Defining Today's Technology Standards; Empowering Tomorrow's Solutions.

Automatic Identification & Data Collection (AIDC) Enabled Efficiency & Traceability Gains for Cannabis Growers

White Paper

AIM North America Cannabis Work Group

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AIDC Enabled Efficiency & Traceability Gains for Cannabis Growers

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Visit www.aim-na.org for more information about automatic identification & capture (AIDC) technologies and innovation.

About AIM North America

AIM North America (NA) is committed to providing commercial-free, accurate, unbiased information to its members and their customers. AIM NA members are manufacturers, distributors, resellers, educators, system integrators, and technology users of Automatic Identification & Data Collection (AIDC) technologies.

AIM represents the following AIDC technologies, systems, solutions, and the enabling software:

- Barcode
- RFID (Radio Frequency Identification); RAIN RFID
- NFC (Near-Field Communication)
- Digital Watermarks
- Sensors
- RTLS (Real-Time Locating Systems)
- Biometrics
- Magnetic Stripe
- IoT (Internet of Things)

AIM NA delivers accurate and unbiased information on AIDC technologies, standards, and applications. Through AIM committees and alliances, AIM NA provides technology perspectives to legislators, media, and consumers.

For 50 years AIM, the AIDC industry trade association, has led the way in:

- Global Standards Development
- Technology Innovations
- AIDC Education & Awareness
- Partnering with "Super Users" Implementing Industry Mandates
- Regulatory Guidance

Today AIDC has become so effective in such a subtle, profound way, it has become ubiquitous and is the invisible force empowering the sustainable world to operate!

AIDC technologies as robust data collection tools - connecting the physical world to the computer world - are driving the future development of IoT, Artificial Intelligence (AI), and Blockchain!

Reference of Terms

1D	**One-Dimensional (or linear) Barcode**
2D	**Two-Dimensional (or matrix) Barcode**
AI	**Artificial Intelligence**
AIDC	**Automatic Identification and Data Collection**
IoT	**Internet of Things**
NFC	**Near-Field Communication**
RFID	**Radio Frequency Identification**
RTLS	**Real-Time Locating Systems**

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INTRODUCTION

This document was prepared by the Cannabis Work Group of AIM North America. We represent all industries and organizations that use, implement, resell, or develop technology. We are essential to enabling adoption, growth, and interoperability to those who depend on accurate, available, and identifiable data.

The AIM North America Cannabis Work Group was formed to engage in outreach to the global Cannabis industry, educating and promoting adoption of AIDC strategies and technologies, and supporting the industry's growth and need for compliance with Cannabis Regulations, specifically traceability and packaging.

You Do Not Have to Go It Alone – We Are Here to Assist You!
AIM has been at the forefront with assisting industries with proven data-driven automation technology for 50 years. We have encountered many obstacles and have created proven solutions to assist industries with the best technology tools to ensure track and trace and compliance.

We have walked the path with ***Defense, Retail, Grocery, Automotive, Aerospace, Medical Device Manufacturing, Pharmaceutical Manufacturing & Management, Food Production industries***, and others that have faced and conquered many of the challenges now being addressed in the Cannabis Industry.

We are an un-biased Trade Association of technology experts that are available to support you on your journey. (Cannabis Ask the Expert Information).

For more information, contact AIM at info@aim-na.org or visit www.aim-na.org.

AIM and the Cannabis Work Group would like to thank our Project Editors:

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Goals of White Paper

- Explore & define what AIDC technology tools exist, such as 1D/2D barcodes, RFID, and digital water marks, to significantly improve the data collection process for cannabis growers.
- Provide an overview of the advantages of the AIDC technologies for the Cannabis industry.
- Establish a working relationship between the AIDC community and the Cannabis industry stakeholders. AIM is here to help with the Cannabis Ask The Expert Information.

What is AIDC (Automatic Identification & Data Collection)?

AIDC is a constellation of technologies and tools used to design, encode, print, identify, verify, and record electronic information. It includes barcode and RFID technologies and their related tools such as design and print software, printers, labels, RFID infrastructure such as readers including smart phones and antennas, along with software/middleware, and verifiers and vision systems.

AIDC has been around for decades, but the advancements in engineering mean that the technologies are continually evolving. The AIDC community has helped solve the complex problems of identification, traceability, and authentication for regulated industries like aerospace, medical device manufacturing, pharmaceutical manufacturing, and food production - helping to keep supply chains running efficiently, and human beings safe.

AIDC technologies are all around us and have become ubiquitous. Our modern economy couldn't function without them. Everyone at one time or another has used AIDC whether trying to speed through the self-checkout line; using an e-boarding pass by scanning a barcode on their smartphone; utilizing a keyless entry system in their home, hotel, or place of employment; scanning UPC barcodes in grocery stores; reading RFID that identifies your car and automatically billing for toll payments; and to help identify your pet through their microchip.

AIDC technologies help users with inventory accuracy, track and trace, authenticity, loss prevention, visibility, inventory control, and other business needs by connecting the physical world to the digital world.

Summary of AIDC Technologies

Please reference the Cannabis Work Group White Paper # 1 ***Track and Trace for the Cannabis Industry, from Cultivation to Consumer*** for complete details on the following summary of AIDC Technology Tools:

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Barcodes: A barcode is a series of parallel, adjacent bars and spaces in the case of linear or 1D barcodes; dots and squares (modules) in the case of two-dimensional (2D) barcodes, such as a QR code; or a combination of these in the case of composite barcodes. These geometric structures encode data in a machine-readable form. The technology enables real-time data to be collected accurately and rapidly.

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RFID (Radio Frequency Identification): can identify and locate items, people, and other things by the transmission of radio signals. There are many types and variations of RFID, based on different frequencies, standards, and technologies, each with varying use cases and applications.

The two main types of RFID commonly used in the cannabis industry are:
• RAIN RFID: The brand name for passive UHF RFID standardized by GS1 EPC Gen2 and ISO/IEC 18000-63
• Near Field Communications (NFC): The brand name for a particular type of HF RFID standardized by ISO/IEC 14443, ISO/IEC 15693, ECMA 352 and ECMA 356 among others.

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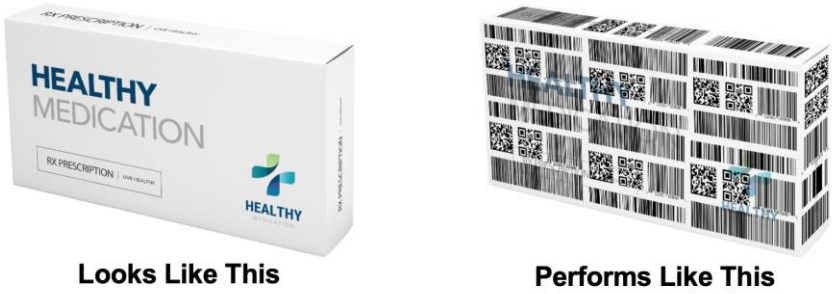
How NFC Works

Digital Watermarks: A digital watermark is an advanced 2D data carrier designed to be scanned reliably and efficiently when applied to packaging and labeling materials. The process creates a typically imperceptible pattern that is designed to be redundantly spread across graphic elements of a package or label design, enabling reliable and easy optical capture without interfering with design aesthetics.



Example of Digital Watermark

Printers: Printers are often used in connection with AIDC solutions to print barcode, digital watermarks, and/or encode RFID labels, usually with variable, or dynamic data, meaning each label in a print run has unique, different data printed/encoded onto it from the data on the other labels.

Variable data is a key concept for AIDC in the cannabis industry, as each item, for example, a specific plant, a shipping carton, or a finished product, often must be uniquely identified.

Variable data capabilities — and by extension, uniquely identified items — allow users to adhere to strict cannabis regulations and optimize business operations.

Printer options include Ink-jet, Thermal, Laser and standard office printers.

Example of a Smart Label that prints barcode and RFID

Scanners: 1D, or linear, barcodes can be scanned with traditional laser scanners or using camera-based imaging scanners. 2D barcodes and digital watermarks can only be read using imaging scanners, such as mobile devices. Traditional scanners include Area Imagers, In-Counter, Wired, Wireless and Mobile. The flexibility of mobile computers allows for configuration for a variety of software applications, barcodes, and RFID readability.

Software: Many of the applications in the cannabis industry that require software are the same as in other industries, for example, accounting, warehouse management, raw material tracking, inventory and retail programs including both POS and back office. But there are factors that impact the choice of application and software platforms specific to the cannabis industry:

- Regulatory compliance
- State-mandated software systems
- Retail loss prevention
- Seed-to-sale tracking
- Recall Management
- Packaging & Labeling
- Supply Chain Management

AIDC Technologies Impact on Grower "Pain Points"

- Optimization of the growing environment by having real-time data available
- Adjustments for season-to-season facility functionality
- Ability to replicate consistent experience for the consumer and to provide critical information about the provenance of the product, legality, growing environment, processing, etc.
- Management of data capture information to identify, capture, share information on individual seedlings/plants, locations, attributes, events (room/location movement, growth phase change, destruction), and environmental data (feeding, watering, plant maintenance)
- Increase inventory management techniques and decrease staff time with plant stakes enabled with RFID, barcodes, or digital watermarks
- Easing data transmission to compliance tracking (e.g., METRC) systems

- Automating the process of counting large numbers quickly and maintaining specific instances (e.g., plant attrition/inventory reduction)
- Seamlessly monitor, capture, and communicate greenhouse/environment data, stages of growth, moisture, temperature, etc. (e.g., germination to growth, to harvest/drying) with sensors
- Visibility into Process Compliance

AIDC Enabled Gains for Cannabis Growers

The critical importance of AIDC technologies cannot be ignored! They have become an essential requirement for doing business, especially in regulated environments.

The Cannabis industry is thriving & booming! The global Cannabis market is projected to reach $197.74 billion by 2028 according to Fortune business insights. Cannabis legalization is in full swing and with legalization comes regulatory compliance and stringent regulations to ensure safe, authentic, reliable products for consumers.

As a Grower, not only must you comply with many regulations for cultivation, harvesting, and quality assurance (QA) testing, but you also want to ensure that your product is not compromised once it leaves your facility. Your product, once delivered to the consumer, is your reputation and the backbone for your continued success. Visibility, transparency, and accessibility to the data as your product moves through the supply chain is the only way to safeguard your product by reducing the risk of error, contamination, or recall.

Recalls are inevitable and can significantly impact a company's reputation and profits by having to remove entire batches from production or retail. AIDC technologies can reduce the burden quickly and efficiently by allowing you to identify and remove all products in a defective batch, keeping your operations functional and not impacting your brand.

More and more, Cannabis is being added to food, beverage, pharmaceuticals, and beauty products, heightening the demands and requirements to track your product and its movements through the chain of custody to the point of sale.

Cannabis growers are faced with mandatory reporting of detailed, accurate and time-sensitive data to regulatory agencies, from monitoring plant inventory levels to ensuring facility process compliance.

Often this work is being done manually, increasing labor demands, and human errors associated with manual records keeping. The University of Arkansas and Auburn University have studied the impact of both barcode and RFID technologies on inventory tracking and counting. They found that RFID technology reduced the time required for a physical inventory count by 96%-97%, and a barcode system reduced the time from 16-man hours to just 2 hours. Another study by VDC Research found that companies that implemented a barcode system saw an average increase in accuracy from 63% to 95%.

AIDC technologies reduce labor hours, improve accuracy, and provide high levels of efficiency in these processes while reducing expenses. Additional opportunities exist such as keeping track of microclimate growth data and using visibility into employee activity to drive process improvement.

AIDC technologies provide the grower accurate, efficient, and inexpensive methods for automating data collection and feeding that data directly into inventory control and reporting systems.

AIDC technologies help you maintain your operating license, implement seed-to-sale traceability (to monitor and track plants, derivatives, pesticides, ingredients, packaging materials, temperature, etc.) and comply with packaging and shipping requirements. In addition, AIDC technologies augment inventory control, employee monitoring, safety & production controls, data management for audits, certifications, inspections, and recalls.

IoT & Blockchain Technologies – The Wave of the Future!

Moreover, technologies like Internet of Things (IoT) and Blockchain are changing the game when it comes to decentralized, synchronized source of truth by trusted partners which are stored across multiple locations to ensure data integrity. Blockchain offers security, transparency, and redundancy to prevent discrepancies.

Blockchain allows cultivators to capture the details of each plant, including origin, species, and sowing procedures on a shared, transparent, and immutable ledger.

IoT offers smart measurement tools whereby remote sensors can monitor a variety of metrics, including soil acidity, humidity, salt concentrations, and temperature, providing data automation and a tracking of each plant's health and history.

Industry Related Associations and Resources

AIM North America Cannabis Work Group
Brightfield Group
Cannabis Alliance
Cannabis Regulator Association
CannaCon
Coalition for Cannabis
CPX (Cannabis Products Exchange)
Green Flower
Hemp Industries Association
Minority Cannabis Business Association
MJBizCon
National Association of Cannabis Businesses
National Association of Convenience Stores
National Cannabis Industry Association
NECANN
Retail Solutions Providers Association Cannabis Group

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