APPLICABILITY OF U.S. DEFENSE TRADE CONTROLS TO PRINTED BOARDS
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an IPC White Paper by
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Note to Readers

This paper is not intended as legal advice. Readers should seek specific legal advice before acting with regard to the subjects mentioned herein. While the Administration has proposed significant changes to the U.S. defense trade control system, this paper focuses solely on the existing system.
To avoid inadvertent violations of law, it is important for defense companies to understand how their products and technology are regulated by U.S. defense trade controls. In particular, defense companies may benefit from a clear explanation of the application of the United States Munitions List (“USML”) and the International Traffic in Arms Regulations (“ITAR”) to printed boards that are specifically designed or modified for defense articles.

IPC analysis indicates that roughly one-third of printed boards manufactured for military use are made outside the United States. Anecdotal evidence indicates that this may include the sourcing of ITAR-controlled printed boards from foreign facilities. Because printed boards are not listed explicitly in the ITAR, a careful analysis of the complex ITAR rules is required in order to properly understand the control of printed boards and their designs. As a result, the applicable controls may be overlooked, resulting in inadvertent violations of the law when, as part of their bid, sourcing, or manufacturing processes, defense companies release ITAR-controlled printed board designs to non-U.S. parties without obtaining required licenses from the State Department’s Directorate of Defense Trade Control (DDTC). Such sourcing of printed boards from non-U.S. parties constitutes an export of the board design under the ITAR and is required to comply with ITAR licensing requirements.

This paper explains the current defense trade controls governing printed boards, their designs, and related digital data and provides specific examples.

I. About Printed Boards

A printed board, or PB, is used to mechanically support and electrically connect electronic components using conductive pathways, tracks or signal traces etched from copper sheets laminated onto a non-conductive substrate. PBs are also referred to as printed wiring boards (PWB) or etched wiring boards. PBs are used to mechanically support and electrically connect electronic components, but do not include those components.

Each printed board is specifically and uniquely designed for the products into which it is incorporated. As a result, there is no such thing as a generic or interchangeable printed board. The design of the printed board is dictated precisely by the nature and type of electronic components to be mounted on the board, which is in turn dictated by the specifications of the product into which the printed board assembly is to be incorporated.

Because of their unique role in connecting all electronic components in the product, printed boards and their designs can reveal significant technical information related to defense articles. For example, the design of the printed boards that are incorporated into flight controls can reveal the data buses used in the controls. Data buses are the communications channel between the flight computer and the aircraft control surfaces. Access to data bus types can provide U.S. adversaries with information about potential weaknesses of the aircraft that may be exploited, including how sensitive the aircraft is to electronic disruption. This is but one of many examples of critical data contained in printed board designs. Additional examples are provided in Section III of the white paper.

Because of these risks, failure to properly secure the information embedded in printed boards could result in a breach of national security, theft of critical defense-related intellectual property and allow for reverse engineering of critical U.S. defense systems. It is therefore important to understand the required export controls on both the printed boards themselves and the design information needed for their manufacture.
II. Applicability of ITAR to Printed Boards and Their Designs

A. Printed Boards
Printed boards designed for defense articles are generally within the scope of the USML’s controls on “components” that are specifically designed or modified for defense articles. Each category on the USML, except for Category V (Explosives and Energetic Materials, Propellants, Incendiary Agents and Their Constituents), specifies that components and parts of items covered by the category are covered as well. Additionally, certain printed boards may also, or alternatively, come within the controls of Category XI(c) (Military Electronics), as components specifically designed or modified for military electronic systems or equipment.

Moreover, printed boards may be considered as “technical data” related to the defense articles into which they are incorporated. The definition of “defense article” includes “technical data recorded or stored in any physical form, models, mockups or other items that reveal technical data directly relating to items designated in § 121.1.” Where printed boards reveal important information about the function of the defense articles into which they are incorporated, they would likely constitute technical data directly relating to the defense articles, and would accordingly be considered as technical data stored in a physical form.

This analysis recognizes that some printed boards destined for military use are not regulated under ITAR. For instance, a printed board may be designed for a dual-use computer used on the aircraft. Such printed boards would not be subject to the USML. In addition, in some cases, the State Department’s DDTC may determine, through the Commodity Jurisdiction (“CJ”) procedure, that a printed board specifically designed for an USML item does not warrant control under ITAR. If company personnel believe that a particular printed board specifically designed for an USML item may not warrant control under the USML, they should consult their internal export control function, export control staff at their prime contractor, or an external legal advisor.

B. Printed Board Designs
In addition to applying to printed boards specifically designed for defense articles, ITAR also covers the design and digital data necessary to manufacture printed boards that are specifically designed for USML items. Each category of the USML specifies that technical data “directly related” to covered items is also covered. Technical data includes “[i]nformation, other than software . . ., which is required for the design, development, production, manufacture, assembly, operation, repair, testing, maintenance or modification of defense articles.” The regulations specify that “[t]his includes information in the form of blueprints, drawings, photographs, plans, instructions, or documentation.”

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1See 22 C.F.R. § 121.1, Categories I(h), II(j), III(d), IV(h), VI(f), VII(g), VIII(h), IX(d), XI(c), XII(e), XIII(g), XIV(k), XVI(e), XVII(a), XVIII(e), XX(c), XXI(a).

2See 22 C.F.R. § 120.6.

3See 22 C.F.R. § 121.1 Category I(i), II(k), III(e), IV(i), V(h), VI(g), VII(h), VIII(i), IX(e), X(e), XI(d), XII(f), XIII(l), XIV(m), XV(f), XVI(e), XVII(a), XVIII(l), XX(d), XXI(b).

4See 22 C.F.R. § 121.10(a).

5Id.
Printed board designs reveal information about the design of printed boards, by definition. However, as shown by the examples below, these designs also normally reveal technical data regarding the defense articles for which the printed boards are designed, and thereby constitute technical data directly related to those USML items. Thus, printed board designs, including the digital data required for their production, generally are controlled on the USML because they reveal technical data regarding both the printed boards and the ultimate defense articles into which printed boards are installed.

The ITAR provides that “[i]f an article or service is covered by the U.S. Munitions List, its export is regulated by the Department of State.” The definition of “export” includes “[d]isclosing (including oral or visual disclosure) or transferring technical data to a foreign person, whether in the United States or abroad.” Therefore, prior to transmitting any printed board design or digital data package to a non-U.S. party (or to a U.S. person located abroad) a defense company should establish whether or not the printed board design directly relates to an USML item. Similar to the discussion above with respect to printed boards, it is possible that the State Department’s DDTC could determine that the design of a printed board relating to an USML item is not technical data directly relating to an USML item, and therefore is not controlled on the USML. If company personnel believe that a particular printed board design for an USML item may not warrant control on the USML, they should consult their internal export control function, export control staff at their prime contractor, or an external legal advisor.

### III. Examples of the Defense-Related Data in Printed Boards

The following are examples of how printed boards and their designs reveal technical information related to defense articles.

- **Electronic Warfare Systems:** Design instructions necessary for manufacturing the printed boards incorporated into phased-array systems and tactical radar and jamming systems outline the dimensions and placement of conductive and insulating patterns. Data of this type reveal specific frequency information about the systems themselves. Further, access to the printed board design imparts knowledge about the general system design, such as which components must be separately packaged and how the system may be countered or disrupted by external means.

- **Flight Communications:** The UHF/VHF radios designed for military aircraft incorporate printed boards for receiver and transmitter components. Both of these board designs reveal the general frequency range in which the radio operates. Additionally, the transmitter printed board designs reveal the power level of the transmission, which equates to the range of operation for the device. Knowledge of these parameters could facilitate attempts to jam or intercept in-flight communications.

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1. 22 C.F.R. § 120.5.
2. 22 C.F.R. § 120.17(a)(4).
• **Integrated Avionics:** One of the key elements that gives fighter jets a tactical advantage against various threats is the integration of avionics. These systems require integration at many levels, including sensor control, sensor data fusion and the architectural components that support these functions. Displays within the aircraft are the primary means of communicating all of this information to the pilot. These functions are driven through complex electronic systems that are based on backplanes, which is a printed board, that has additional modules of printed boards connected to it for increased functionality, such as accurate situational assessment and weapons fire control. This high speed computing system allows the pilot to focus on mission success rather than managing manual sensors. Design features of these printed boards could lead to reverse engineering of the key elements related to electronics involved in the avionics system.

• **Small Caliber Smart Munitions Fuze:** The smart munitions fuze has been used extensively by U.S. forces in both Iraq and Afghanistan. A flexible printed board is the heart of this fuze, supporting and interconnecting all of the electronics. The design of the fuze, while not necessarily exposing the frequencies at which the antenna operates, exposes the operation of the fuze which then could be replicated and/or neutralized.

• **IED Jammers and Detectors:** Improvised explosive devices, also known as IEDs, roadside bombs, or suicide car bombs, have caused over 65% of all American combat casualties in Iraq and over 60% of casualties in Afghanistan, both killed and wounded. Prevention of the remote detonation of these devices has been accomplished through jammer systems called Joint Counter Radio-Controlled Improvised Explosive Device (“RCIED”) Electronic Warfare (“JCREW”). These systems are high-power, modular, programmable, multiband radio frequency jammers that deny enemy use of selected portions of the radio frequency spectrum. Printed boards help determine the frequency and range capability of JCREW systems. Access to the design of these printed boards could lead to an understanding of the system architecture and how to circumvent the jammers, thus allowing for increased remote detonation of IEDs in the field of combat.

**Conclusion**

In sum, to avoid inadvertent legal violations, it is important that defense company personnel involved with procurement from non-U.S. persons of printed boards for defense products fully understand the potential application of the ITAR/USML to these procurements. In case further clarification is desired in a particular procurement context, company personnel should consult their internal export control function, export control staff at their prime contractor, or an external legal advisor.

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