Radio Frequency Identification for Evidence Management

Market Survey Report

August 2023

Science and Technology

NUSTL®
NATIONAL URBAN SECURITY
TECHNOLOGY LABORATORY

SAVER-T-MSR-41

FOREWORD

The National Urban Security Technology Laboratory (NUSTL) is a federal laboratory within the U.S. Department of Homeland Security (DHS) Science and Technology Directorate (S&T). Located in New York City, NUSTL is the only national laboratory focused exclusively on supporting the capabilities of federal, state, local, tribal, and territorial responders to address the homeland security mission. The laboratory assists responders with the use of technology to prevent, protect against, mitigate, respond to, and recover from homeland security threats and incidents. NUSTL provides expertise on a wide range of subject areas, including chemical, biological, radiological, nuclear, and explosive detection, personal protective equipment, and tools for emergency response and recovery.

NUSTL manages the System Assessment and Validation for Emergency Responders (SAVER) program, which provides information on commercially available equipment to assist response organizations in equipment selection and procurement. SAVER knowledge products provide information on equipment that falls under the categories listed in the DHS Authorized Equipment List (AEL), focusing primarily on two main questions for the responder community: "What equipment is available?" and "How does it perform?" The SAVER program works with responders to conduct objective, practitioner-relevant, operationally-oriented assessments and validations of commercially available emergency response equipment. Having the right tools provides a safer work environment for responders and a safer community for those they serve.

NUSTL is responsible for all SAVER activities, including selecting and prioritizing program topics, developing SAVER knowledge products, and coordinating with other organizations to leverage appropriate subject matter expertise. In conjunction with DAGER Technology, LLC, NUSTL conducted a market survey of commercially available evidence management systems featuring RFID technology. This equipment falls under the AEL reference numbers, 04HW-02-RFID titled *Devices, Radio Frequency Identification* and 04AP-07-INVN, titled *Software, Equipment Tracking and Inventory*.

SAVER reports are available at www.dhs.gov/science-and-technology/saver-documents-library.

Visit the NUSTL website at www.dhs.gov/science-and-technology/national-urban-security-technology-laboratory or contact the lab at NUSTL@hq.dhs.gov.

POINT OF CONTACT

TECHNICAL SUPPORT

Authors:

Tyler Mackanin, Engineer, NUSTL
Steve Miller, Senior Operations Associate, DAGER
Eric Morefield, Principal, DAGER

EXECUTIVE SUMMARY

Law enforcement agencies maintain extensive inventories of crime scene evidence, such as firearms, fingerprints, fibers, documents, and biological evidence including blood swabs/samples, hairs, and specimens from sexual assault kits. The proper collection, labeling, and tracking of evidence gives credence that the evidence presented in court is the same evidence that was collected at the crime scene. Radio frequency identification (RFID) technology can help facilitate, standardize, and automate inventory and asset tracking tasks for law enforcement's management of evidence.

Between February and October 2022, the System Assessment and Validation for Emergency Responders (SAVER) program conducted a market survey of commercially available RFID systems for evidence management. This market survey report is based on information gathered from manufacturer and vendor websites, internet research, industry publications, and a government-issued request for information that was posted on the System of Award Management website. Commercially available RFID products span a range from simple, commercially available integrated systems using passive RFID tags and handheld readers to complex, purpose-built systems with active tracking, portal RFID readers, and even global positioning system-based geolocation abilities.

The market survey identified nine products that offer complete, integrated RFID evidence management systems for law enforcement. All nine vendors – all of whom have experience in providing RFID systems to law enforcement agencies – offer handheld and portal readers. All of the companies offer passive tags, and seven offer active tags. Six products are "considered crime scene portable," as elements can be brought and used on site to collect and record evidence. The cost of an RFID evidence management product varies based on system size, customization, features, types of integration with record management systems and other third-party databases, system support, and other aspects of the installation.

RFID systems are not a panacea for poor evidence management practices and have performance limitations that must be fully considered prior to implementation. However, the latest RFID-based evidence management systems may be highly beneficial in reducing the time spent on routine tasks like full evidence and equipment inventories and locating evidence that has been misplaced or misfiled. Some vendors market crime scene software that allows an RFID tag-based chain of custody to start at the point of collection. More advanced systems offer the promise of real-time evidence tracking to allow agencies to monitor evidence in transport between facilities for laboratory testing or courtroom presentation.

The purpose of this market survey report is to provide emergency response agencies with information that will guide them in making operational and procurement decisions. Agencies should consider overall capabilities, technical specifications, and limitations of RFID systems for evidence management in relation to their agency's operational needs when making equipment selections. Performance of these products and information included in this report has not been independently verified by the SAVER program.

Agencies should also consider impacts associated with integrating equipment into their power and information technology infrastructure, data management, concept of operations, and required maintenance. If RFID evidence management systems connect with existing agency databases containing law enforcement information, consideration must be given to ensure all systems comply with the Federal Bureau of Investigation's Criminal Justice Information Services Security Policy [1].

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Law enforcement agencies maintain extensive inventories of crime scene evidence, such as firearms, fingerprints, fibers, documents, and biological evidence including blood swabs/samples, hairs, and specimens from sexual assault kits. The proper collection, labeling, and tracking of evidence gives credence that the evidence presented in court is the same evidence that was collected at the crime scene. These agencies also maintain non-evidentiary items including recovered personal property, vehicles, uniforms, agency weapons, body-worn cameras, ammunition, and other equipment and supplies. Radio Frequency Identification (RFID) technology can help facilitate, standardize, and automate inventory and asset tracking tasks for law enforcement's management of evidence and non-evidence property. While the implementation of RFID evidence management systems may have significant start-up costs, the addition of an RFID evidence management system may improve the overall management of evidence and reduce the costs of maintaining evidence in the long term [2].

Between February and October 2022, the System Assessment and Validation for Emergency Responders (SAVER) program conducted a market survey of commercially available RFID Systems for Evidence Management. This market survey report is based on information gathered from manufacturer and vendor websites, Internet research, industry publications, and a government-issued request for information (RFI) that was posted on the System of Award Management website. The U.S. Department of Homeland Security (DHS) Science and Technology Directorate's (S&T's) Technology Scouting Group also contributed to the market research in this report.

Numerous RFID asset management and tracking products are on the market that have many of the same features as RFID evidence management products. Products included in this report, however, meet the following criteria:

- Are integrated custom solutions
- Are provided by companies with documented experience in implementing evidence tracking systems for law enforcement that produce comprehensive records of intake, chain of custody, inventory, and disposition
- Offer a large variety of passive RFID tags of multiple sizes and form factors to enable the tags to attach to any evidence container
- Use passive RFID tags that are low-cost, durable, water-resistant, affixable to the evidence, and have dual-use markings for existing barcode evidence systems

Some systems offer components such as evidence containers featuring a global positioning system (GPS) with active cellular tracking for evidence transportation and active and semi-active tags for special-use cases such as valuable evidence, drug evidence, and sexual assault kit tracking. These features were not required for a system to be considered but are noted, if available, in the individual product sections of this report.

All companies represented by products in this market survey report rely on third-party RFID hardware, including RFID tags, handheld readers, portal monitors, and printers. The companies have experience with RFID systems for evidence management of law enforcement organizations and integrate their software and middleware systems with third-party hardware to create integrated RFID evidence management solutions. The integrated solutions still require customization and design services by the vendor for specific applications and environments.

NUSTL performed due diligence to develop a report that is representative of products in the marketplace; however, there are many more products on the market providing a complete RFID asset management solution that could be repurposed as an evidence management system.

2.0   RFID EVIDENCE MANAGEMENT SYSTEMS OVERVIEW

Complete RFID evidence management systems have four primary integrated components: tags, readers, middleware, and an evidence management database to store and manage information obtained from the tags and readers. Figure 2-1 illustrates the array of hardware and software components involved in such a system. An RFID tag contains a microchip encoded with a unique identifier that can be associated with an individual evidence item. An antenna on the tag enables it to be wirelessly powered and scanned by a radio-frequency (RF) transceiver (or, commonly, a "reader"), which forwards the embedded data to the system's middleware software. The middleware translates and formats the raw tag data into logical database fields that it exports to an evidence management software application. Evidence management software allows personnel to check-in evidence, conduct inventory, document evidence transfers, generate evidentiary chain of custody records, and manage the disposition of evidence.
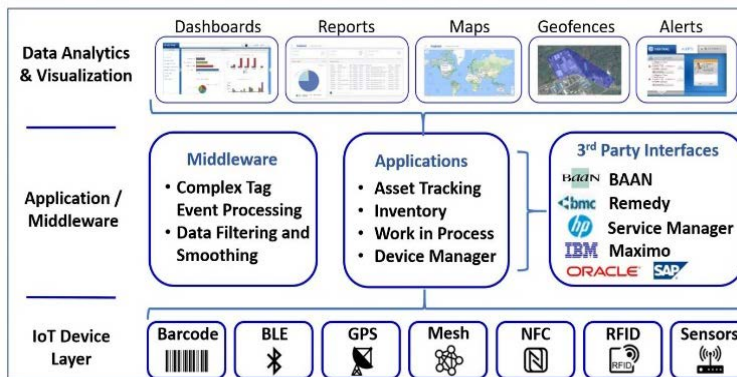
Figure 2-1 Visi-Trac Evidence Management System Architecture

Image Credit: RFID Global Solution

Because of the underlying RF technology, RFID evidence management enables users to scan and receive data from multiple tags simultaneously, an operation that can be performed without physically locating and handling each piece of evidence. This yields advantages over barcode-based evidence management systems such as near-instant inventory of large areas. Furthermore, evidence can be located by sweeping rooms with handheld readers as opposed to scanning individual items.

2.1 Current Technologies

Law enforcement faces challenges in establishing and maintaining the chain of custody for an item of evidence throughout the criminal justice process. Obstacles managing evidence include the loss of evidence due to improper processing, barcodes falling off evidence, ink from handwritten information rubbing off, evidence being placed in the wrong location, and not accounting for evidence transferred to the laboratory or courthouse. Evidence management systems often use barcodes to identify and track evidence, but increasingly, police departments and law enforcement agencies have turned to RFID-based evidence management systems as a supplemental or primary solution to track and maintain the evidentiary chain of custody.

RFID evidence management systems can be as minimal as passive tags with handheld RFID readers or expanded to include features like portal RFID readers and active RFID tags for the continuous tracking of sensitive or high-value items of evidence. Compared to more elaborate systems, passive RFID tags offer greater durability at a lower cost so most law enforcement agencies focus on using passive RFID tags and handheld RFID readers to implement an RFID evidence management solution. Some law enforcement agencies employ more robust tracking solutions that use a combination of passive, active, and semi-active tags as well as alternative RFID readers (e.g., doorway RFID portals) to create zones for the automatic checking-in and -out of evidence. Some agencies use GPS capabilities of RFID tags to track sensitive and/or valuable evidence as it is transported between locations (e.g., from evidence storage to court).

2.2 Considerations and Limitations

RFID tags and readers, like any radio-based system, have varying levels of performance, which depends upon multiple factors. Some variances in RF reception performance can be attributed to:

- the power level of the readers' transmissions and subsequent response transmissions
- the efficiency of the tags' and readers' antennas
- the orientation of a reader to the tag
- the range of a reader to the tag
- electromagnetic interference
- intervening materials
- the number of tags being read simultaneously

For example, metal shelving in evidence rooms or large metal cabinets tends to block or redirect radio waves. While this may not preclude using RFID in an existing evidence room with metal storage features, doing so would require extensive testing to ensure that the proper equipment, tag selection, and storage procedures are used to maximize the potential for accurate and thorough RFID performance.

From an evidence accountability perspective, it is important to note the difference between barcode and RFID accountability. To scan a barcode, an evidence custodian must physically locate and scan each item, implicitly verifying that the label is attached to an evidence item. Because RFID systems can scan multiple items simultaneously, without each item being in sight, it is possible to record the presence of an RFID tag without verifying the presence of the associated item of evidence. For example, if a tag became detached from an item of evidence, an RFID scan would still show that the tag is present, even if the item has been removed from the location. Policies and procedures should be implemented to ensure that periodic physical verification of evidence items is conducted when RFID systems are used as the primary evidence accountability system.

2.3 RFID System Key Components

RFID-capable evidence management systems consist of four basic components: tags, readers, middleware, and an evidence management database to store and manage information obtained from the tags and readers.

2.3.1 RFID Tags

RFID tags are classified as passive, active, or semi-active, and are available in a multitude of sizes, materials, and form factors suitable to most types of evidence packaging. Tags typically incorporate printed information on their label, including case-identification numbers and barcodes. The digital information associated with each RFID-tagged item can be expanded to also include custom data fields such as acquisition date, evidence number, movement time stamps, description, and officer notes. Passive, semi-active, and active RFID systems can support notifications and alarms for exceptions to rules for the entry, movement, and checking out of evidence.

Sensor-based evidence management system features, such as temperature and humidity monitoring, are available on active and semi-active RFID tags; however, higher tag cost and battery life considerations must be weighed before incorporating these tags into an RFID system. Active and semi-active tags may be appropriate for evidence that is deemed as having high value, high theft potential, or requires special storage and monitoring conditions.

2.3.1.1 Passive RFID Tags

Passive RFID is used in everyday items like credit cards and freeway toll passes for payment and accountability, and in pet identification chips for tracking. Passive RFID tags are applicable for evidence management and often used due to their long shelf life and low cost. They have no battery, can be very small, and have no moving parts. Because passive RFID tags have no internal power sources their lifespan can be indefinite in a controlled environment. Passive tags consist of a printed antenna and an integrated circuit, or chip, that has a unique digital identifier. Some are also capable of storing user-defined data directly on the tag.

Figure 2-2 Passive RFID Tags

Image Credit: Identiv

Passive RFID tags (Figure 2-2) transmit information only if queried by a reader and have a limited read range (typically less than 25 feet), depending upon the tag's technology and placement, and the RFID reader's power. Some low-frequency RFID passive tags have limited read ranges of several inches. However, these tags have largely been replaced in RFID-based evidence management systems by ultra-high-frequency (UHF) tags, which operate in the 860–930 MHz range and may have read ranges from several inches up to 50 feet. Numerous factors influence the read range of RFID tags, including the size of the tag (i.e., the smaller the RFID tag, the lower the read range), the orientation of the tag to the reader, the type of container on which the tag is located, the power of the reader, the shelving type, and the storage environment.

Figure 2-3 Passive RFID Labels

Image Credit: Office Interiors of Virginia

Evidence management system vendors typically use third party commercially available passive RFID tags, which come in various sizes, shapes, and applications for use in varying conditions. Passive tags can be used on paper and vinyl labels (Figure 2-3) or in the form of plastic tags, hang tags, hard tags, zip ties, locking tags, metal-container tags, and many more options. Passive tags are available with pre-printed labels, blank labels for adding handwritten information, or can be printed and encoded on site with barcodes and/or asset-related information using RFID printers (Figure 2-4).

The cost of passive RFID tags varies based on features and quantity purchased. Basic passive RFID tags for non-metal surfaces can be priced as low as $0.05 per tag. Specialty passive RFID tags can be used to avoid interference with metal surfaces or liquid containers and cost several dollars each [2]. Passive

Figure 2-4 Zebra ZT430 RFID Printer

Image Credit: Zebra

tags are also available in tamper-evident, tamper-resistant, and tamper proof styles. Most RFID evidence management system companies require a site visit and system customization plan to overcome environmental and operational challenges.

Passive RFID tags can be obtained to suit many environments; some offer ingress protection (IP) ratings of up to IP68[1][3]. Typical passive tags have an operating temperature range of -40°F to +165°F, with higher temperature tags available. In addition to the environment, the placement of passive RFID tags while in storage should be taken into consideration to ensure they are not bent or damaged, which would impact their usability.

2.3.1.2 Active RFID Tags

Active tags transmit data at predefined intervals without waiting for an RFID reader's signal. Active tags have an onboard battery used to increase read range and power any embedded sensors. Battery life of these active tags is dictated by how often they transmit their location. Some active tags have adjustable read ranges from 1 foot up to 10 miles.

Some active tags support a real-time location system (RTLS), which allows users to track the movement of evidence or assets. An RTLS typically uses active RFID, Wi-Fi, Bluetooth Low Energy (BLE), Long-range (LoRa) or Ultra-Wideband (UWB), which is like BLE but more precise. LoRa tracking technologies can locate items within approximately 5–10 feet of their actual location. UWB RFID can locate items within inches of its actual location. Active RFID tags with embedded GPS receivers can provide GPS locations as part of their normal beacon transmission and can be read through an active RFID reader or through a satellite-connected beacon. These RTLS tags transmit a signal every few seconds at an interval set by the user, and the system uses signal triangulation from tags or beacons to precisely locate an item of evidence within a facility. Continuous monitoring systems for active RFID tags often require the installation of dedicated infrastructure, including wireless networks, beacons, and multiple antennas in a facility.

Active RFID tags have a limited lifespan, approximately one to seven years, and increased costs compared to passive RFID tags. LoRa tags range in price from $25 to $80 each. UWB tags cost between $5 and $15 per tag. Pricing of GPS tags start around $70 per tag with a battery life of up to seven years.

2.3.1.3 Semi-Active Tags

Semi-active tags use a battery to power sensors or increase read range but, like passive tags, only transmit when queried by an RFID reader. Semi-active tags may be used to supplement a system that primarily uses passive tags as they offer other features and sensors, such as temperature logging, motion alerts, and tag memory. In addition, some semi-active tags have security measures to detect attempts to remove or tamper with the tags. One example is a security strap, an RFID tag in the style of a zip-tie, that once tightened will emit a signal if cut or stretched.

The batteries of semi-active tags limit their lifespan; still, the tags can last from 2 to 10 years, depending upon how often they are read and the sensors that the batteries are powering. The cost of semi-active RFID tags can vary greatly from $2 to more than $20 each depending on the capabilities of the tag.

---

[1] RFID tags with an IP rating of 68 are dust-tight and are protected against the effects of continuous immersion in water.

2.3.2 RFID Tag Readers

An RFID tag reader contains a radio transmitter-receiver (also known as a "transceiver"), antenna and electronics to manage the collection of data. Tag readers are available in various form factors, including handheld portable scanners, portal (doorway or window) RFID readers, USB RFID block readers and wireless RTLS nodes and antennas. An agency's selection of a specific reader type(s) will be based on the intended use for the system, cost, infrastructure limitations, and agency policy.

RFID readers have four basic functions:

- using RF transmissions to power the circuitry in passive RFID tags
- triggering an RFID tag to transmit a response to the reader
- collecting, appending, and storing RFID tag responses
- transmitting the collected data to an RFID middleware software application

The data received from an RFID tag by a reader typically contains, at a minimum, the unique digital identification number assigned by the tag manufacturer or RFID printer. Some tags can also transmit additional information programmed by the end-user, such as case numbers or other unique identifiers. Active and semi-active tags may also transmit data from onboard sensors. The RFID reader may also append additional data to the identification number that is not stored on the tag (such as the time that the tag was read) for later transmission to the middleware.

Because passive RFID tags do not communicate with one another, they cannot "take turns" communicating with a reader when they are scanned or "interrogated." As such, RFID tag readers often incorporate complex anti-collision algorithms to assist them in discerning one RFID tag's response from another tag's response. These algorithms typically add millisecond-level delays in read times to allow each tag to be read in-turn. Nonetheless, in a typical evidence room setting, the read times will appear instantaneous to the user.

2.3.2.1 Handheld RFID Readers

Most RFID evidence management systems use third-party handheld RFID readers (Figure 2-5). A typical RFID handheld reader resembles the wireless barcode scanners often seen at retail store checkouts but include an antenna module. They feature a touchscreen, rechargeable lithium-ion batteries, and linearly polarized or circularly polarized antennas. Handheld readers typically allow the user to manage some reader functions and control some database input parameters. Some readers achieve a similar functionality via a smartphone holder and RFID application (or "app") that link to the reader's power and antenna module via Bluetooth. Some handheld readers have the capability to scan both RFID tags and traditional optical barcodes, useful to agencies new to RFID technology and wishing to maintain operational redundancy with existing barcode inventory or evidence management systems.

Figure 2-5 MC3300 RFID Handheld Reader

Image Credit: Zebra Technologies

RFID readers with linearly polarized antennas are optimized to emit and receive radio waves in a single plane. This has an advantage of concentrating RF power in that single plane, enabling tags to be read at greater distances than readers with circularly polarized antennas. The disadvantage to a linearly polarized antenna is that for optimal performance, tags being read must be in the same plane as the reader's antenna.

Handheld readers with circularly polarized antennas allow radio waves to transmit in two planes simultaneously, effectively transmitting and receiving signals in a corkscrew-like pattern. This yields the advantages of being able to read tags that are not in the same plane as the antenna and covering a greater area in a single pass than readers with linearly polarized antennas. The disadvantage of a circularly polarized antenna is that the reader splits the RF output power between the two planes, reducing its effective read distance over readers of similar power using a linearly polarized antenna.

A typical handheld RFID reader has an operational battery life of 8–12 hours and can be left in standby mode for several days. Handheld RFID readers operate in the 902–928 MHz frequency for passive tags, and may have additional features like Bluetooth, Wi-Fi, cellular, land mobile radio, or near-field communication (NFC) capabilities. Handheld RFID readers range in price from $1,500 to $4,500 depending upon features and quantities purchased.

2.3.2.2 Portal RFID Readers

Portal RFID readers work on the same principles as handheld RFID readers but are installed in a fixed location, such as police station evidence rooms, courtroom evidence lockers, or between storage and examination areas in forensic laboratories. Portal RFID readers can be deployed at "choke points" (e.g., doorways, windows, or other access points) that evidence must pass through when being checked-in, checked-out, or

Figure 2-6 Fixed doorway RFID reader

Image Credit: Zebra Technologies

moved between functional areas of a facility (Figure 2-6). A portal reader typically looks like the anti-theft security tag reader stanchions often seen at the exits of retail stores; however, numerous styles are available to integrate into an agency's evidence system. Portal RFID readers may have lower power outputs than handheld readers to limit their read range to just a few feet. This helps ensure that only those RFID-tagged items passing through the portal are read, and that objects being stored in nearby areas are not being scanned.

Portal RFID tag readers range in price from $3,500 to $9,000 depending upon size and features.

2.3.2.3 Other RFID Readers and Antennas

USB RFID readers, also known as USB block RFID readers, connect to portable or desktop computers with the appropriate software installed to read RFID tags. Some USB RFID readers can read and write RFID tags. USB RFID readers can be positioned on desks or mounted like portal RFID readers. USB RFID readers range in price from $200 to $1,500 depending upon size and features.

Wireless real-time location system (RTLS) nodes help RFID systems to accurately locate and track items. An RTLS node is equipped with an RFID reader to communicate with RFID tags that are within range of the node. The placement of several RTLS nodes allows the RFID system to estimate the location of all items within a tracking area. RTLS nodes communicate wirelessly with the asset tracking system. Wireless RTLS nodes range in price from less than $100 to several thousand dollars depending on the type of system.

RFID antennas attach to RFID readers to improve the communication with RFID tags. RFID antennas vary in cost from $20 to more than $500.

2.3.3 RFID Middleware

Critical to the implementation of an RFID evidence management solution is a software application referred to as middleware. Middleware is typically a software program that includes a database that collects tag identification data from RFID readers, appends it with information (e.g., date, time, and reader location), and formats that data for export into an evidence management database. Alternately, if the RFID hardware is connected to the middleware in real-time, the RFID system middleware may append the time of the scan. Middleware enables RFID hardware, which simply generates scan data, to interface in a logical manner with external software applications like evidence management databases.

Depending upon the type of readers employed by an agency, middleware may reside on handheld scanners, on dedicated computer hardware, on agency servers, in cloud-based infrastructure, or in a combination of any or all of these components. Handheld readers often have touchscreen interfaces to control basic functions like checking-in evidence or conducting inventory. Fixed portal readers, however, typically lack on-device interfaces; these functions are controlled through external computer hardware.

For companies that provide RFID-based evidence management systems, typically the uniqueness of their product is based on the implementation of their middleware solution, while they source readers and tags from third-party suppliers. Because new RFID-evidence management systems may need to implement existing agency hardware solutions like barcode readers, or integrate with existing evidence management databases, middleware applications are also designed to be tailorable. Vendors typically employ a flexible structured query language (SQL) database and survey existing agency record systems to ensure export/import compatibility between existing records and the new RFID-based information system. RFID system vendors can then map RFID reader output fields to any database input fields as part of a new system integration.

2.3.4 RFID Evidence Management Software

Agency personnel's daily interactions with RFID technology will typically take place through evidence management software. Evidence management software is designed to track the intake, case association, storage, transfer, and disposition of evidence, providing a verifiable chain of custody that will stand up in court. Evidence management software may or may not be supplied by an RFID evidence management system vendor. Agencies may have preexisting evidence management software they choose to retain or have software designed as part of their overall records management systems. Depending upon the requirements of the law enforcement agency, consideration must be given to an RFID vendor's demonstrated ability to support the agency's existing and future evidence management requirements and constraints.

Given today's ubiquitous Internet access and cloud-based applications and storage, many evidence management systems are introducing crime-scene collection software applications that enable evidence to be collected, RFID-tagged, and logged in the field. Agencies may want to consider whether an RFID vendor's system can support this type of integration if that is a desired feature. RFID evidence management systems can vary in complexity depending upon the needs of an organization, and many vendors allow organizations to customize systems to meet the agency's needs.

2.4 Additional Considerations

Agencies considering implementing an RFID-based evidence management solution should require the provider to undertake rigorous testing, performance benchmarking, and proof-of-concept deployments to demonstrate exactly what performance can be expected from the system. How objects are stored – on plastic, wood, or metal shelves – impacts system performance. Multiple evidentiary items stored inside a container of any kind can be problematic. Agency evidentiary policies and requirements are crucial, thus on-site surveys and testing are paramount to installing and setting up a functional and robust RFID evidence management solution.

The system's scalability, adaptability, customizability, and training requirements are important considerations in selecting an RFID evidence management system. An agency may wish to use the RFID system to track assets like weapons, information technology equipment, or other critical resources. The success of the RFID evidence management system will ultimately depend upon the employees of the agency. Training on tagging items based upon how, where, and what they are being stored in and on as well as properly storing items, scanning, and database management are all critical to the success of the RFID system.

2.5 Compliance/Regulations

Evidence management software that is networked to departmental systems may need to meet compliance standards established by the Federal Bureau of Investigation (FBI) Criminal Justice Information Services (CJIS) division. CJIS compliance ensures information storage and transmission methods meet federal security standards for sensitive data [1].

RFID readers are also subject to regulation the Federal Acquisition Regulation: Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment under Federal Communications Commission rules in the Code of Federal Regulations, Title 47, Part 15 [4] and expounded on in section 2.6 below.

2.6 Use of Grant Funds for Certain Telecommunications and Video Surveillance Equipment or Services

The John S. McCain National Defense Authorization Act for Fiscal Year 2019 (NDAA), Pub. L. 115-232, Section 889 (NDAA) prohibits the use of federal funds, including loan and grant[2] funds, to obtain or acquire certain telecommunications technologies manufactured by certain entities or to enter into contracts with entities that use those technologies. The Office of Management and Budget (OMB) published regulations at 2 C.F.R. § 200.216 to clarify the application of the NDAA to the use of federal grant funds to procure or obtain certain telecommunications equipment or services.

---

2 This also includes cooperative agreement funds.

Effective August 13, 2020, federal grant recipients and subrecipients (i.e., **non-federal entities**) are prohibited from obligating or expending loan or grant funds to procure or obtain[3] the following "covered telecommunications equipment or services":

- Telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities)

For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by:

- Hytera Communications Corporation
- Hangzhou Hikvision Digital Technology Company
- Dahua Technology Company
- or any subsidiary or affiliate of such entities
- Other entities identified by the Secretary of Defense

The restriction also applies to systems that use the covered equipment or services as a substantial or essential component, and to subsidiaries or affiliates of those listed above[4]. See www.federalregister.gov/d/2020-17468/p-877.

Costs associated with covered equipment and services are "unallowable" for grant funding. Grant recipients are responsible for ensuring funds are used only for allowable costs, and would be obligated to refund the government for unallowable costs. The Federal Emergency Management Agency (FEMA) issued FEMA Policy #405-143-1, Prohibitions on Expending FEMA Award Funds for Covered Telecommunications Equipment or Services (Interim) for further guidance on the Section 889 prohibitions. Additionally, OMB issued frequently asked questions (FAQs) on the topic.

For **federal** entities, FEMA published interim rules amending the Federal Acquisition Regulation[5].

---

3 Nor may they extend or renew a contract to procure or obtain, or enter into a contract to procure or obtain the covered equipment or services.
4 As well as telecommunications or video surveillance services provided by entities or using equipment described above.
5 www.federalregister.gov/documents/2019/12/13/2019-26579/federal-acquisition-regulation-prohibition-on-contracting-for-certain-telecommunications-and-video and www.federalregister.gov/documents/2019/08/13/2019-17201/federal-acquisition-regulation-prohibition-on-contracting-for-certain-telecommunications-and-video.

3.0 PRODUCT INFORMATION

This section provides information on the nine products that met the criteria for inclusion in the market survey. General characteristics and specifications are provided in Table 3-1. The products are listed alphabetically by manufacturer. The SAVER program obtained the product information presented in this report directly from manufacturers, vendors, and their websites, from February to October 2022. In some cases, manufacturers do not have or do not publish all available specifications. The information in Section 3.0 has not been independently verified by the SAVER program. It is highly recommended to request and obtain the most current specifications from the vendor or manufacturer when requesting a quote.

Below are definitions of the product information in Table 3-1, listed in column order.

Handheld Readers refers to whether the company offers handheld RFID readers as a component of the system.

Portal Readers refers to whether the company offers portal RFID readers as a component of the system.

Passive Tags refers to whether the company offers passive RFID tags as a component of the system.

Active Tags refers to whether the company offers active RFID tags as a component of the system.

Crime Scene Portability refers to whether the product can be used to collect and record evidence labeled with RFID tags at the crime scene.

GSA Pricing refers to whether the company offers GSA Pricing on their products.

Table 3-1 Product Comparison Matrix

Company and Product	RFID Tags & Readers				Crime Scene Portability	GSA Pricing
	Handheld Readers	Portal Readers	Passive Tags	Active Tags		
C&A Associates **PADtrax**	✓	✓	✓	✓		
FALKEN Secure Networks Inc. **AssetWorx**	✓	✓	✓	✓	✓	✓
Hardcat **Asset Management Software**	✓	✓	✓	✓	✓	
JPL Global Logistics Solutions **Containment RFID**	✓	✓	✓	✓	✓	
Knot Technology Solutions **Visi-Trac**	✓	✓	✓	✓	✓	✓
Office Interiors of Virginia **RFID Evidence Tracking**	✓	✓	✓	✓		
Patterson Pope **RFID Solutions**	✓	✓	✓			
Primary Marking Systems **eTWIST**	✓	✓	✓		✓	
Trackable IoT **Evidence Trackr**	✓	✓	✓	✓	✓	

3.1 C&A Associates, PADtrax RFID Evidence Management System

The PADtrax RFID Evidence Management System is a complete integrated RFID-centric evidence management system available from C&A Associates, Inc. PADtrax, which stands for "People, Asset, Document Tracking," is specifically designed to meet law enforcement evidence management needs. The PADtrax RFID Evidence Management System offers PADtrax software, handheld and portal RFID readers, and passive RFID tags. PADtrax software provides a complete chain of custody for evidence items from seizure through final disposition. The PADtrax RFID Evidence Management System can also manage agency assets.

Figure 3-1 PADtrax Evidence Management

Image Credit: C&A Associates

The PADtrax system uses a handheld reader with proprietary PADtrax applications that run on an Android operating system. The reader features a UHF RFID radio, 2D barcode reader, dual battery system, pistol grip, and touchscreen. Optional features for the handheld reader include a camera, GPS, and SIM card. A variety of fixed portal (e.g., a doorway) readers are also available.

The PADtrax Evidence Management System is a combination of hardware and software. The PADtrax system is housed on internal customer systems. The server software consists of a Microsoft SQL database and a series of application services that can be installed on the same server or across different servers. PADtrax systems are typically deployed on virtual machines hosted on a local storage area network. The application runs through a self-updating client-server architecture with a browser-based component available. The infrastructure of the system is designed to exist on premises but can be deployed in hybrid environments spread across local premises and cloud providers.

The PADtrax system is designed to be scalable, making it an option for both small and large agencies. The system can be tailored to workflows and policies for moving and handling evidence. It detects conflicts and issues with accounting for placing and moving evidence in real time. The PADtrax RFID Evidence Management System generates messages to avoid errors throughout the chain of custody process. The PADtrax RFID Evidence Management System is compliant with the FBI CJIS standards on data security for criminal justice information.

C&A Associates offers assistance with software and hardware installations, training, support, RFID selection, RFID placement, and integration of PADtrax into existing systems. Installation pricing for the PADtrax Evidence Management System varies by the location and size of the organization. Depending upon the quantity purchased, RFID portal readers range from $2,250 to $4,000; USB RFID block readers range from $550 to $700; RFID printers range from $2,300 to $10,000; and RFID handheld readers range from $2,750 to $4,500. Passive tags range from $0.27 to $0.39 per unit depending upon the quantity purchased. PADtrax is not on the GSA Schedule.

The PADtrax Evidence Management System comes with a 90-day warranty. Software and hardware support is available 24/7, 365 days per year via telephone and e-mail. New customers have 60 days of free customer support from the purchase date, after which further support is included in the cost of an annual maintenance agreement that varies based on the equipment purchased.

3.2 Falken Secure Networks, AssetWorx

AssetWorx, manufactured by InfinID and distributed by Falken Secure Networks, is a scalable evidence software solution with custom RFID integration. AssetWorx can manage RFID tag printing, evidence registration with customer-definable alerts, chain of custody, and location tracking. AssetWorx integrates with barcode, passive RFID, semi-active temperature logging RFID, active "V-Tag" RFID, beacon tags, portal RFID sensors, handheld RFID readers, and other sensors for asset tracking and location. The system is crime scene portable. AssetWorx is web-based and can be accessed in the field from mobile web browsers running on smartphones or tablets.

Figure 3-2 AssetWorx V-Tag

Image Credit: Falken Secure Networks

AssetWorx is compatible with most RFID handheld readers to conduct periodic inventories and to locate missing evidence. It also works with fixed RFID portal readers, which generate a record of each item's last known location. Used with portal readers, AssetWorx can create an association between the location of the tagged evidence and the location of a person in custody of the evidence if they have an RFID identification badge. The software can determine the direction of travel of an item through a fixed portal reader. This can assist with maintaining chain of custody records as well as creating alerts of unauthorized removal Automated inventory and chain of custody tracking can be implemented at any point of egress or control point with an RFID reader. AssetWorx has built-in middleware functionality. AssetWorx supports end-to-end encryption for all data transmissions, and critical data can be encrypted at the database level. The AssetWorx system is compliant with the FBI CJIS standards on data security for criminal justice information.

AssetWorx offers a battery-powered active RFID called "V-Tag" (see Figure 3-2), which creates a self-generating mesh network that requires minimal infrastructure. A built-in accelerometer in the V-Tag alerts the system to any movement of the evidence. V-Tags, which are reusable, can also contain sensors for location (with long-range wide area network and GPS), temperature, and shock. An active V-Tag RFID is typically used for evidence identified as having high strategic or monetary value, such as sexual assault kits (SAK), drugs, weapons, ammunition, cash, or jewelry. A V-Tag can be attached using Velcro®, adhesive, or cable tie. V-Tags cost $40 and replacement batteries cost $11.50. V-Tag batteries last approximately six years depending upon activity level. The AssetWorx software shows the battery status and provides a low battery alert. V-Tag Active RFID tags may be also incorporated as a location reporting component in a legacy system using the V-Tag Software Development Kit (SDK), which is based on Microsoft.net.

Other features available with AssetWorx include "buddy" labels, biometric authentication, RFID-intelligent safes and lockers, and RFID buddy labels include a peel-and-stick copy of the RFID evidence label for an officer's logbook. The buddy label contains the same basic data as the RFID label that is applied to evidence. Biometric authentication using palm-vein scanning is an optional accessory to the Falken Secure Network AssetWorx evidence management system. RFID-intelligent safes and metal lockers are available as a means to overcoming inventory and security issues for items stored in metal containers. Access to RFID-intelligent safes and lockers is granted through a scan of an RFID identification badge to validate credentials for authorized access. When the safe's door is closed, the system automatically takes inventory, and removed assets are recorded and assigned to the personnel badge ID that accessed the safe.

Falken Secure Networks can conduct a full conversion of an existing property management system and record management system into AssetWorx during the initial onboarding. AssetWorx provides application programming interfaces (APIs) that can interface with any third-party software system. AssetWorx does not currently integrate with any outside agency databases, but this functionality can be built by Falken Secure Networks if needed.

AssetWorx offers two licensing models: on-premises installation or cloud-based. For the on-premises model, AssetWorx RFID software application is installed on a server at the agency. Pricing for the on-premises license varies by the number of concurrent system users. For example, ten concurrent user licenses cost $20,500 plus $1,000 per fixed or mobile reader, with annual support costing approximately 19% of the original software cost. For the cloud-based model, AssetWorx runs securely on a US-based cloud server managed by InfinID Technologies. Pricing for the AssetWorx cloud-based software as a service (SaaS) model is a monthly fee which varies with the number of concurrent system users. For example, a license for one concurrent user is $175/month, while the cost for five concurrent users is $575/month. AssetWorx is available on the GSA Schedule (2FYB-DJ-050008-B).

AssetWorx includes a one-year warranty for an on-premises server, with annual support agreements thereafter. Product support is included with the SaaS model. Manufacturer hardware warranties pass-through to the customer. Customer hardware and software support is available by telephone Monday through Friday, 9 a.m.–5 p.m. Eastern time. Email support regarding all hardware and software is available 24/7.

3.3 Hardcat, Hardcat Asset Management and Exhibit Management Software

Hardcat Asset Management and Exhibit Management Software (Hardcat) is a complete evidence tracking and management system designed to organize evidence and simplify inventory. Hardcat offers an "end-to-end" evidence management solution that uses RFID and/or barcodes, maintaining and tracking evidence from seizure to final disposal. Hardcat offers passive tags, semi-active tags, active tags, portal readers, handheld readers, and a mobile application for crime scene evidence collection. Using portal RFID readers and passive RFID tags (applied to personnel, equipment, and/or evidence), Hardcat allows agencies to check-out and check-in items passing through evidence portals.

Figure 3-3 Hardcat Asset and Exhibit Management

Image Credit: Hardcat

Hardcat's dashboards provide a consolidated view of all items and are configurable, with multiple secure access levels so individuals can access only the information needed for their responsibilities. The Hardcat evidence management software captures evidence location, chain of custody, evidence movement, and sub-exhibits.

Evidence metadata includes all information specific to the type of evidence being seized, along with details of when it was captured, where it was captured, from whom it was captured, case number, photographs, and any other information. These inputs are configurable. Chain of custody information includes the specific location of the evidence, who stored the evidence, and a complete audit trail of any changes to the evidence along with who has viewed the evidence. The Hardcat system is compliant with FBI CJIS standards on data security for criminal justice information.

Hardcat can create sub-exhibits from a parent item of evidence. The sub-exhibits are treated as unique or individual exhibits; however, sub-exhibits are linked to the parent evidence to maintain the relationship but track separately to ensure complete chain of custody and reporting. Evidence audits can be conducted using either RFID or barcodes to confirm the existence and location of exhibits and provide exception reports for any missing items. Check-out and check-in transactions in Hardcat can track movements of evidence between sites, laboratories, departments, and people to ensure there is clear visibility of evidence movement. Hardcat interfaces with Laboratory Information Management Systems (LIMS) and other third-party software.

Hardcat is commercial off-the-shelf (COTS) software application designed, developed, implemented, and supported by Hardcat. Software licenses can be hosted on premises (by the customer) or as hosted, managed SaaS based on the number of modules and users. The Hardcat interface is a browser-based application that connects to an application server via a Microsoft Internet Information System web server. The data resides in a Microsoft SQL Server database.

Hardcat assists with integration and interface development into existing records management systems (RMS) via its comprehensive representational state transfer (REST) API. Hardcat provides several integration options via any combination of third-party integration tools (such as Microsoft Biztalk or IBM's WebSphere), message queuing (MSMQ), XML, or RESTful/SOAP web services.

There is no limit to the number of items to be tracked, and pricing is not dependent on the volume of items to be tracked. The implementation price depends on the level of implementation services required. Without integration in RMS, a standard implementation could range from $100,000 to $300,000, excluding any hardware (i.e., tags, readers, PCs, laptops), software licensing, hosting, and support. RFID tags range from $0.50 per tag to roughly $7.00 per tag depending upon the number of tags purchased, the type of tag, and the application. RFID hardware ranges in price from approximately $1,000 per unit to $7,000 per unit. The system is not on the GSA Schedule.

Customer service includes the initial phase of the project to help understand and document a customer's current and future processes, configuration of software, data migration strategy and capture, training and documentation, standard or customized support, health checks, upgrades, and more. Software licensing costs approximately $120 per month and includes technical support during standard business hours, Eastern time.

3.4 JPL Global Logistics Solutions, LLC: JPL RFID: Get a Grip on Your Assets

The JPL RFID Get a Grip on Your Assets, by JPL Global Logistics Solutions, LLC, is a complete integrated RFID-centric evidence management system. The JPL RFID system is designed for use in crime scene evidence collection, evidence room management, SAK management, blood-alcohol content kit tracking, electronic asset management, inventory management, LIMS, and for use with Combined DNA Index System (CODIS) sample management. JPL RFID offers passive tags, semi-active tags, active tags, GPS- and cellular-tracked containers, handheld and portal scanners, and a mobile application for crime scene collection.

JPL RFID offers RFID reader-enabled containers for collecting sensitive evidence at the scene. Their blood-alcohol content container the "Tox Box" logs an RFID-tagged blood-alcohol sample into evidence when it is dropped into it. The Tox Box also sends a notification to employees to collect the sample from that location. The Tox Box was developed by JPL and can be modified to meet other evidence tracking needs if needed. JPL RFID's SAK solution enables both the kit and each constituent component of the kit to be individually labeled and associated in a traditional "parent-child" evidence relationship. This enables various SAK evidence to be separated and tracked during various laboratory testing procedures and then reunited to the parent container. The JPL RFID system is CJIS compliant.

The proprietary RFID evidence management software for the JPL RFID Get a Grip on Your Assets system is available on iOS, Android, and Windows platforms. The JPL RFID software can integrate with audible and visual warning systems to alert system users if evidence is removed from a storage location without being properly checked out. Additionally, their proprietary SQL-based middleware solution can be configured to interface with any third-party evidence management software.

Figure 3-4 JPL RFID Tox Box with blood alcohol kit

Image Credit: JPL RFID

JPL RFID offers off-the-shelf installations; however, their Get a Grip on Your Assets system is fully configurable to adapt to agency procedures and infrastructure currently in place. JPL RFID provides on-site evaluations to ensure proper hardware implementation and system setup. An optional handheld barcode-enabled RFID kit is available from JPL RFID for an additional cost.

Pricing for licensing, installation, and setup are on a case-by-case basis as determined by the environmental requirements and needs of the agency. Basic installations start at $5,000 per RFID reader, or $6,995 per barcode-enabled RFID reader. Passive tags have a price range of $0.05 to approximately $1.00, depending upon the features required for the tag. The system is not on the GSA Schedule.

Ongoing support is purchased at either a standard or premium level. Customer support is available 24/7 via email or telephone for customers purchasing premium support packages. Standard support is available Monday through Friday from 7am–7pm Central time. The software licensing agreement covers support and software updates. All JPL RFID hardware products offer standard 12-month manufacturer warranties.

3.5 Knot Technology Solutions: Visi-Trac Asset Manager

The Visi-Trac Asset Manager is an integrated RFID-centric evidence management system. Knot Technology Solutions (KTS) partners with the Visi-Trac manufacturer, RFID Global Solution, to provide evidence management software, services and support. Using RFID technology, Visi-Trac Asset Manager is designed to track the movement and locations of evidence and property to maintain chain of custody and inventory accuracy. Visi-Trac records and stores pertinent evidence and asset data using fixed and mobile readers to record and report the last location and custody information. KTS offers third-party passive tags, semi-active tags, active tags, GPS- and cellular-

Figure 3-5 Visi-Trac Platform

Image Credit: RFID Global Solution

tracked containers, handheld scanners, portal scanners, a mobile application for crime scene evidence collection, Bluetooth, Wi-Fi, barcode, and mesh networking.
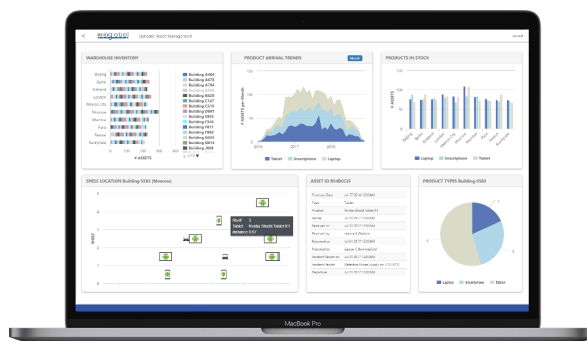
Visi-Trac Asset Manager views the various RFID tag types (passive, semi-active, and active) simultaneously. Visi-Trac software supports numerous definable data fields so that corresponding asset data, such as evidence number, intake records, chain of custody, case number, and disposition, can be displayed and filtered. Customized data fields can be created and visualized through Visi-Trac analytics dashboards. Doorway and portal RFID readers can automatically detect when evidence enters or leaves a room. The Visi-Trac software allows users to create business rules that govern evidence movements. If evidence moves through a doorway without being properly checked out, the software can trigger an alert. This alert is customizable; it can be audible and/or a visual display at the portal as well as an email or text message sent to the appropriate person. All movements of RFID tags are recorded automatically and allow the system to provide last-seen information. The Visi-Trac Asset Manager is compliant with the FBI CJIS standards on data security for criminal justice information, and U.S. Department of Defense Enterprise Certificate of Networthiness, Security Implementation.

Visi-Trac Asset Manager utilizes Microsoft SQL and can run either on-site (on premise) or as SaaS. Visi-Trac is a web-based application and can be hosted on a dedicated server, on a virtual machine, or run through the cloud. Visi-Trac utilizes its own middleware platform called Visi-Trac Edge. The software and system can be customized. Knot Technology Solutions highly recommends a site survey at the outset of the project to determine the proper RFID technology to use and recommend any facility changes that need to be made. The Visi-Trac Asset Manager system license also provides for unlimited users and assets, making it accessible to law enforcement, victims, etc., without concern for operating costs.

Visi-Trac uses REST architectural style API to integrate with existing legacy evidence management systems. Currently, Visi-Trac is interfaced with CODIS, National Crime Information Center database, and Standard Ammunition File.

Each Visi-Trac system is configured specifically to meet the needs of the customer. The system cost scales based on the number of locations and reader infrastructure installed. While installation costs vary, pricing will include hardware, configurable software, tags, installation and training, and customer support. Zebra Technologies (third-party hardware provider) handheld readers range from $1,500 to $2,500. Fixed readers range from $1,300 to $1,500 each. Portal RFID readers average $7,000 to $9,000 each. Active base stations cost $2,000 to $4,000 each. Visi-Trac is available on the GSA Schedule (GS-35F-0613X).

Training is provided either on-site or online and covers all aspects of system operation; training support is annually renewable. Standard manufacturer warranties come with all hardware. Visi-Trac software warranties, including patches, bugs, fixes and upgrades, are annually renewable. Customer service support is available Monday through Friday from 9:00 a.m.–5:00 p.m. Eastern time, with 24/7 coverage available for an additional cost.

3.6 Office Interiors of Virginia: RFID Evidence Tracking

RFID Evidence Tracking by Office Interiors of Virginia combines evidence management software with RFID readers and tags. This includes RFID software, RFID scanners and readers, RFID tags and labels, training, and support. The underlying software is designed specifically to blend tagging, barcoding, and RFID to establish and maintain chain of custody, and to provide RFID evidence tracking. RFID Evidence Tracking by Office Interiors of Virginia is compatible with passive RFID tags, active RFID tags, GPS tags, portal RFID readers, handheld readers, and mobile labelling and tagging at crime scenes. Labels include both RFID and barcodes for items and their location.

Figure 3-6 RFID Hard-tagged Gun Evidence

Image Credit: Office Interiors of Virginia

RFID scans using handheld, USB, and portal RFID readers update the evidence database and audit logs with item, person, place, direction, time, and date. Handheld RFID readers are typically used for RFID-tagged evidence tracking and inventory. Fixed RFID readers can be installed at doorways or chokepoints and configured to automate evidence tracking, including alarms for improperly removed evidence. The RFID Evidence Tracking system is CJIS compliant.

The evidence database license allows unlimited item-types to be configured within the software. The software can be configured to model individual items and perform item life-cycle management through inventory, retention, and disposition. Parent-child evidence structures and data dependencies can be configured into the database schema. Actual data fields and content are configured around customer-specific requirements.

Office Interiors of Virginia recommends readers, scanners, and customizable RFID tags based upon the agency's needs and budget. The company installs RFID stationary readers and long-range RFID readers and antennas. Office Interiors of Virginia also installs and configures all software, including integrating and importing existing data and setting up user-defined fields. Office Interiors of Virginia provides on-site and customized RFID solution training and offers customer support for their RFID Solutions. RFID Evidence Tracking is not on the GSA Schedule.

3.7 Patterson Pope: RFID Solutions

Patterson Pope provides a complete custom RFID evidence management solution that includes RFID tags, hardware, middleware, and software. Patterson Pope works with agencies to identify RFID tagging solutions for the specific application and designs the system based on specific agency needs and processes. Patterson Pope's RFID Solutions also provides evidence storage and prioritizes secure chain of custody. Patterson Pope can integrate RFID Solutions with many existing barcode tracking systems. RFID Solutions is typically used in conjunction with a barcode system, not as a replacement for one. Patterson Pope also offers RFID-customized smart lockers, evidence lockers, evidence drying cabinets, and high-density mobile roller-track shelving.

Patterson Pope's RFID Solutions monitors evidence coming in or going out, and tracks the date, time, and who moved evidence. RFID Solutions creates a database of all evidence movements and a detailed record for chain of custody. Agencies can use Patterson Pope's RFID Solutions to prevent unauthorized removal of evidence with configurable alerts that activate alarms and/or send email notifications. RFID Solutions uses RFID Revolution Express, a third-party middleware that supports portal RFID readers, antennas, handheld RFID readers, and passive and semi-passive RFID tags. The middleware allows for communication with RFID hardware and allows agencies to apply workflows to the data collected. RFID Solutions uses its proprietary RFID Tracking Plus software to interface with the middleware and store the data collected. The RFID Solutions system's evidence audits produce a discrepancy report that details any missing items and updates item location. RFID Solutions can also integrate evidence management databases and synchronize data and web services to display evidence location, history, and requests within third-party applications.

Every RFID project is customized based upon the agency's needs and requirements. Patterson Pope uses a four-step system to design and install their custom RFID evidence management system (Figure 3-7), which begins with analysis of the space then moves toward system planning, installation, and continuing customer support. RFID evidence management projects typically start at $25,000. It is not on the GSA Schedule.

All RFID Solutions systems come with a one year warranty that covers all aspects including software, hardware, support, and training. After the first year, an annual maintenance agreement is available for purchase, which covers support, training, and software updates. The annual maintenance agreement is a negotiated percentage of the cost of the initial system. The Patterson Pope support line is open Monday through Friday, 8 a.m.–5 p.m. Eastern time.
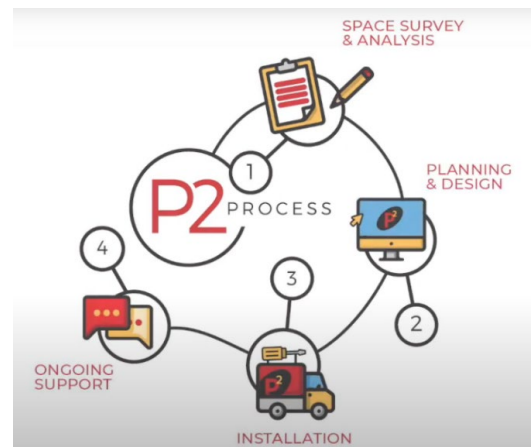

Figure 3-7 Patterson Pope Process

Image Credit: Patterson Pope

3.8 Primary Marking Systems: eTWIST

Primary Marking Systems Inc. offers a customizable end-to-end RFID evidence management solution that includes RFID tags, reader hardware, middleware, and software called "Evidence Tracking with Information Solution Technologies" or "eTWIST". eTWIST is both a barcode and RFID-based evidence management system (Figure 3-8). Paired with Zebra mobile technology devices and mobile barcodes/RFID printers, eTWIST is designed to be deployed at crime scenes to collect, document, photograph, and label evidence with barcode and RFID readable labels. RFID-tagged evidence can be electronically associated with the name of the collecting officer, case number, photographs, description, collection date, time, and GPS location prior to being uploaded into the agency evidence management system. eTWIST Error Checking and Handling are built into all aspects of the application to alert the user regarding any errors or missing information. eTWIST has customizable automated notifications for actionable events, mishandled evidence, disposition, and victim advocate notifications.
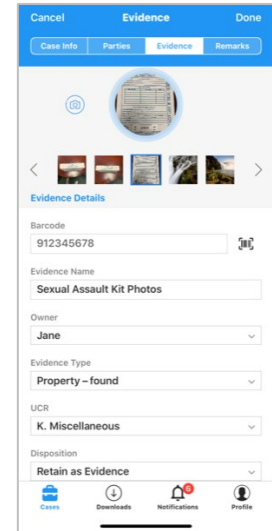

Figure 3-8 eTWIST Mobile Evidence Tracking

Image Credit: Primary Marking Systems

The eTWIST backend is network-based and runs through a browser adhering to HTML standards. eTWIST allows for the customization of various fields and selections and utilizes dual authentication logins and integrates with agency learning management systems, computer aided dispatch, and record management systems. eTWIST has several levels of security built in, including Federal Information Processing Standard (FIPS) 140-2 Level 1 and Advanced Encryption Standard (AES) 256 encryption. The software's backend connectivity complies with FBI CJIS standards.

Depending on customization and service agreements, eTWIST costs approximately $7,000. It does not appear on the GSA Schedule.

Primary Marking Systems, Inc., offers several service-level agreements, with coverage varying from 24/7 support to helpdesk hours Monday through Friday from 8 a.m.–5 p.m. Central time. All eTWIST software solutions include one year of maintenance and all mobile device hardware includes return-to-factory support.

3.9 Trackable IoT, Evidence Trackr

Evidence Trackr is an RFID-centric evidence management system available from Trackable IoT. The Evidence Trackr Evidence Management System is an integrated system that includes software, RFID handheld readers, portal RFID readers, and RFID tags. Evidence Trackr supports passive, semi-active, and active RFID tags. Evidence Trackr is specifically designed to meet law enforcement evidence management needs. Evidence Trackr can also integrate with digital scales, alarms, electronic signature pads, fingerprint readers, and video cameras. Evidence Trackr can be used to track evidence, weapons, narcotics, currency, and vehicles.
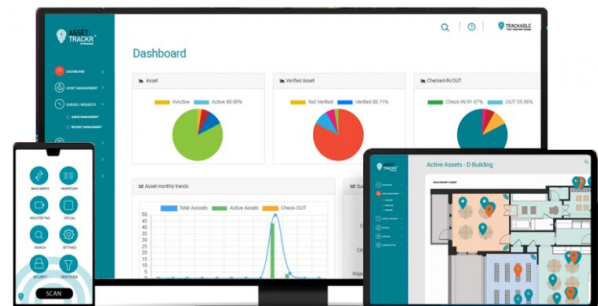

Figure 3-9 Evidence Trackr Platform

Image Credit: Trackable IoT

Using directional portal RFID readers, Evidence Trackr can automatically check-in or check-out evidence, document the movement of evidence items and personnel, and show last point detected. Alarms and alerts for evidence movement can be customized based upon agency rules.

While Evidence Trackr is COTS software, it can be configured for agency requirements for data, workflows, tracking, security, and reporting. Evidence Trackr can be deployed on a cloud-based system or installed on agency servers (virtual and portioned or stand-alone). Evidence Trackr has a proprietary middleware solution. Trackable IoT uses the application programming interfaces (APIs) and software development kits provided by RFID hardware manufacturers.

Evidence Trackr can integrate with third-party systems or platforms, such as System Applications and Products (SAP) and Oracle. Trackable IoT provides API, and Restful Web Services for database and/or systems integration. Trackable IoT has experience with both state and local justice management systems. Complex installations may require integration of multiple backend systems to establish a data import mechanism that captures, filters, and organizes data adequately.

Installation pricing for Evidence Trackr varies by the location, size of the department, and the types and quantities of hardware infrastructure needed. Trackable IoT can implement an RFID evidence management system starting around $15,000. A chokepoint RFID detection zone costs around $3,500, while a directional doorway detection and security zone costs around $6,500, and a mobile scanner or tablet with software is around $4,500. The price of complete system and user technical support, including periodic software updates, is approximately 18% of the initial cost of hardware, software, and software configuration. The system is not on the GSA Schedule.

Evidence Trackr hardware and RFID tags come with warranties provided by their third-party manufacturers. Additional support is available, including for tags, software, technical support, and hardware "repair or replace" provisions. During the installation process, Trackable IoT provides training as part of the overall system cost. The scope and length of support is based on an organization's requirements. Trackable IoT provides 24/7system support every day of the year for all customers under their support agreement. Customer service is available via phone, email, text, web meeting, and/or on-site as required.

4.0 MANUFACTURER AND VENDOR CONTACT INFORMATION

Additional information on the (products) included in this market survey report can be obtained from the manufacturers (and vendors, delete if not applicable) listed in Table 4-1.

Table 4-1 Vendor Contact Information

Company	Website	Address	Phone Number	Email Address
C&A Associates	caassociates.com/rfid-solutions/evidence-tracking-and-management	1814 Range Rd., Suite A Denham Springs, LA 70726	(800) 679-7764	sales@caassociates.com
FALKEN Secure Networks Inc.	falkensecurenetworks.com	15 Dekker St. Everett, Ontario Canada, L0M 1J0	(647) 930-7373	sales@falkensecurenetworks.com
Hardcat Pty Ltd.	hardcat.com/industries/law-enforcement-asset-management	701 South Carson St. Suite 200-3824 Carson City, NV 89701	(530) 362-3935	sales@hardcat.com
JPL Global Logistics Solutions, LLC	jplrfid.com	19500 SH 249, Suite 665 Houston, TX 77070	(832) 900-4747	deployment@jplrfid.com
Knot Technology Solutions	ktsgov.com	5537 Deale Churchton Rd. #23 Churchton, MD 20733	(410) 867-1071	sales@knot-tech.com
Office Interiors of Virginia	www.oi-va.com/products-services/rfid-evidence-tracking	5401 Lewis Rd., Suite A Sandston, VA 23150	(804) 550-0003	oiva@oi-va.com
Patterson Pope	pattersonpope.com/rfid	3001 N Graham St. Charlotte, NC 28206	(866) 866-4778	info@pattersonpope.com
Primary Marking Systems, Inc.	www.e-twist.com/law-enforcement	316 Jungermann Rd. St. Peters, MO 63376	(314) 344-9178	sales@e-twist.com
Trackable IoT	www.trackableiot.com	1680 Fruitville Road #512 Sarasota, Florida 34236	(941) 946-1468	info@trackableiot.com

5.0 CONCLUSIONS

Law enforcement agencies maintain extensive inventories of crime scene evidence, such as firearms, fingerprints, fibers, documents, and biological evidence including blood swabs/samples, hairs, and specimens from sexual assault kits. The proper collection, labeling, and tracking of evidence gives credence that the evidence presented in court is the same evidence that was collected at the crime scene. RFID technology can help facilitate, standardize, and automate inventory and asset tracking tasks for law enforcement's management of evidence.

Between February and October 2022, the SAVER program conducted a market survey of commercially available RFID systems for evidence management. This market survey report includes information on nine products identified during the market survey that offer complete RFID evidence management systems for law enforcement evidence management. All nine companies offer handheld and portal readers. All offer passive tags, and seven offer active tags. Six products are considered crime scene portable as they can be brought and used on-site to collect and record evidence on scene. Every company in this report uses third-party RFID hardware and tags in combination with software and middleware systems to design and implement a complete RFID evidence management system. These RFID evidence management systems can work in conjunction with existing barcode evidence labels and integrate with existing evidence management software.

Each company has experience in providing RFID systems to law enforcement agencies. Pricing of these RFID Evidence Management products vary based on system size, customization, features, types of integration with RMS and other third-party databases, systems support, and installation requirements.

Emergency responder agencies should carefully research the overall capabilities and limitations of RFID management systems in relation to their agency's operational needs when making procurement decisions. Agencies should also consider impacts associated with integrating equipment into their power and information technology infrastructure, data management, concept of operations, and required maintenance. If RFID evidence management systems connect with existing agency databases containing law enforcement information, agencies must ensure that all systems are compliant with the FBI CJIS Security Policy [1].

REFERENCES

[1] Federal Bureau of Investigation, "Criminal Justice Information Services (CJIS) Security Policy," 01 6 2020. [Online]. Available: https://www.fbi.gov/file-repository/cjis_security_policy_v5-9_20200601.pdf/view. [Accessed 17 8 2022].

[2] S. Williams, M. Taylor, J. Irland and A. Mehta, "RFID Technology in Forensic Evidence Management: An Assessment of Barriers, Benefits, and Costs," National Institute of Standards and Technology, US Department of Commerce, November 2014.

[3] International Electrotechnical Commission, "IP Ratings," 2023. [Online]. Available: https://www.iec.ch/ip-ratings. [Accessed 07 06 2023].

[4] "Federal Acquisition Regulation, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment," 84 FR 68314, Federal Register, 13 December 2019. [Online]. Available: https://www.federalregister.gov/documents/2019/12/13/2019-26579/federal-acquisition-regulation-prohibition-on-contracting-for-certain-telecommunications-and-video. [Accessed 21 June 2021].

[5] Office of Management and Budget, "Frequently Asked Questions: Prohibitions Expending FEMA Award Funds on Covered Telecommunications Equipment and Services," [Online]. Available: https://www.fema.gov/sites/default/files/documents/fema_prohibitions-expending-fema-award-funds-covered-telecommunications-equipment-services.pdf.

[6] U. S. House of Representatives. 115th Congress., "H.R. 5515, John S. McCain National Defense Authorization Act for Fiscal Year 2019," 13 August 2018. [Online]. Available: https://www.congress.gov/bill/115th-congress/house-bill/5515/text. [Accessed 05 December 2020].

[7] Office of Management and Budget, "Guidance for Grants and Agreements," 13 August 2020. [Online]. Available: https://www.federalregister.gov/d/2020-17468/p-877. [Accessed 21 June 2021].

[8] "FAR Interim Rule, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment," 89 FR 40216, Federal Register, 13 August 2019. [Online]. Available: https://www.federalregister.gov/documents/2019/08/13/2019-17201/federal-acquisition-regulation-prohibition-on-contracting-for-certain-telecommunications-and-video. [Accessed 21 June 2021].

[9] Federal Emergency Management Agency, "FEMA Policy 405-143-1, Prohibitions on Expending FEMA Award Funds for Covered Telecommunications Equipment or Services (Interim)," 24 November 2020. [Online]. Available: https://www.fema.gov/sites/default/files/documents/fema_prohibitions-expending-fema-award-funds-covered-telecommunications-equipment-services.pdf. [Accessed 21 June 2021].