

## RFID: Growth of a Trade-Enhancing Technology

[Nathan Lotze](#), Office of Industry and Competitiveness Analysis

*Despite being based on a mature technology, the RFID industry has seen recent growth due to its increasing commercial applications, particularly in supply chain management. Exports of “smart cards,” which include RFID tags, have grown 26 percent during 2017-2023. China is the leading global exporter (\$1.9 billion). However, Mexico has a growing RFID industry and recently overtook China as the largest source of U.S. imports. This EBOT explains what RFID tags are, what their applications are in and outside of goods trade, and examines trends in both industry and trade.*

### What are RFID tags?

Radio frequency identification (RFID) tags are microelectronic wireless communication devices. These tags are composed of an integrated circuit, an antenna, and a substrate (often one that is both flexible and adhesive). RFID tags are either active, meaning they are powered by an attached battery, or passive, meaning they are powered by the electromagnetic wave of a reading antenna. RFID tags are often used as smart labels, storing information like serial numbers or item descriptions. Information on RFID tags are read by RFID readers, which are devices typically composed of a scanning antenna and a transceiver.

### What are RFID tags used for?

When it comes to goods trade, RFID tags enable exporters, importers, and logistics firms to identify, track, and communicate with items in real-time. RFID tags are often described by the frequency in which they transmit information. The highest of these, ultra-high frequency (UHF) can allow information to be read from over twenty-five feet away. Near field communication (NFC) is a similar form of technology that can transmit information over shorter ranges, and is commonly found in smart phones and credit cards for uses such as contact-less payment. To track shipments, RFID tags are often affixed to cargo or containers and RFID readers are installed at supply chain nodes, such as ports, warehouses, or distribution centers. This allows supply chain managers and customers greater visibility into the status of their shipments, allowing for quicker response times to delays or other logistical issues.

In addition to tracking shipments and executing contact-less payment, RFID tracking has a number of other use cases. One of these is managing returnable transport items (RTI) such as pallets, roll cages, dollies, and kegs, which carry goods during transport. RFID tracking can help organizations track and manage their inventory of RTIs, preventing waste and shipping delays. Another use is in various entertainment venues; Top Golf, a high-tech golf game, uses RFID-embedded golf balls as part of its tracking and scoring system. Chipotle began testing the use of RFID case labels in 2022 to track the movement of ingredients from suppliers to restaurants as part of an effort to act more quickly and precisely on food safety and quality concerns. Other notable RFID uses include inventory management and livestock tracking.

### RFID Industry Overview

The market for RFID as a supply chain management tool continues to grow as companies seek to optimize their supply chains and reduce the impact of future disruptions. According to a 2021 report by Allied Market Research, the RFID global market size is projected to rise from \$10.4 billion in 2020 to \$25.4 billion by 2030. Like many integrated circuit producers, some RFID producers manufacture their products themselves, while others rely on third parties—a large number of which are located in Asia—for manufacturing, assembly, and testing activities. Impinj, a major U.S.-based RFID producer, for example, relies on third parties like TSMC (headquartered in Taiwan) and Stars Microelectronics (headquartered in Thailand) for manufacturing and packaging of its integrated circuits.

*The views expressed solely represent the opinions and professional research of the author. The content of the EBOT is not meant to represent the views of the U.S. International Trade Commission, any of its individual Commissioners, or the United States government.*

### RFID Trade Statistics and Trends

RFID tags are classified as “smart cards” under HS subheading 8523.52, which includes other RFID-embedded products such as fobs or wristbands. Trade data supports evidence of the industry’s growth. After declining between 2017 and 2020, global exports of smart cards rose sharply, totaling \$6.2 billion in 2023, a 26 percent increase from 2017 (figure 1). The top exporters in 2023 were China (\$1.9 billion), France (\$370 million), Hong Kong (\$357 million), the United States, (\$343 million), and Germany (\$307 million).

Similarly, U.S. imports of smart cards fluctuated mildly between 2017 and 2020, but increased sharply afterwards to \$845 million in 2023, a 45 percent increase since 2017. The composition of U.S. imports also changed during this time; in 2017 the top sources of U.S. smart card imports were China at \$281 million (48 percent of U.S. imports) and Mexico at \$85 million (15 percent of U.S. imports). However, by 2023, the import totals nearly flipped (figure 2) with the U.S. importing \$247 million from Mexico (29 percent of imports) and \$105 million from China (13 percent of U.S. imports). Since 2018, U.S. imports of smart cards from China have been subject to an additional 25 percent Section 301 tariff under HTS 9903.88.03. From 2018 to 2023 Mexico’s imports of smart cards from China rose by over \$20 million (71 percent) and Mexico’s world exports grew by \$70 million (34 percent). Mexico is increasingly becoming a significant RFID producer and was the sixth largest exporter globally in 2023 (\$278 million). Avery Dennison, the world’s largest RFID producer, recently announced a \$100 million expansion of its facility in Queretaro, Mexico, which will become its largest RFID plant in the world.

Figure 1. Global Exports of Smart Cards

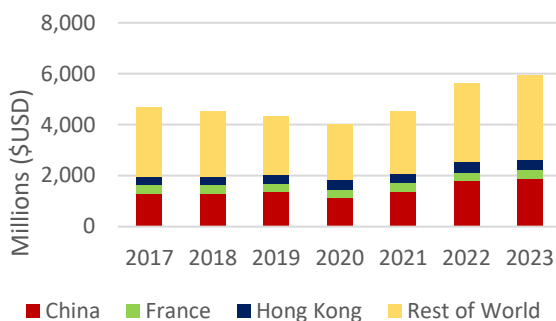


Figure 2. U.S. Imports of Smart Cards from China and Mexico



Note: While HS heading 8523.52 is not exclusive to RFID tags, it excludes “smart cards” containing circuit elements other than embedded integrated circuits in the form of chips, contacts, a magnetic stripe, or an embedded antenna. Source: S&P Global, Global Trade Atlas, accessed March, 2024. HS heading 8523.52. USITC, HTS (2024) *Revision1*, section xvi, [chapter 85](#), note 6(b), January 2024.

Sources: Amsler and Shea, “[RFID \(Radio Frequency Identification\)](#),” accessed March 18, 2024; Identiv, “[What Are RFID Tags and How Are They Used?](#)” February 12, 2021; STMicroelectronics, “[What Is an NFC Chip?](#),” accessed December 8, 2022; Sharma, “[How to Track Supply Chain Shipping Containers with RFID Technology?](#),” accessed March 18, 2024; HID Global, “[Container Tracking Solutions](#),” accessed March 18, 2024; Impinj, “[TopGolf Transforms Golf Driving Ranges with RAIN RFID](#),” accessed September 5, 2023; Avery Dennison, “[Chipotle Deploys RFID for Traceability and Food Safety](#),” August 2022; Rosencrance, “[RFID in Supply Chain: 6 Examples in Use Today](#),” November 17, 2022; Impinj, Inc., [Form 10-K 2023](#), February 12, 2024, 9; S&P Global, Global Trade Atlas, accessed March 19, 2024. HS heading 852352; CBP, “[NY Ruling Letter N308424: The country of origin of RFID icons and badges](#),” December 19, 2019; USITC, HTSUS (2024) *Revision 1*, section xxii, [chapter 99](#), 27, 28, 49, January 2024; Printed Electronics Now, “[Avery Dennison To Invest \\$100 Million In Querétaro, Mexico RFID Plant](#),” January 19, 2023.

*The views expressed solely represent the opinions and professional research of the author. The content of the EBOT is not meant to represent the views of the U.S. International Trade Commission, any of its individual Commissioners, or the United States government.*