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Enterprise

January 30, 2023

By electronic submission: www.regulations.gov
ID: BIS-2022-0025, RIN 0694-AI94

About HPE

Hewlett Packard Enterprise (HPE) is a global edge-to-cloud company that helps organizations accelerate outcomes by unlocking value from all of their data, everywhere. Built on decades of reimagining the future and innovating to advance the way people live and work, HPE delivers unique, open, and intelligent technology solutions as a service. With $27B in annual revenue and 60,000 employees worldwide, HPE is committed to leveraging information technology to solve society's most pressing challenges. HPE's high performance computers enable COVID research and national security applications, our connectivity devices connect schools and healthcare facilities, and our mission critical servers power millions of online financial transactions every day.

Comment Introduction

HPE appreciates the opportunity to comment on the 7 October Interim Final Rule, "*Implementation of Additional Export Controls: Certain Advanced Computing and Semiconductor Manufacturing Items; Supercomputer and Semiconductor End Use; Entity List Modification*" (the "Rule").

HPE would like to offer structured comments regarding technical issues, non-technical issues, and effectiveness of the Rule.

## Technical Terminology & Issues

**3A090 and programmable integrated circuits:** 3A090 sets control thresholds based on communications rates and operations per second. In a programmable device like a Field Programmable Gate Array (FPGA), Field Programmable Logic Device (FPLD) or Complex Programmable Logic Device (CPLD), there is no inherent communications or calculations capability. The device must be programmed to perform communications and calculations. The communications and calculations capabilities of these devices are determined by two variables: how the device is programmed and the amount of programmable space. The programmable space is finite and typically characterized as number of "blocks" or Look Up Tables (LUTs).

- **No universal standard code**: Complex functionality like communications between devices is not universally standard code. Based on code choices, one developer might achieve the communications threshold with the available blocks/LUTs, whereas another might not.
- **Race condition for available blocks/LUTs**: To achieve the 3A090 control parameters, the device must use its finite number of blocks/LUT's to meet both the communications threshold and a calculation performance threshold. An exporter may be confused about determining the correct ECCN.

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- Assume that a programmable device has enough blocks/LUT's to meet either the communications or calculations threshold, but not enough to meet both simultaneously.
- One exporter might determine the item is 3A090 because it can be programmed to meet one parameter at a time, then reprogrammed to meet the other parameter.
- Another exporter might determine the same item is NOT 3A090 because it cannot be programmed to meet both parameters *simultaneously*.
- Proprietary information: Determining the communications rates and calculation rates for these programmable devices may require proprietary manufacturer information.

Recommended Mitigation

- Issue guidance on how to address this complex calculation/interpretation theoretical performance situation, perhaps via a practical manual.
- Leverage metrics from other programmable device Export Control Classification Numbers (ECCN's) that are already on the Commerce Control List (CCL), such as 3A001.a.7, 3A991.d or others.

3A090 TOPS Performance Metric: 3A090 introduces a new performance metric, TOPS (trillions of operations per second). Undertaking a TOPS determination is difficult because the definition of TOPS relies on the term "operations." This word "operations" is not defined in the Rule and does not have a consistent industry definition

- Conventional, non-programmable integrated circuits: Within conventional, non-programmable integrated circuits, this term can be interpreted differently based on:
  - Number format: the range of possible formats across integer, fixed-point and floating-point, combined with bit length is nearly infinite. Number formats associated with vector math are of particular concern.
  - Mathematical events: Each type of mathematical event (e.g., individual arithmetic, fused-multiply-accumulate, matrix/vector events, mixed number format operations) may be interpreted differently – as one or more individual operations.
  - Number domain: Any paradigm for "operation" becomes inconsistent between devices that operate in the digital domain vs. analog domain. What may be perceived as one "operation" in an analog domain likely represents a much larger number of "operations" in the binary domain.
  - Designed for digital use vs. actual analog end use: Technical leaders envision items designed as digital

calculation devices but may be deployable by users as analog calculation devices. The analog deployment is likely to have much higher performance. In such cases, the manufacturer and end user may assign different ECCN's to the same item.

- **Conventional programmable devices**: Calculating the TOPS for programmable devices will also be problematic because there is no clear definition of the term "operation." Without such a clear definition, compounded by programming variability, the TOPS for these devices will be measured inconsistently.
- **Future Hybrid Digital-Analog Programmable Devices:** Programmable devices are evolving. Traditional programmable devices have been exclusively digital. Hybrid digital-analog programmable devices are envisioned for the future. Without clarifications, these hybrid devices will have inconsistent TOPS assessments.
- **Optical computation devices:** As optical computational devices hit the market, the TOPS determination becomes more complicated. An optical calculation device may have no inherent performance limitation from the hardware. The computations are a function of the wavelengths and phases being input into the integrated circuit, often from a *separate* integrated circuit. Even the number of physical inputs can become removed from any notion of performance, as each physical input can take in a multitude of optical signals (various wavelengths & phases). Concepts like "operation" and "physical input count" become moot.

Recommended Mitigation

- BIS should put the highest priority on defining these terms to assure consistent interpretation. This will assure compliance and a level playing field.
- BIS should provide explicit, standard definitions in the regulation text (a parallel example is the **Category 4 "Technical Note on Adjusted Peak Performance (APP)"** and an operational guide (a parallel example is the BIS **"Practitioner's Guide to Adjusted Peak Performance"**).
- BIS may want to use the launch of industry standards (e.g., IEEE) for innovations as a point to determine how to measure performance. Using international standards will assist in a more consistent approach for classification purposes.

## Resolving Non-Technical Ambiguity

**Controls on 4E001 "use" technology:** This appears to be over-controlled and beyond the intent of the Rule. The regulation imposes controls on the technology for the "development", "production" and "use" of 4A090 items controlled under 4E001.

The Rule imposes controls on only the "development" or "production" of 3A090 items controlled under 3E001 – but not the "use" technology of

3A090. This results in the technology to "use" a 4A090 computer part (which happens to have a 3A090 IC onboard) having higher controls than the "use" technology of the 3A090 IC itself.

Furthermore, this approach appears to be inconsistent as applied to other, more-controlled items. For example, the technology for the "use" of a high-APP computer item under 4A003.b or 4A003.c is NOT controlled under 4E001.

This appears to be a case of unintentional over-control on the "use" technology for 4A090 items.

Recommended Mitigation:

- BIS should revise the counterpart technology entry in 4E001 to remove control of "use" technology for 4A090.

Duality of 3A090/4A090 and 5xnn2 (encryption) ECCN's: Under this Rule, items meeting the parameters of 3A090/4A090 and encryption ECCN's are to be effectively controlled as both ECCN's (dual controls), as well as items under 5x002 losing ENC eligibility.

- Dual controls
  - 15 § 742.6(a)(6)(i)
  - ECCN 5A992, License Requirements, *Reason for Control* (Table for RS)
  - Docket No. 220930-0204 / RIN 0694-AI94, Section III *Overview of New Controls for Certain….Entity List Modifications*, Paragraph A. *Addition of advanced computing chips….(supplement no. 1 to part 774 of the EAR)*
- ENC Eligibility
  - Docket No. 220930-0204 / RIN 0694-AI94, Section III *Overview of New Controls for Certain….Entity List Modifications*, Paragraph D. *License Exception eligibility for new advanced computing items*
  - 15 § 740.2(a)(9)

Dual-control is contrary to the EAR. Part 732 and Supplement No. 4 to Part 774 reference the determination and use of *the* ECCN (singular), not plural.

Dual-control is contrary to export compliance systems. Export control systems rely on every item having exactly one ECCN. HPE is unaware of BIS ever issuing a CCATS that identified an item as having two ECCNs or classifications applicable at the same time.

This is contrary to effective communication of ECCN's: If an item meets both criteria and the manufacturer only advises one of the two ECCN's, recipients of this information will be blind to the other ECCN and applicable controls. For example, assume a 5A002 encryption item that

also meets the criteria of 3A090 or 4A090. The item loses ENC eligibility under the Rule.

- If the Item is coded by the manufacturer as 5A002, a 3rd party exporter is only aware of the 5A002 ECCN. The exporter is ignorant of the 3A090/4A090 impact. The exporter will not know to make the required adjustments to ENC eligibility.
- If the item is coded by the manufacturer as 3A090 or 4A090, a 3rd party exporter will be unaware of the encryption characteristic, and not know to apply the encryption-related controls.

Without relief from this paradigm, exporters are forced to revolutionize their compliance and communication systems.

- Export compliance systems would have to associate multiple ECCN's with one item and apply two sets of control rules: There is no provision for this in any system.
- When any two parties (e.g., manufacturer and customer) communicate about the ECCN for these items, they are effectively forced to communicate both applicable ECCNs.

This impact will grow over time. The population of integrated circuits that include encryption functionality is already significant and growing rapidly. At some point, almost all computing integrated circuits will also have encryption functionality.

Recommended Mitigation:
To address this complexity and allow for effective compliance implementation into existing export control and communication systems, HPE recommends creation of new ECCN's that explicitly describe these combinations. A set of suggested examples is below.

- 3A090 + 5A992 = 5A932
- 3A090 + 5A002 = 5A092 or consider 5A392 if there is a need to reflect the Category 3 nature.
- 4A090 + 5A992 = 5A942
- 4A090 + 5A002 = 5A092 or consider 5A492 if there is a need to reflect the Category 4 nature.

Create a list of known 744.23 "targets": The Rule creates new end use and end user requirements under 744.23.

- China IC fabrication facilities, with unknown specific capabilities.
- China IC fabrication facilities known to have specific capabilities.
- China "supercomputer."

Exporters understand their obligation to know their customer. However, leaving the determinations up to each individual exporter's due diligence process could drive inconsistent results.

"Knowledge" regarding the end user or customer will vary based on the relationship and industry of an exporter. For example, an exporter of semiconductor manufacturing equipment is more likely to know more

about a China semiconductor fabrication facility's capability than an exporter of finished computer equipment. Likewise, an exporter of specialized high-performance computers is more likely to know about a China "supercomputer" end use than an exporter of industry-standard computer components.
Furthermore, 744.23 end use and end users in China will go to significant lengths to obscure the exporter's ability to detect license-required scenarios.

Recommended Mitigation:

- Publication of Chinese IC fabrication facilities and supercomputer locations that are known to the US government to meet the restrictions in the published Rule. This would be like parallel action with previous controls (e.g. 744.21 Military End Use Rule), where BIS has published *"includes but not limited to"* lists of confirmed end use/users. This same practice could be followed for 744.23.

744.23 Thresholds & Pace with Innovation: Part 744 controls have been static and with historical controls were not subject to frequent or periodic reviews (examples provided below). The 744.23 thresholds for certain semiconductor fabrication capabilities and "supercomputer" performance per cubic foot thresholds should be regularly adjusted, to keep pace with global technology trends. Through constant innovation, computer performance continues to grow, and semiconductor manufacturing capabilities continue to grow. These industries tend to move at a much faster pace than most other industries. Without regular adjustments, these controls become backwards and ineffective.

Examples of Part 744 Controls that have remained static:

- 744.17: The microprocessor threshold of 744.17.a has been static at 5 GFLOPS and 32 bits for approximately a quarter century; this threshold was long-ago exceeded by portable and embedded consumer level microprocessors. While it may still serve a national security need for Military End Use/User control, the threshold is now meaningless. It now impacts all microprocessors.
- 744.21: The computer Adjusted Peak Performance was originally established as 0.5 WT by 744.21. The intent was to keep higher-performing computers that didn't reach the era's 4A003 threshold (0.75 WT) out of the hands of unfriendly military end use and end users. As the scope of 744.21 has expanded, so has the performance scope. By the recent inclusion of 4A994 computers into 744.21, the threshold was effectively lowered to 0.0128 WT. In 2022, it is common to see single-CPU consumer computers or mobile devices readily exceeding 0.5 WT, let alone 0.0128 WT. Two decades ago, this control was meant for a rarified situation - blocking higher-performing computers from military rivals. This control now creates a burden on consumer-level exporters to determine

military end use or users for commodity smartphones and laptops.

Recommended Mitigation

- BIS should establish an annual review of Part 744 thresholds to determine if they remain appropriate for the control objective. Furthermore, BIS should examine if the thresholds are potentially benefitting the control targets and having a detrimental impact to US industry by swaying global markets to non-US exporters and non-US persons.

**Burden to detect upgrades of China computers into "supercomputers":** The Rule requires licenses for several export scenarios to China "supercomputer" application. As noted in previous comments, detecting China "supercomputer" end use is already a significant challenge. Computers, particularly high-density computers, can be upgraded by simply replacing socket-compatible processors and accelerators. A China computer installation that does not meet the threshold at one point may be quietly upgraded by the operator (using 3rd party items) to exceed the "supercomputer" threshold later. Exporters may not be able to rely on static End Use Statements or similar certifications, due to this "moving target" characteristic. This may require exporters to obtain End Use Statements to all China computer installations (regardless of size) for every transaction. This is a high burden. Furthermore, these "high burden" efforts are likely in vain, as China recipients may claim they have no such "supercomputer" (even if they do) and go to great lengths to obfuscate their capabilities.

Recommended Mitigation:

- This is another case where publishing a list of known 744.23 supercomputer targets will result in compliance that is more effective, more consistent, and less burdensome.

**Total reliance on manufacturers for information:** The complexity of this Rule and the increased need for proprietary manufacturer information will result in exporters being wholly reliant on manufacturers for classification. This is a new dynamic in the IT ecosystem. If a manufacturer does not proactively provide the information, every exporter of integrated circuits and computer assemblies must make inquiries to the manufacturer. Even if BIS can produce a clear definition of "operations" and resolve issues related to programmable devices, an enormous amount of technical information is still required to determine the performance of an integrated circuit. Quite often, these technical details will be proprietary to the manufacturer. For example, only the manufacturer may be able to reliably determine the TOPS. By extension, the exporter is reliant on the manufacturer to determine the correct ECCN.

Exporters are ultimately responsible to assure they have the correct ECCN, but this fact is unsettling if the exporters are functionally reliant on the manufacturer for the ECCN. The May 2021 settlement between BIS and Photonics Industries International, Inc. sheds light on this concern. In this case, a manufacturer had misclassified items as EAR99 that were correctly described as 6A005, which led to non-compliance. Any exporter that would have utilized the manufacturer's erroneous EAR99 ECCN would have also potentially have compliance issues.

There is precedence for this misclassification concern in computing. Composite Theoretical Performance (CTP) was the measurement used to determine ECCN 4A003, until 2006. CTP often required proprietary manufacturer information and made exporters completely reliant on the IC manufacturers to determine this number. Furthermore, CTP left substantial room for interpretation and subjective measurement. Much of this concern was dissolved by the 2006 adoption of Adjusted Peak Performance (APP) as a measurement for 4A003 (and other ECCNs). APP allowed all parties to objectively and uniformly determine their computer APP, with little or no proprietary information from the manufacturer. This advancement has been undone by the Rule and addition of 3A090.

Recommended Mitigation:

- Take previously-described steps to clarify, simplify and harmonize the TOPS measurement.
- Promote an environment where integrated circuit manufacturers freely share consistently measured TOPS information.

## Effectiveness of the Rule

**Unilateral Controls on items are generally ineffective and can be counterproductive:** Unilateral controls lack effectiveness and may tip the global playing field in favor of non-US competitors.

They are often bypassed by unwitting diversion through intermediaries, who are ignorant of the unilateral US controls. For example, the 3A090 items can be exported to an NLR party, who is unaware of their re-export obligations, and then they export (with no local control) to China. Even with inclusion of a Destination Control Statement, this error is easily made and difficult to detect with small items like IC's.

The playing field tips in favor of non-US competitors, giving access to the intended target of control and impacting US industry's ability to maintain technological advances. Previous unilateral ITAR controls prove instructive. As US satellite electronics came under ITAR control, the European and Asian electronics manufacturers quickly snapped up the opportunity. Their competing indigenous products were promoted as "ITAR free," which allowed them to rapidly advance in the market. This not only disadvantaged US satellite electronics manufacturers; it

increased availability of these electronics to the bad actors. A similar pattern could occur in this space.

Recommended Mitigation:

- Note that most existing multilateral export control regimes explicitly prohibit end-use and end-user controls.
- BIS should make every effort to quickly integrate the Rule's controls into multilateral export control regimes.
- If BIS is not successful at broad-based multilateral acceptance within a timely manner, BIS should consider withdrawing or modifying these controls.

Chinese "supercomputer" controls may be bypassed by as-a-Service (aaS) solutions: The Rule limits engagements towards China "supercomputer" activity in China and may preclude some high performance compute capability to China. With the availability of aaS solutions, however, China compute workloads can be offloaded to computers located in other states, possibly including those in the U.S.

- Without a multilateral end-use / end user control, non-U.S. states, even Wassenaar Arrangement partners, may give China computational access to their equivalent "supercomputers" via an aaS arrangement.
- While 744.6 provides controls on U.S. Persons for various situations involving Chinese semiconductor fabrication, there does not appear to be a parallel U.S. Person control for supercomputing.

Recommended Mitigation: BIS should clarify intent regarding supercomputing aaS, particularly in light of previous Advisory Opinions on computing aaS.

- January 2009: Application of EAR to Grid and Cloud Computing Services
- January 2011: Cloud Computing and Deemed Exports

Harm to U.S. Government computing programs: The items now under 3A090 and 4A090 (along with their software and technology tangents) were largely EAR99 until this Rule. Due to the relatively low control scenario of EAR99, some EAR99 "building blocks" for U.S. Government compute programs were being developed in China or with China-located partners. The Rule forces these operations to be licensed or moved out of China. The Temporary General License provides some temporary relief and time to seek licensing, however, there is no certainty that BIS will grant these licenses. Businesses must look towards relocating these programs. Relocation involves increased costs and schedule impacts. Neither are tolerated by the recipient U.S. Government program offices. This may result in contractual penalties upon the U.S. supplier, termination of contract, or program delays. The end effect is harm to both U.S. industry and the U.S. Government.

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Recommended Mitigation

- License applications for these U.S. Government scenarios should get expedited priority.
- Extend the Temporary General License beyond April 2023, to provide ample time for relocation or licensing. Perhaps BIS can narrow any concern with the extension by making the extension only available to parties who have an export license application submitted by the end of the current TGL. This way, if the license is approved, they can continue unabated. If the license is denied, then there would be a set amount of time to relocate.

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