)(11), to read as follows:

§ 742.6 Regional stability.

(a) * * *

(10)(i) *Scope*. A license is required for regional stability reasons to export or reexport any item subject to the EAR and listed on the Commerce Control List (supplement no. 1 to part 774) to any destination worldwide when the ECCN includes an RS license requirement that references this (a)(10) paragraph in the license requirement table.

(ii) *Deemed export and deemed reexport exclusions*. The license

requirements in paragraph (a)(10)(i) of this section do not apply to deemed exports or deemed reexports to the extent consistent with paragraphs (a)(10)(ii)(A) and (B) of this section.

(A) *Grandfather clause*. Except for deemed exports or deemed reexports of “technology” in ECCN 3E905 to foreign persons whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5 in supplement no. 1 to part 740 of the EAR (see GAAFET General License in supplement no. 1 to part 736 general order no. 4), the license requirements in paragraph (a)(10)(i) of this section do not apply to deemed exports or deemed reexports of “technology” or “software,” including for future advancements or versions of the same “technology” or “software,” to employees or contractors already employed by entities subject to this control as of September 6, 2024, and who are not prohibited persons under part 744 of the EAR, e.g., not listed on the Entity List (supplement no. 4 to part 744), Unverified List (supplement no. 6 to part 744), Military End-User List (supplement no. 7 to part 744) or listed on the Denied Persons List (<https://www.bis.doc.gov>). For purposes of this paragraph (a)(10)(ii), the employee need not be a permanent and regular employee as that term is defined in § 734.20(d), e.g., they may be newly hired.

(B) *Deemed export and deemed reexport exclusion*—(1) *Limited exclusion*. There is a limited deemed export or deemed reexport exclusion from the license requirements in paragraph (a)(10)(i) of this section for the following “software” or “technology” ECCNs, unless for foreign persons whose most recent citizenship or permanent residency is a destination specified in Country Group D:1 or D:5: 2D910; 2E910; 3D001 (“software” for “EUV” masks and reticles in ECCN 3B001.q); 3D901 (for “software” for quantum items in ECCNs 3A901.b, 3B904 and scanning electron microscopes (SEM) in ECCN 3B903); 3D907 “software” designed to extract “GDSII” or equivalent data; 3E001 (“technology” for “EUV” masks and reticles in ECCN 3B001.q), 3E901 (for “technology” for quantum items in 3A901, 3A904, 3B904, 3C907, 3C908, and 3C909, and for SEMs in ECCN 3B903); 3E905 (“technology” according to the General Technology Note for the “development” or “production” of integrated circuits or devices, using “Gate all-around Field-Effect Transistor” (“GAAFET”) structures); and “technology” for quantum items in ECCNs 4D906 or 4E906.

(2) *Full exclusion.* There is a full deemed export and reexport exclusion in § 742.6(a)(6)(iv) that conveys to the license requirement in this paragraph (a)(10) for “technology” and “software” in ECCNs 3D001, 3D002, and 3E001 for anisotropic dry plasma etch equipment and isotropic dry etch equipment in 3B001.c.1.a and c.1.c.

(b) * * *

(11) *License review policy for items specified in paragraph (a)(10).* License applications to export or reexport items described in paragraph (a)(10) of this section to destinations specified in Country Group A:1, A:5, and A:6, see supplement no. 1 to part 740 of the EAR, will be reviewed with a presumption of approval. License applications to export or reexport items described in paragraph (a)(10) of this section to destinations specified in Country Groups D:1 or D:5 of supplement no. 1 to part 740 of the EAR will be reviewed under a presumption of denial. License applications to export or reexport items described in paragraph (a)(10) of this section to any other destination will be reviewed on a case-by-case basis, unless subject to a more restrictive RS policy in this section.

* * * * *

PART 743—SPECIAL REPORTING AND NOTIFICATION

■ 11. The authority citation for part 743 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; E.O. 13637, 78 FR 16129, 3 CFR, 2014 Comp., p. 223; 78 FR 16129.

■ 12. Part 743 is amended by adding sections 743.7 and 743.8, to read as follows:

§ 743.7 Reporting on GAAFET General License.

(a) *Transactions to be reported.* (1) *Annual Reports.* Annual reports are required for any export, reexport, or transfer (in-country) of “technology” specified in ECCN 3E905 that is not authorized by an individual validated license but is authorized pursuant to the GAAFET General License in General Order No. 6 paragraph (f)(1) or (f)(2) in supplement no. 1 to part 736 of the EAR.

(2) *Termination reports.* Companies that use the GAAFET General License for deemed exports and reexports to current employees of “technology” specified in ECCN 3E905 must report to BIS the voluntary or involuntary termination of employment of foreign person employees whose most recent country of citizenship or permanent

residency is a destination specified in Country Group D:1 or D:5 within 30 days of termination.

(b) *Party responsible for reporting.* The entity who exported or reexported the items must ensure the reports required by this section are submitted to BIS.

(c) *Information to be included in the reports—(1) Annual report information.* The annual report must include the following:

(A) Description of the “technology”;

(B) All parties, including name and address, involved in the collaboration; and

(C) End item of the “technology,” including a description and ECCN of the end item (if known).

(2) *Termination report information.* The termination report must include the following:

(A) Name of foreign person;

(B) Name of host company;

(C) If they are leaving the United States to go to a destination specified in Country Group D:1 or D:5 (if known); and

(D) If they are leaving to change employers within the United States.

(d) *Annual reporting requirement.* (1) You must submit the first report on November 5, 2024 subject to the provisions of this section. The report must be labeled with the exporting company’s name and address at the top of each page and must include all the information specified in paragraph (c) of this section. The annual report shall cover collaboration occurring during the time between September 6, 2024 and October 28, 2024. Thereafter, reports are due according to the provisions of paragraph (d)(2) of this section.

(2) Annual reports for the reporting period ending December 31 must be received by BIS no later than February 1.

(e) *Where to submit GAAFET General License reports—*Report may be emailed to EAR.Reports@bis.doc.gov and must include “Annual report for GAAFET General License” or “Termination report for GAAFET General License” in the subject line, whichever is appropriate.

(f) *Contacts.* General information concerning the GAAFET General License report is available from the Office of National Security Controls, Tel. (202) 482–0092, or Email: EAR.Reports@bis.doc.gov.

§ 743.8 Reporting on quantum deemed exports and deemed reexports.

(a) *Requirement.* A report must be submitted to BIS in accordance with this section for the deemed export or deemed reexport under General License

in General Order no. 6 in paragraph (f)(3) of supplement no. 1 to part 736 of the EAR to foreign person employees whose most recent country of citizenship or permanent residency is a destination specified in Country Group D:1 or D:5 of quantum “software” or “technology” specified in the following ECCNs: 3D901 (for 3A901.b, 3B904), 3E901 (for 3A901, 3A904, 3B904, 3C907, 3C908, 3C909), 4D906, or 4E906.

(b) *Party responsible for reporting.* The entity who released the specified “software” or “technology” must ensure the reports required by this section are properly submitted to BIS.

(c) *Information to be included in the reports.* The report must include the following:

(1) The name, address and point of contact of the entity that made the release;

(2) Description of the “software” or “technology”;

(3) Foreign person information, including all the information that would be provided in a deemed export license application, see guidelines for deemed export license applications under the learn and support tab of the BIS website at www.bis.gov;

(4) End item of the “technology” or “software” including a description and ECCN of the end item (if known); and

(5) The exporting company’s name and address must appear at the top of each page.

(d) *Annual reporting requirement.* (1) You must submit the first report on November 5, 2024 subject to the provisions of this section. The report shall cover any releases during the time between September 6, 2024 and October 28, 2024. Thereafter, reports are due according to the provisions of paragraph (d)(2) of this section.

(2) Reports for the reporting period ending December 31 must be received by BIS no later than February 1.

(e) *Termination reporting.* When a foreign person, who has had access to “software” or “technology” identified in paragraph (a) of this section, leaves your employment or academic institution, you must report the name, host company or university, and if known, if they are leaving the United States to go be employed in a destination specified in Country Group D:1 or D:5 or if they are leaving to change employer or university within the United States. This report is due within 30 days of the foreign person’s last day with the host company or university.

(f) *Where to submit Quantum General License reports—*Report may be emailed to EAR.Reports@bis.doc.gov and must include “Quantum General License Report” in the subject line.

(g) *Contacts*. General information concerning the “Quantum General License Report” is available from the Office of National Security Controls, Tel. (202) 482–0092, or Email: EAR.Reports@bis.doc.gov.

PART 772—DEFINITIONS OF TERMS

■ 13. 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.

■ 14. Section 772.1 is amended by adding in alphabetic order the definition for “GDSII” to read as follows:

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

* * * * *

GDSII (“*Graphic Design System II*”) (Cat 3) is a database file format for data exchange of integrated circuit artwork or integrated circuit layout artwork.

* * * * *

PART 774—[AMENDED]

■ 15. 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.

■ 16. Supplement no. 1 to part 774 is amended by:

- a. Adding ECCNs 2B910, 2D910;
- b. Revising ECCN 2E003;
- c. Adding ECCNs 2E903 and 2E910;
- d. Revising Notes 1 and 2 and a Nota Bene in Category 3, Product Group A;
- e. Revising ECCN 3A001;
- f. Adding ECCNs 3A901 and 3A904;
- g. Revising ECCN 3B001;
- h. Adding ECCNs 3B903 and 3B904;
- i. Revising ECCN 3C001;
- j. Adding ECCNs 3C907, 3C908, and 3C909;
- k. Revising ECCNs 3D001 and 3D002;
- l. Adding ECCNs 3D901 and 3D907;
- m. Adding a Note and a Technical Note to Category 3 to Product Group E;
- n. Revising ECCN 3E001;
- o. Adding ECCNs 3E901, 3E905 and 4A906;
- p. Revising ECCNs 4D001;
- q. Adding ECCN 4D906;
- r. Revising ECCN 4E001; and
- s. Adding ECCN 4E906.

The additions and revision read as follows:

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

* * * * *

2B910 Additive manufacturing equipment, designed to produce metal or metal alloy components, having all of the following (see List of Items Controlled), and “specially designed” “components” therefor.

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: For related “technology” see ECCN 2E910.

Related Definitions: N/A
Items:

- a. Having at least one of the following consolidation sources:
 - a.1. “Laser”;
 - a.2. Electron beam; or
 - a.3. Electric arc;
- b. Having a controlled process atmosphere of any of the following:
 - b.1. Inert gas; or
 - b.2. Vacuum (equal to or less than 100 Pa);
- c. Having any of the following ‘in-process monitoring’ equipment in a ‘co-axial configuration’ or ‘paraxial configuration’:
 - c.1. Imaging camera with a peak response in the wavelength range exceeding 380 nm but not exceeding 14,000 nm;
 - c.2. Pyrometer designed to measure temperatures greater than 1,273.15K (1,000 °C); or
 - c.3. Radiometer or spectrometer with a peak response in the wavelength range exceeding 380 nm but not exceeding 3,000 nm; and
- d. A closed loop control system designed to modify the consolidation source parameters, build path, or equipment settings during the build cycle in response to feedback from ‘in-process monitoring’ equipment specified in 2B010.c.

Technical Notes: For the purposes of 2B910:

1. ‘In-process monitoring’, also known as *in-situ process monitoring*, pertains to the observation and measurement of the additive

manufacturing process including electromagnetic, or thermal, emissions from the melt pool.

2. ‘Co-axial configuration’, also known as *on-axis* or *inline configuration*, pertains to one or more sensors that are mounted in an optical path shared by the “laser” consolidation source.

3. ‘Paraxial configuration’ pertains to one or more sensors that are physically mounted onto or integrated into the “laser”, electron beam, or electric arc consolidation source component.

4. For both ‘co-axial configuration’ and ‘paraxial configuration’, the field of view of the sensor(s) is fixed to the moving reference frame of the consolidation source and moves in the same scan trajectories of the consolidation source throughout the build process.

* * * * *

2D910 “Software”, not specified elsewhere, “specially designed” or modified for the “development” or “production” of equipment specified in ECCN 2B910.

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: N/A

Related Definitions: N/A

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

* * * * *

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

License Requirements

Reason for Control: NS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
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: (1) 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. (2) See 2E903 for “technology”, not specified elsewhere, for the “development” or “production” of coating systems (as defined in 2E903).

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”;
 - 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: For the purposes of 2E003.b.1.c, “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.

* * * * *

2E903 “Technology”, not specified elsewhere, for the “development” or “production” of ‘coating systems’ having all of the following: (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.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: N/A

Related Definitions: N/A

Items:

- a. Designed to protect ceramic “matrix” “composite” materials specified by ECCN 1C007 from corrosion; and
 - b. Designed to operate at temperatures exceeding 1,373.15 K (1,100 °C).
- Technical Note:** For the purposes of 2E903, “coating systems” consist of one or more layers (e.g., bond, interlayer, top coat) of material deposited on the substrate.

* * * * *

2E910 “Technology”, not specified elsewhere, “specially designed” or modified for the “development” or “production” of equipment specified in ECCN 2B910.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: N/A

Related Definitions: N/A

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

* * * * *

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 (other than those described in 3A001.a.3 to 3A001.a.10, 3A001.a.12 to 3A001.a.14, 3A001.b.12, or 3A001.z), 3A002, 3A901, which are “specially designed” for or which have the same functional characteristics as other equipment is determined by the control status of the other equipment.

Note 2: The control status of integrated circuits described in 3A001.a.3 to 3A001.a.9,

3A001.a.12 to 3A001.a.14, 3A001.z or 3A901 that are unalterably programmed or designed for a specific function for other equipment is determined by the control status of the other equipment.

N.B.: When the manufacturer or applicant cannot determine the control status of the other equipment, the control status of the integrated circuits is determined in 3A001.a.3 to 3A001.a.9, or 3A001.a.12 to 3A001.a.14, 3A001.z and 3A901.

* * * * *

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

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

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers in 3A001.b.2 and discrete microwave transistors in 3A001.b.3, except those 3A001.b.2 and b.3 items being exported or reexported for use in civil telecommunications applications; and 3A001.z.1.	NS Column 1.
NS applies to entire entry.	NS Column 2.
RS applies “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers in 3A001.b.2 and discrete microwave transistors in 3A001.b.3, except those 3A001.b.2 and b.3 items being exported or reexported for use in civil telecommunications applications; and 3A001.z.1.	RS Column 1.
RS applies to 3A001.z ...	To or within destinations specified in Country Groups D:1, D:4, and D:5 of supplement no. 1 to part 740 of the EAR, excluding any destination also specified in Country Groups A:5 or A:6. See § 742.6(a)(6)(iii) of the EAR.
MT applies to 3A001.a.1.a when usable in “missiles”; and to 3A001.a.5.a when “designed or modified” for military use, hermetically sealed and rated for operation in the temperature range from below –54 °C to above +125 °C; and 3A001.z.2.	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 in 3A201.a and 3A201.b, respectively; and 3A001.z.3.	NP Column 1.
AT applies to entire entry	AT Column 1.

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

License Requirements: 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, NP; N/A for “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers in 3A001.b.2, discrete microwave transistors in 3A001.b.3, and 3A001.z.1, 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, .g, and z.1 (exported or reexported for use in civil telecommunications applications).

\$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, .h, .i, and z.1 (exported or reexported for use in civil telecommunications applications).

NAC/ACA: Yes, for 3A001.z.

Note: See § 740.2(a)(9)(ii) of the EAR for license exception restrictions for ECCN 3A001.z.

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,’ ‘transmit modules,’ or ‘MMICs’ “subject to the ITAR.” (2) See also 3A090, 3A101, 3A201, 3A611, 3A901 for cryogenic CMOS integrated circuits and parametric signal amplifiers or quantum limited amplifiers not controlled by 3A001, 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 5×10^3 Gy (Si), or higher;

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

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

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

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

Technical Note: For the purposes of 3A001.a.2, ‘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);

N.B.: For cryogenic CMOS integrated circuits not specified by 3A001.a.2, see 3A901.a.

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: For the purposes of 3A001.a.5.a:

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: For the purposes of 3A001.a.5.b:

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: For the purposes of 3A001.a.7:

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. [Reserved];

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: For the purposes of 3A001.a.12, when N is equal to 1,024 points, the formula in 3A001.a.12 gives an execution time of 500 μ s.

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

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

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

Technical Note: For the purposes of 3A001.a.13, 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: For the purposes of 3A001.a.14:

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 the 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.

N.B.: For parametric signal amplifiers or Quantum-limited amplifiers (QLAs) not specified by 3A001.b, see ECCN 3A901.b.

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/cm² or a pulsed (non-continuous) current density at rated operating conditions exceeding 10 A/cm²;

b.1.d. “Vacuum electronic devices” with the capability to operate in a ‘dual mode.’

Technical Note: For the purposes of 3A001.b.1.d, ‘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 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 ms 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 cm³;

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 cm³/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: For the purposes of 3A001.b.9:

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: $20 \text{ W} \times 10 \text{ cm}^3/\text{W} = 200 \text{ cm}^3$.

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 $10 \text{ Hz} \leq F \leq 10 \text{ kHz}$;

Technical Note: For the purposes of 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: For the purposes of 3A001.b.11, 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 [$P_{\text{sat}} > 505.62 \text{ W} \cdot \text{GHz}^2 / f_{\text{GHz}}^2$] for any channel;

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

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

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

Technical Notes: For the purposes of 3A001.b.12:

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 [$d \leq 15 \text{ cm} \cdot \text{GHz} \cdot N / 2.7 \text{ GHz}$].

6. 3A001.b.12 applies to ‘transmit/receive modules’ or ‘transmit modules’ with or without a heat sink. The value of d in 3A001.b.12.c does not include any portion of the ‘transmit/receive module’ or ‘transmit module’ that functions as a heat sink.

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

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

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

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

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

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

c.1.b.2. A product of the maximum delay time and the bandwidth (time in 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: For the purposes of 3A001.c.1, 'frequency side-lobe rejection' is the maximum rejection value specified in data sheet.

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

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

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

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

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

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

e. High energy devices as follows:

e.1. 'Cells' as follows:

e.1.a 'Primary cells' having any of the following at 20 °C:

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

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

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

Technical Notes:

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

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

e.2. High energy storage capacitors as follows:

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

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

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

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

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

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

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

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

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

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

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

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

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

e.3.c. Rated for a magnetic induction of more than 8 T or "overall current density" in the winding of more than 300 A/mm²;

e.4. Solar cells, cell-interconnect-coverglass (CIC) assemblies, solar panels, and solar arrays, which are "space-qualified," having a minimum average efficiency exceeding 20% at an operating temperature of 301 K (28 °C) under simulated 'AM0' illumination with an irradiance of 1,367 Watts per square meter (W/m²);

Technical Note: For the purposes of 3A001.e.4, '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' (V_{π}) less than 2.7 V when measured at a frequency of 1 GHz or below; or

i.1.b. A ' V_{π} ' of less than 4 V when measured at a frequency of more than 1 GHz; or

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

i.2.a. A ' V_{π} ' less than 3.3 V when measured at a frequency of 1 GHz or below; or

i.2.b. A ' V_{π} ' less than 5 V when measured at a frequency of more than 1 GHz.

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

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

j. through y. [Reserved]

z. Any commodity described in 3A001 that meets or exceeds the performance parameters in 3A090, as follows:

z.1. “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers described in 3A001.b.2 and discrete microwave transistors in 3A001.b.3 that also meet or exceed the performance parameters in ECCN 3A090, except those 3A001.b.2 and b.3 items being exported or reexported for use in civil telecommunications applications;

z.2. Commodities that are described in 3A001.a.1.a when usable in “missiles” that also meet or exceed the performance parameters in ECCN 3A090; and to 3A001.a.5.a when “designed or modified” for military use, hermetically sealed and rated for operation in the temperature range from below -54°C to above $+125^{\circ}\text{C}$ and that also meet or exceed the performance parameters in ECCN 3A090;

z.3. Pulse discharge capacitors described in 3A001.e.2 and superconducting solenoidal electromagnets in 3A001.e.3 that meet or exceed the technical parameters in 3A201.a and 3A201.b, respectively and that also meet or exceed the performance parameters in ECCN 3A090;

or

z.4. All other commodities specified in this ECCN that meet or exceed the performance parameters of ECCN 3A090.

* * * * *

3A901 Electronic items, not specified by ECCN 3A001, as follows (see List of Items Controlled).

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: For related “software” see ECCN 3D901 and for “technology” see ECCN 3E901.

Related Definitions: N/A

Items:

a. Complementary Metal Oxide Semiconductor (CMOS) integrated circuits, not specified by 3A001.a.2, designed to operate at an ambient temperature equal to or less (better) than $4.5\text{ K } (-268.65^{\circ}\text{C})$.

Technical Note: For the purposes of 3A901.a, CMOS integrated circuits are also referred to as cryogenic CMOS or cryo-CMOS.

b. Parametric signal amplifiers having all of the following:

b.1. Designed for operation at an ambient temperature below $1\text{ K } (-272.15^{\circ}\text{C})$;

b.2. Designed for operation at any frequency from 2 GHz up to and including 15 GHz; and

b.3. A noise figure less (better) than 0.015 dB at any frequency from 2 GHz up to and including 15 GHz at $1\text{ K } (-272.15^{\circ}\text{C})$.

Note: For the purposes of 3A901.b, parametric signal amplifiers include Travelling Wave Parametric Amplifiers (TWPAs).

Technical Note: For the purposes of 3A901.b, parametric signal amplifiers may also be referred to as Quantum-limited amplifiers (QLAs).

* * * * *

3A904 Cryogenic cooling systems and components, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: See ECCN 3E901 for related technology controls for the “development” or “production” of this ECCN.

Related Definitions: N/A

Items:

a. Systems rated to provide a cooling power greater than or equal to $600\text{ }\mu\text{W}$ at or below a temperature of $0.1\text{ K } (-273.05^{\circ}\text{C})$ for a period of greater than 48 hours;

b. Two-stage pulse tube cryocoolers rated to maintain a temperature below $4\text{ K } (-269.15^{\circ}\text{C})$ and provide a cooling power

greater than or equal to 1.5 W at or below a temperature of $4.2\text{ K } (-268.95^{\circ}\text{C})$.

* * * * *

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

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to 3B001.c.1.a, 3B001.c.1.c, and 3B001.q.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to 3B001.c.1.a, 3B001.c.1.c, and 3B001.q.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
NS applies to 3B001.a.1 to a.3, b, e, f.1.a, f.2 to f.4, g to i.	NS Column 2
NS applies to 3B001.a.4, c, d, f.1.b, j to p.	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.4(a)(4) of the EAR.
RS applies to 3B001.a.4, c, d, f.1.b, j to p.	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.6(a)(6) of the EAR.
AT applies to entire entry	AT Column 1.

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

LVS: \$500, except semiconductor manufacturing equipment specified in 3B001.a.4, c, d, f.1.b, j to p.

GBS: Yes, except a.3 (molecular beam epitaxial growth equipment using gas sources), c.1.a (Equipment designed or modified for isotropic dry etching), c.1.c (Equipment designed or modified for anisotropic dry etching), .e (automatic loading multi-chamber central wafer handling systems *only* if connected to equipment controlled by 3B001.a.3, or .f), .f (lithography equipment) and .q (“EUV” masks and reticles designed for integrated circuits, not specified by 3B001.g, and having a mask “substrate blank” specified by 3B001.j).

IEC: Yes for 3B001.c.1.a, c.1.c, and .q, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship 3B001.c.1.a, c.1.c, or .q 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: See also 3B903 and 3B991

Related Definitions: N/A

Items:

a. Equipment designed for epitaxial growth as follows:

a.1. Equipment designed or modified to produce a layer of any material other than silicon with a thickness uniform to less than $\pm 2.5\%$ across a distance of 75 mm or more;

Note: 3B001.a.1 includes atomic layer epitaxy (ALE) equipment.

a.2. Metal Organic Chemical Vapor Deposition (MOCVD) reactors designed for compound semiconductor epitaxial growth of material having two or more of the following elements: aluminum, gallium, indium, arsenic, phosphorus, antimony, or nitrogen;

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

a.4. Equipment designed for silicon (Si), carbon doped silicon, silicon germanium (SiGe), or carbon doped SiGe epitaxial growth, and having all of the following:

a.4.a. Multiple chambers and maintaining high vacuum (equal to or less than 0.01 Pa) or inert environment (water and oxygen partial pressure less than 0.01 Pa) between process steps;

a.4.b. At least one preclean chamber designed to provide a surface preparation means to clean the surface of the wafer; and

a.4.c. An epitaxial deposition operating temperature of 685 °C or below;

b. Semiconductor wafer fabrication equipment designed for ion implantation and having any of the following:

b.1. [Reserved]

b.2. Being designed and optimized to operate at a beam energy of 20 keV or more and a beam current of 10 mA or more for hydrogen, deuterium, or helium implant;

b.3. Direct write capability;

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

b.5. Being designed and optimized to operate at beam energy of 20 keV or more and a beam current of 10mA or more for silicon implant into a semiconductor material “substrate” heated to 600 °C or greater;

c. Etch equipment.

c.1. Equipment designed for dry etching as follows:

c.1.a. Equipment designed or modified for isotropic dry etching, having a largest ‘silicon germanium-to-silicon (SiGe:Si) etch selectivity’ of greater than or equal to 100:1; or

c.1.b. Equipment designed or modified for anisotropic etching of dielectric materials and enabling the fabrication of high aspect ratio features with aspect ratio greater than 30:1 and a lateral dimension on the top surface of less than 100 nm, and having all of the following:

c.1.b.1. Radio Frequency (RF) power source(s) with at least one pulsed RF output; and

c.1.b.2. One or more fast gas switching valve(s) with switching time less than 300 milliseconds; or

c.1.c. Equipment designed or modified for anisotropic dry etching, having all of the following:

c.1.c.1. Radio Frequency (RF) power source(s) with at least one pulsed RF output;

c.1.c.2. One or more fast gas switching valve(s) with switching time less than 300 milliseconds; and

c.1.c.3. Electrostatic chuck with twenty or more individually controllable variable temperature elements;

c.2. Equipment designed for wet chemical processing and having a largest ‘silicon germanium-to-silicon (SiGe:Si) etch selectivity’ of greater than or equal to 100:1;

Note 1: 3B001.c includes etching by ‘radicals’, ions, sequential reactions, or non-sequential reaction.

Note 2: 3B001.c.1.c includes etching using RF pulse excited plasma, pulsed duty cycle excited plasma, pulsed voltage on electrodes modified plasma, cyclic injection and purging of gases combined with a plasma, plasma atomic layer etching, or plasma quasi-atomic layer etching.

Technical Notes:

1. For the purposes of 3B001.c, ‘silicon germanium-to-silicon (SiGe:Si) etch selectivity’ is measured for a Ge concentration of greater than or equal to 30% ($\text{Si}_{0.70}\text{Ge}_{0.30}$).

2. For the purposes of 3B001.c Note 1 and 3B001.d.14, ‘radical’ is defined as an atom, molecule, or ion that has an unpaired electron in an open electron shell configuration.

d. Semiconductor manufacturing deposition equipment, as follows:

d.1. Equipment designed for cobalt (Co) electroplating or cobalt electroless-plating deposition processes;

Note: 3B001.d.1 controls semiconductor wafer processing equipment.

d.2. Equipment designed for:

d.2.a. Chemical vapor deposition of cobalt (Co) fill metal; or

d.2.b. Selective bottom-up chemical vapor deposition of tungsten (W) fill metal;

d.3. Equipment designed to fabricate a metal contact by multistep processing within a single chamber by performing all of the following:

d.3.a. Deposition of a tungsten layer, using an organometallic compound, while maintaining the wafer substrate temperature greater than 100 °C and less than 500 °C; and

d.3.b. A plasma process using hydrogen (H_2), including hydrogen and nitrogen ($\text{H}_2 + \text{N}_2$) or ammonia (NH_3);

d.4. Equipment or systems designed for multistep processing in multiple chambers or stations and maintaining high vacuum (equal to or less than 0.01 Pa) or inert environment between process steps, as follows:

d.4.a. Equipment designed to fabricate a metal contact by performing the following processes:

d.4.a.1. Surface treatment plasma process using hydrogen (H_2), including hydrogen and nitrogen ($\text{H}_2 + \text{N}_2$) or ammonia (NH_3), while maintaining the wafer substrate at a temperature greater than 100 °C and less than 500 °C;

d.4.a.2. Surface treatment plasma process using oxygen (O_2) or ozone (O_3), while maintaining the wafer substrate at a temperature greater than 40 °C and less than 500 °C; and

d.4.a.3. Deposition of a tungsten layer while maintaining the wafer substrate temperature greater than 100 °C and less than 500 °C;

d.4.b. Equipment designed to fabricate a metal contact by performing the following processes:

d.4.b.1. Surface treatment process using a remote plasma generator and an ion filter; and

d.4.b.2. Deposition of a cobalt (Co) layer selectively onto copper (Cu) using an organometallic compound;

Note: This control does not apply to equipment that is non-selective.

d.4.c. Equipment designed to fabricate a metal contact by performing all the following processes:

d.4.c.1. Deposition of a titanium nitride (TiN) or tungsten carbide (WC) layer, using an organometallic compound, while maintaining the wafer substrate at a temperature greater than 20 °C and less than 500 °C;

d.4.c.2. Deposition of a cobalt (Co) layer using a physical sputter deposition technique and having a process pressure greater than 133.3 mPa and less than 13.33 Pa, while maintaining the wafer substrate at a temperature below 500 °C; and

d.4.c.3. Deposition of a cobalt (Co) layer using an organometallic compound and having a process pressure greater than 133.3 Pa and less than 13.33 kPa, while maintaining the wafer substrate at a temperature greater than 20 °C and less than 500 °C;

d.4.d. Equipment designed to fabricate copper (Cu) interconnects by performing all of the following processes:

d.4.d.1. Deposition of a cobalt (Co) or ruthenium (Ru) layer using an organometallic compound and having a process pressure greater than 133.3 Pa and less than 13.33 kPa, while maintaining the wafer substrate at a temperature greater than 20 °C and less than 500 °C; and

d.4.d.2. Deposition of a copper layer using a physical vapor deposition technique and having a process pressure greater than 133.3 mPa and less than 13.33 Pa, while maintaining the wafer substrate at a temperature below 500 °C;

d.5. Equipment designed for plasma enhanced chemical vapor deposition of carbon hard masks more than 100 nm thick and with stress less than 450 MPa;

d.6. Atomic Layer Deposition (ALD) equipment designed for area selective deposition of a barrier or liner using an organometallic compound;

Note: 3B001.d.6 includes equipment capable of area selective deposition of a barrier layer to enable fill metal contact to an underlying electrical conductor without a barrier layer at the fill metal via interface to an underlying electrical conductor.

d.7. Equipment designed for Atomic Layer Deposition (ALD) of tungsten (W) to fill an entire interconnect or in a channel less than 40 nm wide, while maintaining the wafer substrate at a temperature less than 500 °C.

d.8. Equipment designed for Atomic Layer Deposition (ALD) of ‘work function metal’ having all of the following:

d.8.a. More than one metal source of which one is designed for an aluminum (Al) precursor;

d.8.b. Precursor vessel designed and enabled to operate at a temperature greater than 30 °C; and

d.8.c. Designed for depositing a ‘work function metal’ having all of the following:

d.8.c.1. Deposition of titanium-aluminum carbide (TiAlC); and

d.8.c.2. Enabling a work function greater than 4.0eV;

Technical Note: For the purposes of 3B001.d.8, 'work function metal' is a material that controls the threshold voltage of a transistor.

d.9. Spatial Atomic Layer Deposition (ALD) equipment having a wafer support platform that rotates around an axis having any of the following:

d.9.a. A spatial plasma enhanced atomic layer deposition mode of operation;

d.9.b. A plasma source; or

d.9.c. A plasma shield or means to confine the plasma to the plasma exposure process region;

d.10. Equipment designed for Atomic Layer Deposition (ALD) or Chemical Vapor Deposition (CVD) of plasma enhanced of low fluorine tungsten (FW) (fluorine (F) concentration less than 10^{19} atoms/cm³) films;

d.11. Equipment designed to deposit a metal layer, in a vacuum (equal to or less than 0.01 Pa) or inert gas environment, and having all of the following:

d.11.a. A Chemical Vapor Deposition (CVD) or cyclic deposition process for depositing a tungsten nitride (WN) layer, while maintaining the wafer substrate at a temperature greater than 20 °C and less than 500 °C; and

d.11.b. A Chemical Vapor Deposition (CVD) or cyclic deposition process for depositing a tungsten (W) layer having a process pressure greater than 133.3 Pa and less than 53.33 kPa, while maintaining the wafer substrate at a temperature greater than 20 °C and less than 500 °C.

d.12. Equipment designed for depositing a metal layer, in a vacuum (equal to or less than 0.01 Pa) or inert gas environment, and having any of the following:

d.12.a. Selective tungsten (W) growth without a barrier; or

d.12.b. Selective molybdenum (Mo) growth without a barrier;

d.13. Equipment designed for depositing a ruthenium layer (Ru) using an organometallic compound, while maintaining the wafer substrate at a temperature greater than 20 °C and less than 500 °C;

d.14. Equipment designed for deposition assisted by remotely generated 'radicals', enabling the fabrication of a silicon (Si) and carbon (C) containing film, and having all of the following properties of the deposited film:

d.14.a. A dielectric constant (k) of less than 5.3;

d.14.b. An aspect ratio greater than 5:1 in features with lateral openings of less than 70 nm; and

d.14.c. A feature-to-feature pitch of less than 100 nm;

d.15. Equipment designed for void free plasma enhanced deposition of a low-k dielectric layer in gaps between metal lines less than 25 nm and having an aspect ratio greater than or equal to 1:1 with a less than 3.3 dielectric constant;

d.16. Equipment designed for deposition of a film, containing silicon and carbon, and having a dielectric constant (k) of less than 5.3, into lateral openings having widths of less than 70 nm and aspect ratios greater than 5:1 (depth: width) and a feature-to-feature pitch of less than 100 nm, while maintaining the wafer substrate at a temperature greater than 400 °C and less than 650 °C, and having all of the following:

d.16.a. Boat designed to hold multiple vertically stacked wafers;

d.16.b. Two or more vertical injectors; and

d.16.c. A silicon source and propene are introduced to a different injector than a nitrogen source or an oxygen source;

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

e.1. Interfaces for wafer input and output, to which more than two functionally different 'semiconductor process tools' controlled by 3B001.a.1, 3B001.a.2, 3B001.a.3 or 3B001.b are designed to be connected; and

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

Note: 3B001.e does not control automatic robotic wafer handling systems "specially designed" for parallel wafer processing..

Technical Notes:

1. For the purposes of 3B001.e, 'semiconductor process tools' refers to modular tools that provide physical processes for semiconductor production that are functionally different, such as deposition, implant or thermal processing.

2. For the purposes of 3B001.e, 'sequential multiple wafer processing' means the capability to process each wafer in different 'semiconductor process tools', such as by transferring each wafer from one tool to a second tool and on to a third tool with the automatic loading multi-chamber central wafer handling systems.

f. Lithography equipment as follows:

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

f.1.a. A light source wavelength shorter than 193 nm; or

f.1.b. A light source wavelength equal to or longer than 193 nm and having all of the following:

f.1.b.1. The capability to produce a pattern with a "Minimum Resolvable Feature size" (MRF) of 45 nm or less; and

f.1.b.2. Having any of the following:

f.1.b.2.a. A maximum 'dedicated chuck overlay' value of less than or equal to 1.50 nm; or

f.1.b.2.b. A maximum 'dedicated chuck overlay' value greater than 1.50 nm but less than or equal to 2.40 nm;

Technical Notes: For the purposes of 3B001.f.1.b.:

1. The 'Minimum Resolvable Feature size' (MRF), i.e., resolution, is calculated by the following formula:

(an exposure light source wavelength in nm) x (K factor)

MRF

=

maximum numerical aperture

where, for the purposes of 3.B.1.f.1.b, the K factor = 0.25 'MRF' is also known as resolution.

2. 'Dedicated chuck overlay' is the alignment accuracy of a new pattern to an existing pattern printed on a wafer by the same lithographic system. 'Dedicated chuck overlay' is also known as single machine overlay.

f.2. Imprint lithography equipment capable of production features of 45 nm or less;

Note: 3B001.f.2 includes:

Micro contact printing tools

Hot embossing tools

Nano-imprint lithography tools

3. Step and flash imprint lithography (S-FIL) tools

f.3. Equipment "specially designed" for mask making having all of the following:

f.3.a. A deflected focused electron beam, ion beam or "laser" beam; and

f.3.b. Having any of the following:

f.3.b.1. A Full-Width Half-Maximum (FWHM) spot size smaller than 65 nm and an image placement less than 17 nm (mean + 3 sigma); or

f.3.b.2. [Reserved]

f.3.b.3. A second-layer overlay error of less than 23 nm (mean + 3 sigma) on the mask;

f.4. Equipment designed for device processing using direct writing methods, having all of the following:

f.4.a. A deflected focused electron beam; and

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

f.4.b.1. A minimum beam size equal to or smaller than 15 nm; or

f.4.b.2. An overlay error less than 27 nm (mean + 3 sigma);

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

h. Multi-layer masks with a phase shift layer not specified by 3B001.g and designed

to be used by lithography equipment having a light source wavelength less than 245 nm;

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

N.B.: For masks and reticles, “specially designed” for optical sensors, see 6B002.

i. Imprint lithography templates designed for integrated circuits by 3A001;

j. Mask “substrate blanks” with multilayer reflector structure consisting of molybdenum and silicon, and having all of the following:

j.1. “Specially designed” for “Extreme Ultraviolet” (“EUV”) lithography; and

j.2. Compliant with SEMI Standard P37;

k. Equipment designed for ion beam deposition or physical vapor deposition of a multi-layer reflector for “EUV” masks;

l. “EUV” pellicles;

m. Equipment for manufacturing “EUV” pellicles;

n. Equipment designed for coating, depositing, baking, or developing photoresist formulated for “EUV” lithography;

o. Annealing equipment, operating in a vacuum (equal to or less than 0.01 Pa) environment, performing any of the following:

o.1. Reflow of copper (Cu) to minimize or eliminate voids or seams in copper (Cu) metal interconnects; or

o.2. Reflow of cobalt (Co) or tungsten (W) fill metal to minimize or eliminate voids or seams;

p. Removal and cleaning equipment as follows:

p.1. Equipment designed for removing polymeric residue and copper oxide (CuO) film and enabling deposition of copper (Cu) metal in a vacuum (equal to or less than 0.01 Pa) environment;

p.2. Single wafer wet cleaning equipment with surface modification drying; or

p.3. Equipment designed for dry surface oxide removal pre-clean or dry surface decontamination.

Note to 3B001.p.1 and p.3: These controls do not apply to deposition equipment.

q. “EUV” masks and “EUV” reticles, designed for integrated circuits, not specified by 3B001.g, and having a mask “substrate blank” specified by 3B001.j;

Technical Notes: For the purposes of 3B001.q, masks or reticles with a mounted pellicle are considered masks and reticles.

* * * * *

3B903 Scanning Electron Microscope (SEM) equipment designed for imaging semiconductor devices or integrated circuits, having all of the following (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.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: See ECCNs 3D901 for related “development” or “production” “software”, ECCN 3E901 for related “development” and “production” “technology”.

Related Definition: N/A

Items:

a. Stage placement accuracy less (better) than 30 nm;

b. Stage positioning measurement performed using laser interferometry;

c. Position calibration within a field-of-view (FOV) based on laser interferometer length-scale measurement;

d. Collection and storage of images having more than 2×10^8 pixels;

e. FOV overlap of less than 5 percent in vertical and horizontal directions;

f. Stitching overlap of FOV less than 50 nm; and

g. Accelerating voltage more than 21 kV.
Note 1: 3B903 includes SEM equipment designed for chip design recovery.

Note 2: 3B903 does not apply to SEM equipment designed to accept a Semiconductor Equipment and Materials International (SEMI) standard wafer carrier, such as a 200 mm or larger Front Opening Unified Pod (FOUP).

3B904 Cryogenic wafer probing “equipment”, having all of the following (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.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: See ECCN 3E901 for related technology controls for the “development” or “production” of this ECCN.

Related Definitions: N/A

Items:

a. Designed to test devices at temperatures less than or equal to 4.5 K (-268.65°C); and

b. Designed to accommodate wafer diameters greater than or equal to 100 mm.

* * * * *

3C001 Hetero-epitaxial materials consisting of a “substrate” having stacked epitaxially grown multiple layers of any of the following (see List of Items Controlled).

License Requirements

Reason for Control: NS, AT

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: \$3,000

GBS: N/A

List of Items Controlled

Related Controls: (1) This entry does not control equipment or material whose functionality has been unalterably disabled. (2) See also ECCNs 3C907 (Epitaxial materials), 3C908 (Fluorides, hydrides, chlorides, of silicon or germanium), and 3C909 (Silicon, silicon oxides, germanium or germanium oxides).

Related Definitions: N/A

Items:

a. Silicon (Si);

b. Germanium (Ge);

c. Silicon Carbide (SiC); or

d. “III/V compounds” of gallium or indium.

Note: 3C001.d does not apply to a “substrate” having one or more P-type epitaxial layers of GaN, InGaN, AlGaN, InAlN, InAlGaIn, GaP, GaAs, AlGaAs, InP, InGaP, AlInP or InGaAlP, independent of the sequence of the elements, except if the P-type epitaxial layer is between N-type layers.

e. Gallium Oxide (Ga_2O_3); or

f. Diamond.

N.B.: For materials having layers of isotopically enriched Silicon or Germanium isotopes, see 3C907.

* * * * *

3C907 Epitaxial materials consisting of a “substrate” having at least one epitaxially grown layer of any of the following (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.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.

Control(s)	Country chart (see Supp. No. 1 to part 738)
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry..	AT Column 1.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: See ECCN 3E901 for related technology controls for the “development” or “production” of this ECCN.

Related Definitions: N/A

Items:

a. Silicon having an isotopic impurity less than 0.08% of silicon isotopes other than silicon-28 or silicon-30; or

b. Germanium having an isotopic impurity less than 0.08% of germanium isotopes other than germanium-70, germanium-72, germanium-74, or germanium-76.

3C908 Fluorides, hydrides, chlorides, of silicon or germanium, containing any of the following (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.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: See ECCN 3E901 for related technology controls for the “development” or “production” of this ECCN.

Related Definitions: N/A

Items:

a. Silicon having an isotopic impurity less than 0.08% of silicon isotopes other than silicon-28 or silicon-30; or

b. Germanium having an isotopic impurity less than 0.08% of germanium isotopes other than germanium-70, germanium-72, germanium-74, or germanium-76.

3C909 Silicon, silicon oxides, germanium or germanium oxides, containing any of the following (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.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: See ECCN 3E901 for related technology controls for the “development” or “production” of this ECCN.

Related Definitions: N/A

Items:

a. Silicon having an isotopic impurity less than 0.08% of silicon isotopes other than silicon-28 or silicon-30; or

b. Germanium having an isotopic impurity less than 0.08% of germanium isotopes other than germanium-70, germanium-72, germanium-74, or germanium-76.

Note: 3C909 includes “substrates”, lumps, ingots, boules and preforms.

N.B.: For materials having layers of isotopically enriched silicon (Si) or germanium (Ge) isotopes, see 3C907.

* * * * *

3D001 “Software” “specially designed” for the “development” or “production” of commodities controlled by 3A001.b to 3A002.h, 3A090, or 3B (except 3B903, 3B904, 3B991 and 3B992).

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to “software” for equipment controlled by 3B001.c.1.a, 3B001.c.1.c, and 3B001.q.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.

Control(s)	Country chart (see Supp. No. 1 to part 738)
RS applies to “software” for equipment controlled by 3B001.c.1.a, 3B001.c.1.c, and 3B001.q.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
NS applies to “software” for commodities controlled by 3A001.b to 3A001.h, 3A001.z, and 3B (except 3B001.a.4, c, d, f.1.b, j to p, 3B002.b and c).	NS Column 1.
NS applies to “software” for commodities controlled by 3B001.a.4, c, d, f.1.b, j to p, 3B002.b and c.	To or within destinations specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR or Macau. See § 742.4(a)(4) of the EAR.
RS applies to “software” for commodities controlled by 3A001.z and 3A090.	To or within destinations specified in Country Groups D:1, D:4, and D:5 of supplement no. 1 to part 740 of the EAR, excluding any destination also specified in Country Groups A:5 or A:6. See § 742.6(a)(6)(iii) of the EAR.
AT applies to entire entry	AT Column 1.

Reporting Requirements

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

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

TSR: Yes, except for “software” “specially designed” for the “development” or “production” of Traveling Wave Tube Amplifiers described in 3A001.b.8 having operating frequencies exceeding 18 GHz; or commodities specified in 3A090, 3B001.a.4, c, d, f.1.b, j to p, and 3B002.b and c.

Note: See § 740.2(a)(9)(ii) of the EAR for license exception restrictions for ECCN 3D001 “software” for commodities controlled by 3A001.z and 3A090.

IEC: Yes, for “software” for equipment controlled by 3B001.c.1.a, 3B001.c.1.c, and 3B001.q, see § 740.2(a)(22) and § 740.24 of the EAR.

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 3B001.c.1.a, c.1.b, or .q to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR); and 3A090, 3A002.g.1, 3B001.a.4, a.2, c, d, f.1.b, j to p, or 3B002.b and c to any of the destinations listed in Country Group A:6.

List of Items Controlled

Related Controls: N/A

Related Definitions: N/A

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

3D002 “Software” “specially designed” for the “use” of equipment controlled by 3B001.a to .f and .j to .p, or 3B002.

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry, except “software” for 3B001.a.4 c, d, f.1.b, j to p, 3B002.b and c.	NS Column 1.
NS applies to “software” for equipment controlled by 3B001.c.1.a or c.1.c.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to “software” for equipment controlled by 3B001.c.1.a or c.1.c.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
NS applies to “software” for 3B001.a.4, c, d, f.1.b, j to p, 3B002.b and c.	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.4(a)(4) of the EAR.
RS applies to “software” for 3B001.a.4, c, d, f.1.b, j to p, 3B002.b and c.	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.6(a)(6) of the EAR.
AT applies to entire entry	AT Column 1.

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

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

TSR: Yes, except N/A for RS.

IEC: Yes, for “software” for equipment controlled by 3B001.c.1.a and 3B001.c.1.c, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit “software” “specially designed” for the “use” of equipment specified by 3B001.c.1.a or c.1.b 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: Also see 3D991.

Related Definitions: N/A

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

* * * * *

3D901 “Software”, not specified elsewhere, “specially designed” or modified for the “development” or “production” of items specified in ECCN 3A901.b, 3B903, or 3B904.

License Requirements

Reason for Control: NS, RS, AT

Control(s)

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

NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.
<i>Special Reporting:</i> Deemed exports and deemed reexports of “software” specified in this ECCN for commodities in ECCNs 3A901.b, and 3B904 are subject to reporting requirements in accordance with § 743.8 of the EAR.	
List Based License Exceptions (See Part 740 for a Description of All License Exceptions)	
<i>TSR:</i> N/A	
<i>IEC:</i> Yes, see § 740.2(a)(22) and § 740.24 of the EAR.	
Special Conditions for STA	
<i>STA:</i> License Exception STA may not be used to ship any item in this ECCN 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: N/A

Related Definitions: N/A

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

* * * * *

3D907 “Software” designed to extract “GDSII” or equivalent standard layout data and perform layer-to-layer alignment from SEM images, and generate multi-layer “GDSII” data or the circuit netlist.

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: An example of an equivalent standard to “GDSII” would be Open Artwork System Interchange Standard (OASIS).

Related Definitions: N/A

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

* * * * *

E. “Technology”

Note 1 to Cat 3 Product Group E: 3E001 and 3E905 do not apply to ‘Process Design Kits’ (‘PDKs’) unless they include libraries implementing functions or technologies for items specified by 3A001.

Technical Note: For the purposes of 3E001 and 3E905, a ‘Process Design Kit’ (‘PDK’) is a software tool provided by a semiconductor manufacturer to ensure that the required design practices and rules are taken into account in order to successfully produce a specific integrated circuit design in a specific semiconductor process, in accordance with technological and manufacturing constraints (each semiconductor manufacturing process has its particular ‘PDK’).

3E001 “Technology” according to the General Technology Note for the “development” or “production” of commodities controlled by 3A (except 3A901, 3A904, 3A980, 3A981, 3A991, 3A992, or 3A999), 3B (except 3B903, 3B904, 3B991 or 3B992) or 3C (except 3C907, 3C908, 3C909, or 3C992).

License Requirements

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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to “technology” for commodities controlled by 3A001, 3A002, 3A003, 3B001 (except 3B001 a.4, c, d, f.1.b, j to p), 3B002 (except 3B002.b and c), or 3C001 to 3C006.	NS Column 1.
NS applies to “technology” for equipment controlled by 3B001.c.1.a, 3B001.c.1.c, and 3B001.q.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to “technology” for equipment controlled by 3B001.c.1.a, 3B001.c.1.c, and 3B001.q.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
NS applies to “technology” for 3B001 a.4, c, d, f.1.b, j to p, 3B002.b and c.	To or within Macau or a destination specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR. See § 742.4(a)(4) of the EAR.
MT applies to “technology” for commodities controlled by 3A001 or 3A101 for MT Reasons.	MT Column 1.
NP applies to “technology” for commodities controlled by 3A001, 3A201, or 3A225 to 3A234 for NP reasons.	NP Column 1.

Control(s)	Country chart (see Supp. No. 1 to part 738)
RS applies to “technology” for commodities controlled in 3A090, when exported from Macau or a destination specified in Country Group D:5.	Worldwide (See § 742.6(a)(6)(ii)).
RS applies to “technology” for commodities controlled by 3A001.z, 3A090.	To or within destinations specified in Country Groups D:1, D:4, and D:5 of supplement no. 1 to part 740 of the EAR, excluding any destination also specified in Country Groups A:5 or A:6. See § 742.6(a)(6)(iii) of the EAR.
RS applies to “technology” for commodities controlled by 3B001.a.4, c, d, f.1.b, j to p, 3B002.b and c.	To or within destinations specified in Country Group D:5 of supplement no. 1 to part 740 of the EAR or Macau. See § 742.6(a)(6)(i) of the EAR.
RS applies to “technology” for commodities controlled by 3A001.a.15 or b.13, 3A004, 3B003, 3C007, 3C008, or 3C009.	RS Column 2.
AT applies to entire entry	AT Column 1.

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

Reporting Requirements

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

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

TSR: Yes, except N/A for MT, and “technology” for the “development” or “production” of: (a) vacuum electronic device amplifiers described in 3A001.b.8, having operating frequencies exceeding 19 GHz; (b) solar cells, coverglass-interconnect-cells or covered-interconnect-cells (CIC) “assemblies”, solar arrays and/or solar panels described in 3A001.e.4; (c) “Monolithic Microwave Integrated Circuit” (“MMIC”) amplifiers in 3A001.b.2; and (d) discrete microwave transistors in 3A001.b.3; (e) commodities described in 3A090, 3B001.a.4, c, d, f.1.b, j to p, 3B002.b and c.

Note: See § 740.2(a)(9)(ii) of the EAR for license exception restrictions for ECCN 3E001 “technology” for commodities controlled by 3A001.z, 3A090. IEC: Yes, for “technology” for equipment controlled by 3B001.c.1.a, 3B001.c.1.c, and 3B001.q, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit “technology” according to the General Technology Note for the “development” or “production” of equipment specified by ECCNs 3A002.g.1 or 3B001.a.2 to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR). License Exception STA may not be used to ship or transmit “technology” according to the General Technology Note for the “development” or “production” of components specified by ECCN 3A001.b.2, b.3, commodities specified in 3A090, 3B001.a.4, c, d, f.1.b, j to q, or 3B002.b and c, to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR).

List of Items Controlled

Related Controls: (1) “Technology” according to the General Technology Note for the “development” or “production” of certain “space-qualified” atomic frequency standards described in Category XV(e)(9), MMICs described in Category XV(e)(14), and oscillators described in Category XV(e)(15) of the USML are “subject to the ITAR” (see 22 CFR parts 120 through 130). See also 3E101, 3E201 and 9E515. (2) “Technology” for “development” or “production” of “Microwave Monolithic Integrated Circuits” (“MMIC”) amplifiers in 3A001.b.2 is controlled in this ECCN 3E001; 5E001.d refers only to that additional “technology” “required” for telecommunications.

Related Definition: N/A

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

Note 1: 3E001 does not control “technology” for equipment or “components” controlled by 3A003.

Note 2: 3E001 does not control “technology” for integrated circuits controlled by 3A001.a.3 to a.14 or .z, having all of the following:

- (a) Using “technology” at or above 0.130 µm; and
- (b) Incorporating multi-layer structures with three or fewer metal layers.

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3E901 “Technology” according to the General Technology Note for the “development” or “production” of items controlled by ECCN 3A901, 3A904, 3B903, 3B904, 3C907, 3C908, or 3C909.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

Special Reporting: Deemed exports and deemed reexports of “technology” specified in this ECCN are subject to reporting requirements in accordance with § 743.8 of the EAR.

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

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: N/A

Related Definitions: N/A

Items:

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

3E905 “Technology” according to the General Technology Note for the “development” or “production” of integrated circuits or devices, using “Gate all-around Field-Effect Transistor” (“GAAFET”) structures.

License Requirements

Reason for Control: NS, RS, AT

Control(s)	Country chart (see Supp. No. 1 to part 738)
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN to any of the destinations listed in Country Group A:5 or A:6 (See Supplement No.1 to part 740 of the EAR).

Note: See General Order No. 6 in supplement no. 1 to part 736 for additional authorization that may apply for exports, reexports, or transfers (in-country) of this item.

List of Items Controlled

Related Controls: 1. ECCN 3E905 applies to process “technology” exclusively for the “development” or “production” of GAAFET structures of integrated circuits at a semiconductor wafer production facility. ECCN 3E905 does not, for example, control an integrated circuit design such as the physical layout file in “GDSII” format or EDA tools, or any other technology used to produce the physical layout file for integrated circuit design. 2. ECCN 3E905 does not apply to vertical GAAFET architectures, e.g., those used for 3D NAND.

Related Definitions: N/A

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

Note 1: 3E905 includes ‘process recipes’.

Note 2: 3E905. does not apply for tool qualification or maintenance.

Technical Note: For the purposes of Note 1 to 3E905, a ‘process recipe’ is a set of conditions and parameters for a particular process step.

4A906 Quantum computers and related “electronic assemblies,” and “components” therefor, as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

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

LVS: N/A

GBS: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: See ECCN 4D906 for related “software” controls for the “development” or “production” of this ECCN. See ECCN 4E906 for related “technology” controls for the “development” or “production” of this ECCN.

Related Definitions: N/A

Items:

a. Quantum computers, as follows:

a.1. Quantum computers supporting 34 or more, but fewer than 100, ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’, and having a ‘C–NOT error’ of less than or equal to 10^{-4} ;

a.2. Quantum computers supporting 100 or more, but fewer than 200, ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’, and having a ‘C–NOT error’ of less than or equal to 10^{-3} ;

a.3. Quantum computers supporting 200 or more, but fewer than 350, ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’, and having a ‘C–NOT error’ of less than or equal to 2×10^{-3} ;

a.4. Quantum computers supporting 350 or more, but fewer than 500, ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’, and having a ‘C–NOT error’ of less than or equal to 3×10^{-3} ;

a.5. Quantum computers supporting 500 or more, but fewer than 700, ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’, and having a ‘C–NOT error’ of less than or equal to 4×10^{-3} ;

a.6. Quantum computers supporting 700 or more, but fewer than 1,100, ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’,

and having a ‘C–NOT error’ of less than or equal to 5×10^{-3} ;

a.7. Quantum computers supporting 1,100 or more, but fewer than 2,000, ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’, and having a ‘C–NOT error’ of less than or equal to 6×10^{-3} ;

a.8. Quantum computers supporting 2,000 or more ‘fully controlled’, ‘connected’ and ‘working’ ‘physical qubits’;

b. Qubit devices and qubit circuits, containing or supporting arrays of ‘physical qubits’, and “specially designed” for items specified by 4A906.a;

c. Quantum control components and quantum measurement devices, “specially designed” for items specified by 4A906.a;

Note 1: 4A906 applies to circuit model (or gate-based) and one-way (or measurement-based) quantum computers. This entry does not apply to adiabatic (or annealing) quantum computers.

Note 2: Items specified by 4A906 may not necessarily physically contain any qubits. For example, quantum computers based on photonic schemes do not permanently contain a physical item that can be identified as a qubit. Instead, the photonic qubits are generated while the computer is operating and then later discarded.

Note 3: Items specified by 4A906.b include semiconductor, superconducting, and photonic qubit chips and chip arrays; surface ion trap arrays; other qubit confinement technologies; and coherent interconnects between such items.

Note 4: 4A906.c applies to items designed for calibrating, initializing, manipulating or measuring the resident qubits of a quantum computer.

Technical Notes: For the purposes of 4A906:

1. A ‘physical qubit’ is a two-level quantum system used to represent the elementary unit of quantum logic by means of manipulations and measurements that are not error corrected. ‘Physical qubits’ are distinguished from logical qubits, in that logical qubits are error-corrected qubits comprised of many ‘physical qubits’.

2. ‘Fully controlled’ means the ‘physical qubit’ can be calibrated, initialized, gated, and read out, as necessary.

3. ‘Connected’ means that two-qubit gate operations can be performed between any arbitrary pair of the available ‘working’ ‘physical qubits’. This does not necessarily entail all-to-all connectivity.

4. ‘Working’ means that the ‘physical qubit’ performs universal quantum computational work according to the system specifications for qubit operational fidelity.

5. Supporting 34 or more ‘fully controlled’, ‘connected’, ‘working’ ‘physical qubits’ refers to the capability of a quantum computer to confine, control, measure and process the quantum information embodied in 34 or more ‘physical qubits’.

6. ‘C–NOT error’ is the average physical gate error for the nearest-neighbor two-‘physical qubit’ Controlled–NOT (C–NOT) gates.

* * * * *

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

License Requirements

Reason for Control: NS, RS, CC, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	NS Column 1.
RS applies to “software” for commodities controlled by 4A003.z, 4A004.z, and 4A005.z.	To or within destinations specified in Country Groups D:1, D:4, and D:5 of supplement no. 1 to part 740 of the EAR, excluding any destination also specified in Country Groups A:5 or A:6. See § 742.6(a)(6)(iii) of the EAR.
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 the following:

(1) Commodities with an “Adjusted Peak Performance” (“APP”) exceeding 29 WT; or
(2) Commodities controlled by 4A005 or “software” controlled by 4D004.

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

ACE: Yes for 4D001.a (for the “development”, “production” or “use” of equipment or “software” specified in ECCN 4A005 or 4D004), except to Country Group E:1 or E:2. See § 740.22 of the EAR for eligibility criteria.

Note: See § 740.2(a)(9)(ii) for license exception restrictions for “software” for commodities controlled by 4A003.z, 4A004.z, and 4A005.z.

Special Conditions for STA

STA: License Exception STA may not be used to ship or transmit “software” “specially designed” or modified for the “development” or “production” of equipment specified by ECCN 4A001.a.2 or for the “development” or “production” of “digital computers” having an ‘Adjusted Peak Performance’ (‘APP’) exceeding 29 Weighted TeraFLOPS (WT) to any of the destinations listed in Country Group A:6 (See Supplement No.1 to part 740 of the EAR); and may not be used to ship or transmit “software” specified in 4D001.a “specially designed” for the “development” or “production” of equipment specified by ECCN 4A005 to any of the destinations listed in Country Group A:5 or A:6.

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, 4A005 or 4D (except 4D090, 4D906, 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 24 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.

* * * * *

4D906 “Software” “specially designed” or modified for the “development” or “production” of commodities controlled by 4A906.b or 4A906.c.

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

Special Reporting: Deemed exports and deemed reexports of “software” specified in this ECCN are subject to reporting requirements in accordance with § 743.8 of the EAR.

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

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: See ECCN 4E906 for related “technology” controls for the “development” or “production” of this ECCN.

Related Definitions: N/A

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

* * * * *

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

License Requirements

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

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry, except for “technology” for 4A090 or “software” specified by 4D090.	NS Column 1.
MT applies to “technology” for items controlled by 4A001.a and 4A101 for MT reasons.	MT Column 1.
RS applies to “technology” for commodities controlled by 4A003.z, 4A004.z, 4A005.z, 4A090 or “software” specified by 4D001 (for 4A003.z, 4A004.z, and 4A005.z), 4D090.	To or within destinations specified in Country Groups D:1, D:4, and D:5 of supplement no. 1 to part 740 of the EAR, excluding any destination also specified in Country Groups A:5 or A:6. See § 742.6(a)(6)(iii) of the EAR.
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 the following:

(1) “Technology” for the “development” or “production” of commodities with an “Adjusted Peak Performance” (“APP”) exceeding 70 WT or for the “development” or “production” of commodities controlled by 4A005 or “software” controlled by 4D004; or

(2) “Technology” for the “development” of “intrusion software”.

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

ACE: Yes for 4E001.a (for the “development”, “production” or “use” of equipment or “software” specified in ECCN 4A005 or 4D004); and for 4E001.c, except to Country Group E:1 or E:2. See § 740.22 of the EAR for eligibility criteria.

Note: See § 740.2(a)(9)(ii) of the EAR for license exception restrictions for technology for .z paragraphs under ECCNs 4A003, 4A004, 4A005 or 4A090, or “software” specified by 4D001 (for 4A003.z, 4A004.z, 4A005.z, and 4A090).

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 4A906, 4A980 or 4A994 and “use” of equipment controlled under 4A090) or 4D (except 4D906, 4D980, 4D993, 4D994 and “use” of software controlled under 4D090).

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 24 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 .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 .c.

* * * * *

4E906 “Technology” according to the General Technology Note as follows (see List of Items Controlled).

License Requirements

Reason for Control: NS, RS, AT

<i>Control(s)</i>	<i>Country chart (see Supp. No. 1 to part 738)</i>
NS applies to entire entry.	Worldwide control. See § 742.4(a)(5) and (b)(10) of the EAR.
RS applies to the entire entry.	Worldwide control. See § 742.6(a)(10) and (b)(11) of the EAR.
AT applies to entire entry	AT Column 1.

Special Reporting: Deemed exports and deemed reexports of “technology” specified in this ECCN are subject to reporting requirements in accordance with § 743.8 of the EAR.

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

TSR: N/A

IEC: Yes, see § 740.2(a)(22) and § 740.24 of the EAR.

Special Conditions for STA

STA: License Exception STA may not be used to ship any item in this ECCN 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: N/A
Related Definitions: N/A
Items:

- a. “Technology” for the “development” or “production” of items controlled by 4A906.b, 4A906.c, or 4D906;
- b. “Technology” for “use” of “software” controlled by 4D906.
* * * * *

Thea D. Rozman Kendler,
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