April 4, 2016

Via email DDTCPublicComments@state.gov
Publiccomments@bis.doc.gov

Re: Proposed Revisions to EAR and USML Category XII

ATTN: Mr. Ed Peartree, Director, Office of Defense Trade Controls Policy

Dear Sir,

Princeton Infrared Technologies, Inc. ("Princeton IR") submits the following comments on the proposed rule changes to the U.S. Munitions List, Category XII as well as the Department of Commerce Bureau of Industry and Security for your consideration.

Background

Princeton IR was founded in December 2013 to develop and manufacture infrared detector solutions, particularly indium gallium arsenide ("InGaAs") focal plane arrays, for various commercial and military applications. Commercial applications of Princeton IR's products include spectroscopy for material inspection, machine vision in factories for glass inspection, and monitoring dense wavelength division multiplexing telecommunication networks.

Overview

Princeton IR believes the proposed regulations of February 19, 2016 are a significant improvement from the last set of rules release in May of 2015. That being said this revision does have some areas which can be quite detrimental to many in the Infrared industry with these new regulations. The current rules are still somewhat ambiguous and could hurt the domestic IR industry and would have negative economic and national security consequences. Foreign competition would likely leap-frog over domestic production both in quality and cost, making better, cheaper product available outside the U.S. and increasing costs for U.S. defense contractors. The foreign competition does not have to deal with the ambiguity and are freer to send their Infrared parts to commercial applications. For these reasons, we believe there should be modifications to the proposed rule changes in their current form and ask that the agencies involved revise those rules accordingly. Modifications to protect military technology but allow the commercial applications to be sold world wide will actually strengthen the domestic infrared market. Removing the ambiguity in some of the rules will enable this to happen.

Princeton Infrared Technologies

Discussion

USML revisions Vol 81, No. 33

1. Definitions

A. Focal Plane Arrays

Several new definitions are established in this USML reading. The first one on page 8441.

"Focal Plane array is a linear or two-dimensional planar layer, or combination of planar layers, of individual detector elements, with or without readout electronics which work in the focal plane."

This definition is problematic as it needlessly immediately sets up non-bright lines and very low walls.

It has been well established in the literature that a "detector array" is an array of detector elements either in linear or two dimensional form. These detectors are not tied to electronics and are simply able to convert photons to electron-hole pairs. The detector elements need to be hooked to some electronics to convert the signal.

Once these detector arrays are then attached to electronics or a Read our integrated circuit it becomes a focal plane array, either one dimensional or two dimensional. The above definition needs to be changed as any photodiode manufactured using standard semiconductor techniques becomes a focal plane array. Thus any detector array could fall under the USML. In semiconductor processing the detectors are manufactured in arrays of diodes. This makes it easy for processing since a step and repeat mask set can be used. It also allows for easy testing and post processing where the die are cut and separated. By the above definition once the wafer is processed into detectors it would then inherently be a focal plane array. That could be single element detectors or where linear arrays or 2D arrays where intended. The process is the same for both. This definition is a poor definition and should be changed as it places any detector manufacture by semiconductor processes as a focal plane array. This is the definition of a very low wall and not a bright line.

The definition should be a "focal plane array' is an array of detector elements either one dimensional or two dimensional where each individual detector is attached to set of read out electronics that has amplifiers that outputs an analog or digital signal the user can utilize. The detector arrays should not be in the USML since the detector structures are quite common and thoroughly understood in the literature and manufactured all over the world. We need to have bright lines and the current definition creates a very gray line between the specific detector arrays and how semiconductor detectors are manufactured.

This definition of a focal plane array does not appear anywhere in the actual document, it only appeared in the discussion section. This needs to be clarified.

B. Military End Users

Another problematic definition is what is defined as military end user. It was stated as follows:

While applying the standard terminology ''specially designed for a defense article'' would apply to articles that operate as a component for a higher level assembly, that terminology would not describe the same articles when used as end items on their own for the same military purpose. To address this concern, paragraphs (b)(6) and (c)(2)(iii) control articles if they are specially designed for a military end user. A military end user is defined in the new Note to Category XII as the national armed services, National Guard, national police, government intelligence or reconnaissance organizations, or any person or entity whose actions or functions are intended to support military end uses. If an item is created for both military and non-military end users, or if the item was created for no specific end user, then it is not specially designed for a military end user. Contemporaneous documents are required to support the design intent; otherwise, use by a military end user will establish that the item was specially designed for a military end user.

It is confusing as to why an item is considered "specifically designed for a defense article" if there is no documentation showing it was designed for commercial applications. That is counter intuitive and in direct contrast to the sentence above, which is highlighted here: "If an item is created for both military and non-military end users, **or if the item was created for no specific end user, then it is not specifically designed for a military end user.**" If something is specifically designed for a military end user then there are specifications or documents showing it was designed for a military end user application. That second part of the sentence clearly puts the onus on the government to show the item is designed for a military end user not the other way around. The definition above clearly indicates you don't need documentation for a non-military use if there is no end user. If in the lab someone decided to put peanut butter down on an ROIC and found that it detected infrared light then it should not be considered "designed for a military end user" even if there is no documentation it was for a commercial application. The device was not designed for a military application and no end user was requesting it yet there was no documents to show the intent was to build a commercial imager with a specific application but it be considered under the USML by the above rule. There is no reason it should be established to be for a military end user. Especially by the highlighted sentence above. **The sentence "Contemporaneous documents are required to support the design intent; otherwise, use by a military end user will establish that the item was specially designed for a military end user"**

should be struck since it is in direct opposition to the highlighted sentence above. It is clear by the definition that if it was not specifically designed for a military end user then it is commercial.

C. Funded by Department of Defense

E(23) funded by the department of defense needs further definition. What is the definition of funded? If an item was developed 95% commercially and then the government pays for the last 5% of development for a system is that considered funded? The definition of funded should be more clearly laid out.

D. Specifically Designed

In XIII a2i does not say specifically designed for a military end user yet for c2(iii) states specifically designed for a military end user. In a(2)i there is a vagueness of what a weapon imaging system is. By the USML definition a weapon imaging system does not need a display or reticle and therefore it could be any infrared imaging camera. The camera does not need to be attached to a weapon to be a weapon sight according to the definition. **The definition of a weapon sight in the proposed rules could be any camera, it does not even need a viewer or display.** This is not a bright line and sets up for very low walls. **It should be clear in a2i that it is for military end user or the definition of a weapon sight become clear since the current definition is unclear.** An e.g. is added to state it could clip on but that is just an example. The government needs to define a weapon sight versus a camera since any infrared camera could fall under this definition.

A weapon sight is used for aiming a weapon so we believe the reticle is a main part of a weapon sight. In addition we are not sure why "clip-on" is the example not a definition of a weapon sight.

Furthermore the definition of an infrared focal plane array is 1D and 2D making both technically under the definition in a camera as USML. This can't be the intention of this rule. The definition of a weapon sight needs to be clarified as this definition is counter to what is states in c2(iii) which stated "Having an infrared focal plane array or imaging camera, and is specially designed for a military end user;" and e(4) for Infrared focal plane array (IRFPAs) specially designed for articles in this subchapter. Under the current rule the FPAs would not be under USML unless they were put in a camera since any camera could be construed as a weapon sight under the definition given.

The following table contains a few examples of devices that are readily available now, but which would be now considered USML because they most likely have no documentation saying before they were designed that they were for commercial applications and they are simply detector arrays which will fall under the current focal Plane array definition. They also could also be considered a weapon sight by the above definition:

Device Name	URL
InGaAs PIN Photodiode with Large Photosensitive Area Chip-on-Carrier	http://welcome.gofoton.com/product/ingaas-pin-photodiode-with-large-photosensitive-area-chip-on-carrier/
Simple InGaAs photodiode array without packages	http://www.alibaba.com/product-detail/Optoelectronic-chip-integrated-circuits-ingaas-pin_1783007100.html?s=p
Short 4x1 array on InGaAs photon detectors that can be repeated many times to form a 3x4 array for fiber ribbons	http://www.albisopto.com/albis_product/pdcaxx-32-sc/
12-channel optical receiver used in Datacom and telecom	http://www.avagotech.com/pages/en/fiber_optics/parallel_optics/12-channel_parallel_optics/afbr-83pdz/
45 element arrays of receivers	http://www.a3pics.com/a_spec.htm

Princeton IR is unaware of any military system, anywhere in the world, that uses a one-dimensional photodetector array in the SWIR band (900-2600nm). Thus, Princeton IR believes that the focal plane array definition should only refer to two dimensional arrays and linear arrays should continue to be controlled by commerce department.

Further, we believe that the distinction between square pixels and tall pixels should also be removed from the CCL list, such that SWIR products using tall or square pixels should fall within the EAR99 classification.

First, it is important to note that many telecommunication detectors are manufactured in arrays called linear focal plane arrays fall under this section. Since these arrays are never packaged, the detectors would be subject to significantly heightened controls, with no national security benefit. The array sizes of 1024 elements and 2048 elements are currently available from foreign suppliers and have been sold for years in the U.S. and around the world.

The following table contains a few examples of companies that sell these types of arrays:

Device Name	URL
12 channel 10Gb/s detector array (Singapore)	http://www.avagotech.com/pages/en/fiber_optics/parallel_optics/12-channel_parallel_optics/afbr-83pdz/

4x1 array (Switzerland)	http://www.albisopto.com/albis_product/pdcaxx-32-sc/
256x1, 512x 1, 1024x1 and 2048x1 on pitches from 50um to 10um (USA)	http://www.sensorsinc.com/products/detail/le-series http://www.sensorsinc.com/products/detail/gl2048-r-ingaas-linescan-camera
512x1, 1024x1 and 2048x1 (Belgium)	http://www.sinfrared.com/en/infrared_camera/detector_arrays_for_infrared_linescan_imaging_and_spectroscopy_applications/xlin_detector_series.asp
Camera systems using the arrays (Belgium)	http://www.sinfrared.com/en/infrared_camera/swir_-_short_wave_infrared_cameras/lynx-gige_-_high_resolution_high_speed_uncooled_swir_gige_line-scan_camera.asp
1024 on 25um pitch (Japan)	http://www.hamamatsu.com/us/en/product/category/3100/4005/4208/4121/G10768-1024DB/index.html
256 element arrays (China)	http://en.cnki.com.cn/Article_en/CJFDTOTAL-JGHW200611007.htm http://www.medsci.cn/sci/show_paper.asp?id=2608159269

The examples above are only used in commercial applications.[1]

For the above reasons, we believe the proposed regulations need modifications to their definitions and should either be amended or discarded in their entirety.

2. Comments on other modifications of the CCL

2.1. General Commentary

The new CCL is now so complicated that two Engineers and a scientist with a Ph.D. could not understand these new rules after three days of reading them. There are so many ECCNs that refer to other ECCNs that it appears circular in nature. This is not a simplification of the rules but a way of making them more complex. They are so complicated that we could not provide great guidance on the new set of rules. The CCL is complicated, lengthy and should be simplified to better serve the needs of small businesses. Currently, we are able to manage the workload with minimal advice from our attorneys. However, due to the new, complex language and overuse of acronyms and multiple ECCNs that are circular, small businesses must hire expensive attorneys for advice and assistance in establishing the correct procedures for exports. **Even our attorneys were confused by the rules and**

[1] There are systems that are TDI (time domain integration), but TDI systems are made by adding multiple linear array elements together, which differentiates them from pure one-dimensional arrays.

said they were waiting guidance. They couldn't even help us provide commentary. Businesses also need to pay for a full-time administrator to handle the increase in paperwork and documentation. The modifications were meant to simplify the process, but we believe the changes have actually made the process more difficult.

The new rules were so complicated that they were not printed out in their entirety. Instead it constantly just showed the ECCN and where it referred. It should have been just printed out in one document that one could read in its entirety, similar to the USML. Instead one needs to have multiple documents now to see where insertions and deletions should occur. There are also too many acronyms and subheadings. Many of these rules could be simplified with charts and tables versus lists that go down many levels. There are many lines with "having the following" or having double negatives in the control line.

2.2. Revisions to ECCN 6A002

The change in Category XII now will allow 2D arrays to be exported under commerce control if the array was not "specially designed for military end users. It is not clear from this rule what will be considered EAR99 for 2D focal plane arrays and what will be commerce control and to what level of 6A003.

2.3. ECCN 6a990

We understand the DoD is trying to restrict sensitive information on military grade ROICs from leaving the country; however, to be effective, the regulation needs to distinguish military and commercially designed ROICs more clearly. Commercial ROICs should be excused from the CCL and USML. The USML is taking care of ROICs specially designed for military end users but this is not true for commercial ROICs. IRFPA ROICs are readily available worldwide up to resolutions of 1280x1024 for both SWIR, MWIR and LWIR devices, http://www.mikro-tasarim.com.tr/products. All commercial ROICs should be considered EAR99. This regulation is not clear where the ROICs sit for commercial ROICs. The specialty designed ROICs are under USML Category XII but other than that there is a lack of clarity.

Note: We believe that the exception for ROICs valued under $500 appears reasonable Wafers from a foundry cost about $5,000, and one receives more than 10 chips even for larger devices. We assume this $500 limit is per ROIC not a wafer of ROICs.

2.4. Revisions to ECCNs 6E001 and 6E002

The proposed rule puts restrictions on the commodities related to manufacturing a focal plane array including substrates, epitaxial grown materials, zinc diffusion, software and firmware in cameras. The commodities portion of the proposed rules is our biggest concern

because lattice matched InGaAs epitaxial wafers are currently not made in the United States. Due to the commodities restriction, the proposed rule would require all companies to get a license. We believe the rule will heavily impact the SWIR and telecommunications industries unless and until licenses are issued. (Companies that manufacture telecommunications devices use InGaAs detector material for single element devices and would be subject to the same regulations.)

A license would also be required for the software that interfaces with the arrays for either manufacture or testing applications including the software that interfaces with the cameras. U.S. companies using non-U.S. workers—including consultants, visitors, or temporary employees—would be subjected to the heightened regulations even if the cameras are just in the U.S. plants. Any person in the company with access to the cameras would place the entire company in violation of the proposed rule. This software ruling needs to be modified. Software used to operate a camera should be EAR99. This regulation will force companies in the U.S. to get a license if a camera is in their plant and they have foreign workers.

As a result, this rule is not protecting U.S. technology and is just making SWIR commercial equipment more difficult to use. Companies will resort to other solutions ultimately weakening the SWIR industry at home.

3. Conclusion

Princeton IR believes refinement to these rules are necessary to make bright lines to distinguish military hardware from commercial hardware. Some of the definitions allow for ambiguity which then leads to problems further down the road. This is especially true in the USML list. The definitions needs to be clear so the bright lines are bright. The Department of Commerce revision needs to be simplified. The new rules are way too complicated and circular in nature. The USML list is straightforward and the Department of Commerce list should be the same.

Respectfully submitted,

Martin H. Ettenberg, Ph. D.