Radio Frequency Identification for Packages, Parcels, and Flat Mail

Approved: 19 May 2006

Abstract

This standard provides guidance for the use of radio-frequency identification (RFID) for the handling and tracking of packages, parcels, and flat mail. The standard identifies minimum data requirements as well as semantic and syntactical recommendations. This standard further provides specific recommendations for the air interface communications of RFID devices based on the application requirements identified by the carriers.

Developed by:

MH10 Committee, Unit-Loads and Transport-Packages

Published by MH10 Secretariat:

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American National Standard

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American National Standard

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American National Standards Institute, Inc.

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Foreword   (This foreword is not part of American National Standard MH10.8.8-2006)

Increasingly, commercial and government letter, parcel, and small package carriers are finding needs to have interoperable methods of handling, processing, and tracking of items sent through postal and logistics services. Many industries have adopted the framework of a specific standard, American National Standards (ANS) MH10.8.1, in their implementation of shipper-to-consignee information with respect to optically readable media. This standard addresses the carrier implementation of the MH 10/SC8 standards while expanding the applications to radio frequency identification.

Internationally, the ISO TC 122 (Packaging)/TC 104 (Freight Containers) Joint Working Group – Supply Chain Applications of RFID is addressing standards for product packages (ISO 17366) and transport units (ISO 17365). There is a close coordination between the efforts of the international community and the development of this standard.

At the time of approval, the MH10 Committee consisted of the following members:

AIM, Inc.
American Trucking Associations
American Wood Packaging Association
APA – The Engineered Wood Association
Association of American Railroads
Assoc. of Professional Material Handling Consultants
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Textile Bag Manufacturers Association
U.S. Dept. of Agriculture
U.S. Dept. of Defense Logistics
U.S. Forest Products Laboratory
Uniform Code Council
United Fresh Fruit & Vegetable Association
United Parcel Service

At the date of approval of this standard, the MH10.8 Committee consisted of the following members:

AIAG
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ATA
Boeing
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Canada Post
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Telecordia Tech/ATIS BCSC
Texas Instruments
Uniform Code Council
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USPS

Suggestions for improvement, and questions regarding interpretation of this standard will be welcome. They should be sent to: MH 10 Committee (MHIA), Material Handling Industry of America, 8720 Red Oak Blvd., Suite 201, Charlotte, NC, 28217-3992 or mhstandards@mhia.org.

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RADIO FREQUENCY IDENTIFICATION FOR PACKAGES, PARCELS, AND FLAT MAIL

1   SCOPE

This standard provides guidance for the use of radio-frequency identification (RFID) for the handling and tracking of packages, parcels, and flat mail from the pickup to the delivery of the item. This standard does not address any warehousing or inventory control requirements of package logistics.

The standard identifies minimum data requirements as well as semantic and syntactical recommendations. This standard further provides specific recommendations for the air interface communications of RFID devices based on the application requirements identified by the carriers.

This standard does not supersede or replace any applicable safety or regulatory marking or labeling requirements. The standard is to be applied in addition to any other mandated labeling requirements. This standard covers all mailable items other than letter mail.

In this document the term label refers to an adhesively applied media capable of being marked with information in machine-readable and/or human-readable form and does not apply to direct marking on the package or to RFID embedded in the packaging material.

2   NORMATIVE REFERENCES

ISO/IEC 15418	GS1 Application Identifiers and ASC MH10.8 Data Identifiers
ISO/IEC 15434	Information technology – Automatic identification and data capture techniques – Syntax for high capacity ADC media
ISO/IEC 15459-1	Information Technology – Unique identification – Part 1: Unique identification of transport units
ISO/IEC 15459-2	Information Technology – Unique identification – Part 2: Registration procedures
ISO/IEC 15459-3	Information Technology – Unique identification – Part 3: Common rules for unique identification
ISO/IEC 15459-4	Information Technology – Unique identification – Part 4: Unique item identification for supply chain management
ISO/IEC 15961	Information technology – Radio frequency identification (RFID) for item management – Data protocol: application interface
ISO/IEC 15962	Information technology – Radio frequency identification (RFID) for item management – Data protocol: data encoding rules and logical memory functions

ISO/IEC 15963	Information technology – Radio frequency identification (RFID) for item management – Unique identification for RF tags
ISO/IEC 17365	Supply chain applications of RFID – Transport units
ISO/IEC 17366	Supply chain applications of RFID – Product packaging
ISO/IEC 18000, Part 3	Information technology – Automatic identification and data capture techniques – Radio-frequency identification for item management, Part 3: Parameters for air interface communications at 13.56MHz
ISO/IEC 18000, Part 6	Information technology – Automatic identification and data capture techniques – Radio-frequency identification for item management, Part 6: Parameters for air interface communication at 860 – 960 MHz
ISO/IEC 18000, Part 7	Information technology – Automatic identification and data capture techniques – Radio-frequency identification for item management, Part 7: Parameters for active RFID air interface communications at 433 MHz
ISO/IEC 18046	Information technology – Automatic identification and data capture – RFID device performance test methods
ISO/IEC TR 18047-3	Information technology – Radio frequency identification device conformance test methods – Part 3: Test methods for air interface communications at 13.56 MHz
ISO/IEC TR 18047-6	Information technology – Automatic identification and data capture techniques – RFID device conformance test methods – Part 6: Test methods for air interface communications at 860 – 960 MHz
ISO/IEC TR 18047-7	Information technology – Automatic identification and data capture techniques – RFID device conformance test methods – Part 7: Test methods for air interface communications at 433 MHz
ISO/IEC 19762	Information technology – AIDC techniques – Harmonized vocabulary
ANS MH10.8.1	Data Identifier and Data Capture Techniques Used in Shipping, Receiving, and Transport Applications
ANS MH10.8.2	Data Identifier and Application Identifier Standard
GS1 General Specifications	GS1 General Specification
EPCglobal™ Tag Data Standard v1.3	EPCglobal™ Tag Data Standard v1.3
AIM SAG-0501	AIM Global Standard for the use of the AIM RFID Emblem™ and Index to identify RFID-enabled labels

3   TERMS AND DEFINITIONS

For the purposes of this document, the terms and definitions given in ISO/IEC 19762 and the following apply.

3.1 **carrier pickup –** process of tendering a single or multiple non-aggregated items(s) not containerized or associated with a unit load at the time of pickup.
Note: Aggregated carrier pickup (e.g. items in pallets, returnable containers, etc.) is an extension of the transportation process.

3.2 **container –** non-specific terms for a receptacle capable for closure (adapted from ISO 830).

3.3 **delivery –** process of tendering the item to consignee.

3.4 **delivery preparation –** process of placing items into a vehicle for delivery.
Note: Can be loose or containerized. Sometimes called pre-loading.

3.5 **dock operations –** process of loading or unloading vehicles at a facility.
Note: May include the process of manually separating and sorting aggregated items into newly aggregated items, cross docking etc.

3.6 **flat –** general term for flat-size mail, so called because the mail is sorted without bending so that it remains flat.

3.7 **flat mail (flat-size mail) –** mailpiece that exceeds one of the dimensions for letter-size mail (291 mm long, 159 mm high, 6 mm thick) but that does not exceed the maximum dimension for the mail processing category (381 mm long, 305 mm high, 19 mm thick).
Note: Dimensions are different for automation rate flat-size mail eligibility. Flat-size mail may be unwrapped, sleeved, wrapped, or enveloped.

3.8 **item –** (1) a whole individual unit; especially when included in a list or collection. (2) a distinct part that can be specified separately in a group of things that could be enumerated on a list. (3) a small part that can be considered separately from the whole.

3.9 **label –** an adhesively applied media capable of being marked with information in machine-readable and/or human-readable form.

3.10 **letter mail –** mail processing category of mailpieces, including cards, that do not exceed any of the dimensions for letter-size mail (that is, 291mm long, 159mm high, 6mm thick).

3.11 **mail –** mailable matter that is accepted for mail processing and delivery by a postal operator. Also, the sum total of the mail at any time that is in postal operator custody.

3.12 **package –** containerized group of addressed pieces assembled and secured together to make up a basic unit of bulk items for processing purposes.

3.13 **packaging –** products made of any materials of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from raw material to processed goods, from the producer to the user or the consumer. Non-returnable items used for the same purpose shall also be considered to constitute packaging. Packaging consists of industrial packaging, sales packaging, grouped packaging, and transport packaging (adapted from ISO 21067).

3.14 **parcel –** item that does not meet the mail processing category of letter-size mail or flat-size mail. It is unusually enclosed in a mailing container such as a carton.

3.15 **pure URI –** an abstract name or number used to identify an entity shown as a character string representation.

3.16   **sortation –** process of automatically or manually separating and sorting items or aggregated singulated items into newly aggregated items.

3.17   **tag –** transponder plus the information storage mechanism attached to the object.
Note: The tag is typically either supplied in a paper label or embedded in a corrugated box.

3.18   **transport unit –** either a transport package or a unit load.

3.19   **transport package –** package intended for the transportation and handling of one or more articles, smaller packages, or bulk material (adapted from ISO 21067).

3.20   **transportation –** proves of moving collections of items (singly or aggregated) from one facility to another facility. Includes containers and trailers.

3.21   **UII (Unique Item Identifier) –** identification that uniquely identifies a specific entity during its life (adapted from ISO/IEC 15459).
Note: May be used as a qualifier: UII-Returnable UII-Container UII-Transport, etc.

3.22   **unit load (unitized load) –** one or more transport packages or other items held together by means such as pallet, slip sheet, strapping, interlocking, glue, shrink wrap, or net wrap, making them suitable for transport, stacking, and storage as a unit. In distribution, an item or assembly of items assembled or restrained for handling and transportation as a single entity (adapted from ISO 21067).

3.23   **URI –** uniform resource identifier are short strings that identify resources in the web that provide the means for application software to process compliant resources, for example, EPC tag encodings, either literally i.e. at the bit level, or at various levels of semantic abstraction that is independent of tag variations.

4   APPLICATION DESCRIPTION(S)

4.1   Survey results

A survey was sent to logistics providers to gain information on the RFID needs for handling packages. The results of the survey are shown in Annex A. The following requirements are the committee's interpretation of those results.

4.2   How far?

For each of the application areas the results show the typical distance (minimum and maximum) over which the RFID tag will be expected to function.

	Carrier Pickup	Sortation	Transportation	Delivery Preparation	Delivery	Dock Operations
Tag to Reader Distance						
Range	100mm – 1m	100mm – 2m	Truck loading 100mm – 3m	100mm - 3m	100mm – 1m	100mm – 3m

The above results suggest that the tag could be used as close as 100mm but as far as 3m in different applications.

4.3   How fast

For each of the application areas the results show the typical speed of the package (minimum and maximum) that the RFID tag over which will be expected to function.

	Carrier Pickup	Sortation	Transportation	Delivery Preparation	Delivery	Dock Operations
Speed range of tags for read and write operations	Stationary	1-3 m/s	2-7 m/s	0.5 – 1.5 m/s	Stationary	0 – 1 m/s
Number of tags read or written in the field at one time	1-5	1 to 10	10-100	5 - 40	1 to 5	>=40
Singulation (Identify one tag from among many)	Yes	Yes	Yes	Yes	Yes	Yes
Spatial Separation / Tags to One and the Other	5 mm to 150 mm	5 mm to 150 mm	5 mm to 150 mm/	5 mm to 150 mm	5 mm to 150 mm	5 mm to 150 mm

Note: Tags closer than 10mm could show reduced functionality. Tags and readers must be appropriately selected.

4.4   How much

For each of the application areas the results show the amount of data that the RFID tag will be expected to handle.

	Carrier Pickup	Sortation	Transportation	Delivery Preparation	Delivery	Dock Operations
Number of characters stored on tag and being transferred during read or write	<= 500	<= 500	<= 500	<= 500	<= 500	<= 500

For each application the results show how the data should be treated.

Read specific field without reading entire tag	Yes
Data changed or appended during tag life	Yes
Data Encryption	Yes
Unique tag ID	Yes

4.5   How many

For each of the application areas the results show the typical speed of the package (minimum and maximum) that the RFID tag over which will be expected to function.

	Carrier Pickup	Sortation	Transportation	Delivery Preparation	Delivery	Dock Operations
Maximum number of tags in field	Up to 500	5 to 20	Up to 5000	5 to 20	Up to 500	Up to 40
Multiple tags read at same time?	Yes	Yes	Yes	Yes	Yes	Yes
Read/write a continuous flow of multiple tags	Yes	Yes	Yes	Yes	Yes	Yes

4.6   Environmental conditions

The following environmental conditions are common across all the applications.

8. Environmental Conditions	
Operating Temperature	-20 to +60 C
Non-operating Temperature	- 40 to +85 C
Humidity	5% - 100% @ 50C for 8 hours
Shock	TIA/EIA 603 para 3.3.4
Vibration	TIA/EIA 603 para 3.3.5
Tag life	Single use or reusable

4.7   General characteristics

The following general attributes were recorded for the various applications:

Read-only/Read-write	Read/write
Orientation (perpendicular/omni-directional)	Omni
Metal storage racks/cages? – Proximity	Yes (25mm – 600mm)
Obstructions	Yes
Visible/embedded (plastic, cardboard, wood metal)	Visible/Embedded
Requisite mounting apparatus	Adhesive backed
Requisite tag size (height, width, thickness)	No requirement, thickness shall not impede the use of the tag (printing etc.)
Reclaimable/Reusable tag	Yes

Note: Labels that include an RFID tag must be printed with care. Printers that are designed to print RFID media must be used.

5   TECHNOLOGY CONSIDERATIONS

5.1   Antenna placement/design

The antenna design on the tag will be appropriate for the frequency and application chosen. Location of this chip/antenna on a label shall be such that the following considerations are given:

- The location of the RFID chip should not interfere with any printing that has to be applied to the label.
- The printing process, label design, and tag design shall be selected to minimize damage to tags and printers during processing.
- The location of the chip/antenna should be such that normal use of the label does not require the antenna to be bent.
- Labels should always be placed on an object such that they are in the most stable position and not on the seam of a parcel or package.
- Flat mail, packages and parcel may include metallic content and the label shall be designed and placed accordingly.
- ISO/IEC 24729-1 provides guidance on implementation, including label placement. Design of reader antenna systems should be appropriate to the location and orientation of the antenna on the object.

5.2   Frequency applicability

ISO/IEC JTC 1/SC 31 has defined acceptable international air interfaces for RFID standards and the basic properties of each are listed below.

Table 1 – Properties of popular RFID frequencies

Regulation	Frequency	Regulation	Range	Data Speed	Comments
ISO/IEC 18000, Part 2	125-150 kHz	Basically unregulated	< 1 m	Low	Animal identification and factory data collection systems
ISO/IEC 18000, Part 3	13.56 MHz	ISM band, differing power levels and duty cycle	< 1 m	Low to high	Popular frequency for I.C. Cards (Smart Cards), ISO 17364, ISO 17366, ISO17367, EPCglobal
ISO/IEC 18000, Part 4	2450 MHz	ISM band, differing power levels and duty cycle	1 – 2 m	High	IEEE 802.11b, Bluetooth, CT, AIAG B-11
ISO/IEC 18000, Part 6	860-960 MHz	ISM band (Region 2); increasing use in other regions, differing power levels and duty cycle	2 – 5 m	Low to moderate	MH10.8.4 (RTI), AIAG B-11 (Tires), EPCglobal, ISO 17364, ISO 17365, ISO 17366, ISO 17367
ISO/IEC 18000, Part 7	433 MHz	Non-specific Short Range Devices (SRD), Location Systems	1 – 100 m	Moderate	Container security and tracking, asset tracking for DoD (Pallets-containers)

The following requirements are identified above (section 4):

Read range: 100 mm to 3 m
Data content: Up to 512 characters
Read speed: Tags moving from 0 to 3 m/s
Field of view: 1 to 100 tags per second

Based on the application requirements stated above the better frequency range for battery-less, passive tags, for applications of 0 – 3 meters – ISO/IEC 18000, 6 is most suitable.

6 TECHNOLOGY CONSIDERATIONS

6.1   Principles

The purpose of an RF tag within package, parcel, and flat mail applications is to support the carrier's material handling application while providing the opportunity of added value to the consignees and consignors. The minimum amount of data, in an RF tag, and in human readable form, is dependent on the requirements of the carrier. Where an RF tag is used in conjunction with electronic databases and/or electronic data interchange (EDI) systems the amount of data may be significantly reduced and may consist of only one piece of data, the unique identifier for the package, parcel, or flat mail piece. Different consignees and consigners have different information requirements. Some information may be common to two or more trading partners while other information may be specific to a single trading partner. Information for various trading partners becomes available at different times, e.g.:
- product specific information at the point of manufacture or packaging

- order processing information at the time of processing the order
- transport information at the time of shipment.

Trading partners may find it necessary to include significant data elements to support the information needs of all trading partners including the carrier which may be presented both in RF tags and human readable form.

6.2   Unique Identifier (UII)

The labeler applies an identifier to each mail piece prior to shipment in conformance with the carrier's requirements. This is a common requirement for all label formats specified by this standard. The identifier or "license plate" is the key providing access to information stored in computer files and which may be transmitted electronically. The identifier may be used by all of the trading partners to retrieve information about the mail piece itself or about the status of the physical movement of the mail piece along the supply chain. It enables systems to track and trace individual mail pieces.

6.3   Label formats

6.3.1   Base item label/tag

The Base Label defined by this standard includes the data that fulfills the minimum requirements of all trading partners in a supply chain when data is exchanged electronically between the parties involved.

A Unique Transport Unit Identifier shall be included on the Base Label. All Base Labels attached to the Transport Unit shall be identical.

In addition to the Unique Transport Unit Identifier (license plate), it is recommended to provide the following information on a Base Label:

- Ship From address (to be able to return the shipment in the case delivery was not possible),
- Ship To address (for shipment delivery),
- key to the carrier's database (if the license plate is not this data element),
- key to the customer's database (if the license plate is not this data element).

6.3.2   Extended mail piece label/tag

In practice, fully automated communication channels which make it possible to rely exclusively on electronic files for retrieving information on the movements of the mail pieces are not always available. For this reason, there may be a need to indicate relevant information on the mail pieces themselves, in addition to their identification.

The Extended label/tag is used when the data available from the Base label/tag is not sufficient to satisfy the requirements of all trading partners. In order to facilitate the processing and interpretation by trading partners, information provided in the Extended label/tag is organized in three segments:
- Carrier segment. In addition to the key to the carrier's database this segment may contain additional data, such as shipment identification and delivery instructions;
- Customer segment. In additional to the pointer to the customer's database, this segment may contain additional data such as the customer part number;
- Supplier segment. Additional data may be generated by the supplier, such as product identification, batch number, and dimensions.

7   DATA STRUCTURE

7.1   Data

The data encoded on the tag shall either be of a license plate type application or a data rich application.

7.1.1   License plate application

In the case of a license plate application, the registration authority for the application shall be as defined in ISO/IEC 15962 AFI field.

7.1.2   Data rich application

The information contained in the tag will conform to 7.3 below.

7.2   Data presentation

7.2.1   Data semantics

Data elements shall include the appropriate identifiers called out in either the GS1 General Specifications (Application Identifiers) or within the ANS MH10.8.2 (Data Identifiers). These conventions comply with ISO/IEC 15418, GS1 *Application Identifiers and ASC MH10 Data Identifiers.*

7.2.2   Data syntax

When mutually agreed by trading partners, information beyond the Unique Item Identifier may also be provided in the mail piece label/tag. Data syntax for such mail pieces shall be in accordance with ISO/IEC 15434, *Syntax for high capacity ADC media*. Only Format Indicators "01" (Carrier Sortation & Tracking), "05" (EAN/UCC Application Identifiers), and "06" (Using Data Identifiers) shall be used.

7.2.3   Data in human readable form

The human readable information representing the data presented in the label/RF tag shall be provided on the mail piece.

7.3   Data elements

7.3.1   Unique item identifier (UII) (Mandatory)

A unique item identifier (UII) shall be assigned by the labeler prior to shipment of each item. The item identifier shall be preceded by the appropriate Application Identifier or Data Identifier. The structure of the item identifier is defined in ISO/IEC 15459-1. The item identifier:
1. starts with the Issuing Agency Code (IAC), assigned to the issuing agency by the Registration Authority;
2. conforms to a format specified by the issuing agency;
3. is unique in the sense that no issuer re-issues a number until a sufficient period of time has passed so that the first number has ceased to be of significance to any user (one year is a recommended minimum);
4. contains only numeric and upper case alphabetic characters (not including lower case characters or punctuation marks);

5. if an Application Identifier for an SSCC is used (00) the UII will contain 20 characters or the "pure URI" as defined in the EPCglobal™ Tag Data Standard v1.3. If a Data Identifier is used up to 35 characters may be used.

The unique transport unit identifier shall be either:
- the SSCC, that uses Application Identifier "00";
- the unique transport unit identifier using the ANS MH10.8.2 Data Identifier "J".

7.3.2 TAG Unique identifier (TAGID) (Mandatory)

The TagID is a unique number encoded in the RFID integrated circuit during manufacture to enable the tracking of the IC. This number is not related to the unique number assigned to the item that the tag is placed on. ISO/IEC 15963, *Automatic identification – Radio Frequency Identification for item management – Unique identification for RF* tags provides for the unique identification of RF tags.

The Unique identifier as defined by ISO/IEC 15459, *Information technology – Item Management – Unique item identification for supply chain management*, provides for the establishment of license plates for tracking items.

RF tags as defined in this standard shall comply with both ISO/IEC 15963 and ISO/IEC 15459.

7.3.3 Ship to (Optional)

The "Ship to" data element refers to the address of the party to which items are to be delivered. When used, it shall be represented in a maximum of five lines of human readable characters comprised of no more than 35 alphanumeric (an..35) characters each.

7.3.4 Ship from (Optional)

The "Ship from" data element refers to the address of the party to which items are to be returned, in case the shipment was unable to be delivered. When used, it shall be represented in a maximum of five lines of human readable characters each comprised of no more than 35 alphanumeric characters (an..35).

7.3.5 Key to carrier's database (Optional)

If the unique transport unit identifier described in 7.2.1 above does not provide the key to the carrier's database, one or more of the following keys may be used:
- Carrier tracking number that includes class of service
- Carrier code to identify the shipment
- Carrier code to identify the transport unit
- EPC identifying key to carrier's database

7.3.6 Key to consignee's database (Optional)

If the unique transport unit identifier described in 7.2.1 above does not provide the key to the customer's database, one or more of the following keys may be used:
- Consignee's purchase order number
- Part Number
- KANBAN / Pull Signal Number
- EPC identifying key to consignee's database, e.g. SSCC or
- Shipment ID or Unique shipment control number, e.g. TCN, FedEx number, UPS tracking number

7.3.7   Key to consignor's database (Optional)

If the unique transport unit identifier described in 7.2.1 above does not provide the key to the customer's database, one or more of the following keys may be used:
- Consignor's order number
- Tracking Number
- Shipment ID or Unique shipment control number, e.g. TCN, FedEx number, UPS tracking number

7.3.8   Hazardous Material (HazMat) (Optional)

If RFID tags include classification of items that are hazardous for storage, transportation, or use the tag will represent this indication within the user data storage as defined in ISO/IEC 15962.

The data element shall be identified as HazMat with an appropriate Data Identifier (5P or 10P). The following information shall be recorded on the tag:
- Proper Shipping Name as identified by International Maritime Organization (IMO) associated with IMDG (International Maritime Dangerous Goods) (1965) codes
- Emergency Contact – This is a telephone number and a company name. It generally appears under the product description
- IMO Class – Three digits as in "1.2" or "4.1"
- United Nations (U.N.) Number – Four digits, e.g. 2922
- Packaging Group – Choices are I, II or III

This standard does not supersede or replace any applicable safety or regulatory marking or labeling requirements. This standard is meant to satisfy the minimum product identification requirements of numerous applications and industry groups. As such its applicability is to a wide range of industries, each of which may have specific implementation guidelines for this standard. This standard is to be applied in addition to any other mandated labeling requirements.

7.3.9   Other data elements (Optional)

As much additional data as required may be included in the Extended label to fulfill the needs of the supplier, carrier, and customer.

8   DATA SECURITY

8.1   Data integrity

Tags shall have the ability to protect their data to prevent the alteration or erasure of data commonly known as "locking" data. This shall be at the discretion of the user. Tag manufacturers shall have the option of locking a portion of the tag data for identification and storage of data related to that manufacturer and not the user.

8.2   Confidentiality

Tag users desiring to protect their data shall have the ability to store the data in an encrypted form. The encryption process shall be external to the tag. The mandatory required data shall not be encrypted. The tag shall be capable of having encrypted data written to it and read from it without interference from the tag design or structure. Use of this feature shall be at the discretion of the user and will be agreed by trading partners.

8.3   Identification of RFID labeled material

A tag may be marked to show that an RFID tag is present. The mark shall conform to the AIM Global Standard for the use of the AIM RFID Emblem™ and Index to identify RFID-enabled labels SAG-0501, V2.01. Information on this standard may be obtained from http://www.aimglobal.org/rfidmark.asp.

9   TAG OPERATION

9.1   Data protocol

The data protocol for RF tags shall support the requirements of ISO/IEC 15961 and ISO/IEC 15962. The data syntax and semantics shall be as identified in Clause 7.1 of this American National Standard.

9.2   Minimum performance requirements

Range and rate performance requirements shall be stated as set forth in ISO/IEC 18046. Minimum performance requirements are defined in section 5.2. Passing speed, range, discrimination (tag separation) and presentation angle requirements are found in Section 5.2 above.

9.3   Environmental requirements

Minimum environmental requirements are defined in section 4.6.

9.4   Air interface

The air interface requirements for item tag operation are as defined in ISO/IEC 18000-6.

9.5   Memory requirements for application

The suggested memory capacity for license plate tags is 512 bits. The suggested minimum memory capacity for data rich passive tag operations is 512 bytes.

9.6   Safety and regulatory considerations

All tags conforming to this standard shall meet the safety and regulatory requirements of FCC Part 15/EU ERC 70-03/NTIA (as required), to include power, duty cycle and electromagnetic radiation.

9.7   Tag Reliability requirement

The tags used in accordance with this standard shall be capable of being read and if so structured written to with a reliability of 99.99%. The reliability shall be first read and first write reliability. The testing shall be over the environmental conditions specified in Annex C.

9.8   Tag privacy

The nature of tag privacy is such that individual tag applications shall utilize whatever privacy measures they choose provided that the privacy measures do nothing to impact on, interfere with, or deteriorate the operation of other tags in the supply chain. Tags that are intended for use over the supply chain shall have the mandatory data elements readable.

10 MATERIAL

Label material and the method of attaching the label to the transport unit shall be selected to ensure that the label complies with MIL-L-61002, *Military specification, Labels, pressure-sensitive adhesive for bar codes and other markings*, Annex B of this standard and:

- remains attached to the transport unit for the intended life of the label
- remains readable for the life of the label;
- survives the environments for the life of the label, for example, contamination, heat, light, moisture;
- meets disposability requirements.

10.1 Tag recyclability

The recyclability of RF tags is dependent upon the component materials used in the individual tags. In agreement with local regulations mail pieces tagged with RF tags that require recycling, shall be marked with an appropriate logo or other visible symbol that indicates the required recycling. Tags that should be recycled but for which such recycling is not mandated by regulation, statute or operating condition, shall be marked with an appropriate recycling symbol to assist the user in the proper disposal of the tag.

11 CONFORMANCE

The conformance to the required technical specification (i.e. 18000 part 6) shall be measured using ISO/IEC 18047-6.

12 LABEL PLACEMENT

12.1 General considerations

Labels should be affixed at a suitable location where there is a minimum risk of damage. The RF tag should be placed on the same face of the mail piece as the current label. The exact placement shall be specified by the trading partners.

Examples of label placement are shown in Annex E.

13 BIBLIOGRAPHY

ISO 3166-1   Codes for the representation of names and countries and their
                       subdivisions, Part 1: Country Codes

ISO 4217   Codes for the representation of currencies and funds

ISO/IEC 15424   Information technology – Automatic identification and data capture
                       techniques – Data Carrier Identifiers (including Symbology Identifiers)

UPU Standard M82-3   Universal Postal Union – Attribute Definitions

UPU Standard S26-5   Universal Postal Union – License Plates for Parcels

ANSI INCITS:256   Radio-frequency identification (RFID)

13.1 Useful references

13.1.1 aggregation - process of combining items into collections of multiple items by size, destination, etc.

13.1.2 bundle – aggregation of items bound together and treated as a single item.

13.1.3 returnable transport item (RTI) – means to assemble goods for transportation, storage, handling and product protection in the supply chain which are returned for further usage, including for example pallets with and without cash deposits as well as all forms of reusable crates, totes, trays, boxes, roll pallets, barrels, trolleys, pallet collars and lids. The term "reusable transport item" is usually allocated to secondary and tertiary packaging. But in certain circumstances also primary packaging may be considered as a form of RTI. Freight containers, trailers and other similar enclosed modules are not covered by the term "returnable transport item".

13.1.4 totes – form of reusable or returnable transport item.

ANNEX A: SURVEY RESULTS (NORMATIVE)

A.1   SURVEY RESULTS

Company:	Canada Post Corp	FedEx Services	USPS
	Carrier Pickup	**Carrier Pickup**	**Carrier Pickup**
1. Tag to Reader Distance			
1a. Minimum	3 ft	1in	3 ft
1b. Maximum	10 ft	12in	3 ft
1c. Maximum distance for handheld reader, if different	-		-
2. Read-only / Read-write	Read Only	Read-Write	Read Only
3. Tag stationary or moving when read			
3a. If moving, what speed	Stationary	Stationary	Stationary
3b. Tags per second when reading	5	5	1-5 at once
4. Tag stationary or moving when written	na	Stationary	Stationary
4a. If moving, what speed	na		na
4b. Tags per second when writing	na	1	1-5 at once
5. Number of characters transferred during read	Up to 300	Up to 500	Up to 300
6. Number of characters transferred during write	na	Up to 500	Up to 300
7. Number of characters being stored on tag	Up to 300	Up to 500	Up to 300
8. Environmental Conditions			
8a. Temperature	-20 to +60 C	-20 to +55 C	-40 to +60 C
8b. Humidity	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing
8c. Shock	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8d. Vibration	TIA/EIA 603 para 3.3.5	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.5
8e. Tag life	90 days	30 days	Reusable
8f. Chemical Resisitance	No		Yes--environmental
8g. Dirt, dust, precipitation	IP64		Yes--environmental
8h. Rough handling	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8i. Electromagnetic interference	Per ETSI, EMC and RTTE	per FAA requirements	Per ETSI, EMC and RTTE
9. Presence of metal		YES - < 1 in	
9a. Attached to metal?	No	No	No
9b. Metal storage racks/cages? - Proximity	Yes (min 1 inch max 2 ft)	YES	Yes (2" to 2')
10. Orientation (perpendicular / omni-directional)	Omni	Omni	Omni
11. Tag data			
11a. Read specific field without reading entire tag	Yes	Yes	Yes
11b. Data changed or appended during tag life	No	Yes	No
11c. Encryption	No	Yes	No

Company:	Canada Post Corp	FedEx Services	USPS
12. Obstructions	Yes	Yes	Yes
13. Handheld / Fixed position	Handheld	Handheld	Handheld
13a. Batch or RFDC	RFDC	RFDC	RFDC
14. Multiple tags read at same time?		Yes	
14a. Read a continuous flow of multiple tags	Yes	Yes	Yes
14b. Write a continuous flow of multiple tags	No	Yes	Yes
15. Reclaimable / reusable tag	No	No	Yes
16. Unique tag ID	Yes	Yes	Yes
17. Visible / embedded (plastic, cardboard, wood, metal	visible on pkg	Visible	Visible/Embedded
18. Requisite mounting apparatus		Adhesive backed	Low Probability
19. Requisite tag size (height, width, thickness)	flat on pkg	flat on pkg	Dependant on 18
	H = 100 mm max	Must go through a	
	W = 100 mm max	thermal printer.	
	T = 5 mm max	Min. label size 3x4"	
20. Singulation (Identify one tag from among many)	Yes	Yes	Yes
21. Spatial Separation / Tags to One and the Other	min 5 mm	2in	5 mm to 6 in.
22. Movement Speed During Write	na	Stationary	See 4a/b above
23. Movement Speed During Read	Stationary	Stationary	See 3a/b above
24. Group Select	Yes	Yes	Yes
25. Requisite reader size (height, width, thickness)	Handheld - Fits in Portable Data Terminal	Handheld	Handheld - Fits in Portable Data Terminal
	H = 25 mm max	Fit into current	
	W = 25 mm max	courier hand held	
	T = 25 mm max	terminal	
26. Maximum number of tags in field	Up to 500	20	Up to 500
27. Comments	Similar to Delivery	Contents of package tag is placed on might contain metal.	Implementation in this area is conceptualized; no plans for implementation discussed as yet

Company:	Canada Post Corp	FedEx Services	USPS
	Sortation	**Sortation**	**Sortation**
1. Tag to Reader Distance			
1a. Minimum	5 ft	3in	5 ft
1b. Maximum	15 ft	5ft	15 ft
1c. Maximum distance for handheld reader, if different			
2. Read-only / Read-write	Read Only	Read-Write	Read Only
3. Tag stationary or moving when read			
3a. If moving, what speed	500 fpm	600fpm	250 fpm
3b. Tags per second when reading	1	10	1 (singulated) at once
4. Tag stationary or moving when written	na	moving	Moving
4a. If moving, what speed	na	< 200 fpm	250 fpm
4b. Tags per second when writing	na	5	1 (singulated) at once
5. Number of characters transferred during read	Up to 300	Up to 500	Up to 300
6. Number of characters transferred during write	na	Up to 500	Up to 300
7. Number of characters being stored on tag	Up to 300	Up to 500	Up to 300
8. Environmental Conditions			
8a. Temperature	+10 to +40 C	-20 to +55 C	+10 to +40 C
8b. Humidity	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing
8c. Shock	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8d. Vibration	TIA/EIA 603 para 3.3.5	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.5
8e. Tag life	90 days	30 days	Reusable
8f. Chemical Resisitance	No		Yes--environmental
8g. Dirt, dust, precipitation	IP64		Yes--environmental
8h. Rough handling	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8i. Electromagnetic interference	Per ETSI, EMC and RTTE	per FAA requirements	Per ETSI, EMC and RTTE
9. Presence of metal		YES - pan under belt	
9a. Attached to metal?	No	No	No
9b. Metal storage racks/cages? - Proximity	No	YES	Yes--conveyor system
10. Orientation (perpendicular / omni-directional)	Omni	Omni	Omni
11. Tag data			
11a. Read specific field without reading entire tag	Yes	Yes	Yes
11b. Data changed or appended during tag life	No	Yes	No
11c. Encryption	No	Yes	No
12. Obstructions	Yes	Yes	Yes
13. Handheld / Fixed position	Fixed Position	Fixed	Fixed Position
13a. Batch or RFDC	RFDC	RFDC	RFDC

Company:	Canada Post Corp	FedEx Services	USPS
14. Multiple tags read at same time?		Yes	
14a. Read a continuous flow of multiple tags	No	Yes	Yes
14b. Write a continuous flow of multiple tags	No	Yes	Yes
15. Reclaimable / reusable tag	No	No	Yes
16. Unique tag ID	Yes	Yes	Yes
17. Visible / embedded (plastic, cardboard, wood, metal	visible on pkg	Visible	Visible/Embedded
18. Requisite mounting apparatus		Adhesive backed	Low Probability
19. Requisite tag size (height, width, thickness)	flat on pkg	flat on pkg	Dependant on 18
	H = 100 mm max	Must go through a	
	W = 100 mm max	thermal printer.	
	T = 5 mm max	Min. label size 3x4"	
20. Singulation (Identify one tag from among many)	Yes	Yes	Yes
21. Spatial Separation / Tags to One and the Other	50 - 150 mm	2in	50 - 150 mm
22. Movement Speed During Write	na	< 200 fpm	See 4a/b above
23. Movement Speed During Read	500 fpm	600fpm	See 3a/b above
24. Group Select	Yes	Yes	Yes
25. Requisite reader size (height, width, thickness)		Smaller is better	Fit over conveyor @ 4ft max. width
		Must fit with current	
		laser scanners	
26. Maximum number of tags in field	5	20	5
27. Comments		Must be able to locate tag location by its x, y, and z coordinates in the field of view	Implementation in this area is conceptualized; no plans for implementation discussed as yet

Company:	Canada Post Corp	FedEx Services	USPS
	Transportation	Transportation	Transportation (Vehicles/Air Carriers)
1. Tag to Reader Distance			
1a. Minimum	25 ft	6in	4 ft
1b. Maximum	100 ft	20ft	45 ft
1c. Maximum distance for handheld reader, if different			
2. Read-only / Read-write	Read Only	Read-Write	Read/Write
3. Tag stationary or moving when read			
3a. If moving, what speed	10 - 15 mph	10-15mph	5-25 mph
3b. Tags per second when reading	100	100	40-100 at once
4. Tag stationary or moving when written	na	moving	Moving
4a. If moving, what speed	na	<5 mph	5-25 mph
4b. Tags per second when writing	na	10	40-100 at once
5. Number of characters transferred during read	Up to 35	Up to 500	Up to 300
6. Number of characters transferred during write	na	Up to 500	Up to 300
7. Number of characters being stored on tag	Up to 300	Up to 500	Up to 300
8. Environmental Conditions			
8a. Temperature	-20 to +40 C	-20 to +55 C	-40 to +60 C
8b. Humidity	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing
8c. Shock	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8d. Vibration	TIA/EIA 603 para 3.3.5	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.5
8e. Tag life	90 days	30 days	Reusable
8f. Chemical Resisitance	No		Yes--environmental
8g. Dirt, dust, precipitation	IP64		Yes--environmental
8h. Rough handling	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8i. Electromagnetic interference	Per ETSI, EMC and RTTE	per FAA requirements	Per ETSI, EMC and RTTE
9. Presence of metal		YES - Pallet floor	
9a. Attached to metal?	No	No	Yes
9b. Metal storage racks/cages? - Proximity	Yes (min 1 inch max 2 ft)	YES	Yes (2" to 2')
10. Orientation (perpendicular / omni-directional)	Omni	Omni	Omni
11. Tag data			
11a. Read specific field without reading entire tag	Yes	Yes	Entire
11b. Data changed or appended during tag life	No	Yes	Changed/Appended
11c. Encryption	No	Yes	Yes
12. Obstructions	Yes	Yes	Yes
13. Handheld / Fixed position	Fixed Position	Fixed & Handheld	Fixed Position
13a. Batch or RFDC	RFDC	RFDC	RFDC

Company:	Canada Post Corp	FedEx Services	USPS
14. Multiple tags read at same time?		Yes	
14a. Read a continuous flow of multiple tags	Yes	Yes	Yes
14b. Write a continuous flow of multiple tags	Yes	Yes	Yes
15. Reclaimable / reusable tag	No	No	Yes
16. Unique tag ID	Yes	Yes	Yes
17. Visible / embedded (plastic, cardboard, wood, metal	visible on pkg	Visible	Visible
18. Requisite mounting apparatus		Adhesive backed	High Probability
19. Requisite tag size (height, width, thickness)	flat on pkg	flat on pkg	Dependant on 18
	H = 100 mm max	Must go through a	
	W = 100 mm max	thermal printer.	
	T = 5 mm max	Min. label size 3x4"	
20. Singulation (Identify one tag from among many)	Yes	Yes	Yes
21. Spatial Separation / Tags to One and the Other	50 - 150 mm	2in	0.5 in to vehicle separation
22. Movement Speed During Write	na	<5 mph	See 4a/b above
23. Movement Speed During Read	10 - 15 mph	10-15mph	See 3a/b above
24. Group Select	Yes	Yes	Yes
25. Requisite reader size (height, width, thickness)		Smaller is better	Fixed mount at gate or in the yard
		Must fit with current	
		laser scanners	
26. Maximum number of tags in field	Up to 5000	300+	Up to 5000
27. Comments			Requirements identified for reading/writing to tags on vehicles, containers, or handling units

Company:	Canada Post Corp	FedEx Services	USPS
	Delivery		
	Delivery Preparation	**Delivery Preparation**	**Delivery Preparation**
1. Tag to Reader Distance			
1a. Minimum	5 ft	3in	5 ft
1b. Maximum	15 ft	5ft	15 ft
1c. Maximum distance for handheld reader, if different			
2. Read-only / Read-write	Read Only	Read-Write	Read Only
3. Tag stationary or moving when read			
3a. If moving, what speed	250 fpm	100fpm	1-2 mph (walking spd.)
3b. Tags per second when reading	5	10	>=40 at once
4. Tag stationary or moving when written	na	moving	na
4a. If moving, what speed	na	<200fpm	na
4b. Tags per second when writing	na	5	na
5. Number of characters transferred during read	Up to 300	Up to 500	Up to 300
6. Number of characters transferred during write	na	Up to 500	na
7. Number of characters being stored on tag	Up to 300	Up to 500	Up to 300
8. Environmental Conditions			
8a. Temperature	+10 to +40 C	-20 to +55 C	+10 to +40 C
8b. Humidity	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing
8c. Shock	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8d. Vibration	TIA/EIA 603 para 3.3.5	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.5
8e. Tag life	90 days	30 days	Reusable
8f. Chemical Resisitance	No		Yes--environmental
8g. Dirt, dust, precipitation	IP64		Yes--environmental
8h. Rough handling	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8i. Electromagnetic interference	Per ETSI, EMC and RTTE	per FAA requirements	Per ETSI, EMC and RTTE
9. Presence of metal		YES - pan under belt	
9a. Attached to metal?	No	No	No
9b. Metal storage racks/cages? - Proximity	No	YES	Yes (2" to 2')
10. Orientation (perpendicular / omni-directional)	Omni	Omni	Omni
11. Tag data			
11a. Read specific field without reading entire tag	Yes	Yes	Entire
11b. Data changed or appended during tag life	No	Yes	No
11c. Encryption	No	Yes	No
12. Obstructions	Yes	Yes	Yes
13. Handheld / Fixed position	Handheld and Fixed	Fixed & Handheld	Handheld and Fixed
13a. Batch or RFDC	RFDC	RFDC	RFDC
14. Multiple tags read at same time?		Yes	

Company:	Canada Post Corp	FedEx Services	USPS
14a. Read a continuous flow of multiple tags	No	Yes	Yes
14b. Write a continuous flow of multiple tags	No	Yes	na
15. Reclaimable / reusable tag	No	No	Yes
16. Unique tag ID	Yes	Yes	Yes
17. Visible / embedded (plastic, cardboard, wood, metal	visible on pkg	Visible	Visible/Embedded
18. Requisite mounting apparatus		Adhesive backed	Low Probability
19. Requisite tag size (height, width, thickness)	flat on pkg	flat on pkg	Dependant on 18
	H = 100 mm max	Must go through a	
	W = 100 mm max	thermal printer.	
	T = 5 mm max	Min. label size 3x4"	
20. Singulation (Identify one tag from among many)	Yes	Yes	Yes
21. Spatial Separation / Tags to One and the Other	50 - 150 mm	2in	5 mm to 6 in.
22. Movement Speed During Write	na	<200fpm	See 4a/b above
23. Movement Speed During Read	250 fpm	100fpm	See 3a/b above
24. Group Select	Yes	Yes	Yes
25. Requisite reader size (height, width, thickness)		Smaller is better	Fixed mount on ceiling or at door
		Must fit with current	
		laser scanners	
26. Maximum number of tags in field	5	20	5
27. Comments			Implementation in this area is conceptualized; no plans for implementation discussed as yet

Company:	Canada Post Corp	FedEx Services	USPS
	Delivery	**Delivery**	**Delivery**
1. Tag to Reader Distance			
1a. Minimum	3 ft	1in	3 ft
1b. Maximum	10 ft	12in	3 ft
1c. Maximum distance for handheld reader, if different			
2. Read-only / Read-write	Read Only	Read-Write	Read Only
3. Tag stationary or moving when read			
3a. If moving, what speed	Stationary	Stationary	Stationary
3b. Tags per second when reading	5	5	1 (sigulated) at once
4. Tag stationary or moving when written	na	Stationary	na
4a. If moving, what speed	na		na
4b. Tags per second when writing	na	1	na
5. Number of characters transferred during read	Up to 35	Up to 500	Up to 300
6. Number of characters transferred during write	na	Up to 500	na
7. Number of characters being stored on tag	Up to 300	Up to 500	Up to 300
8. Environmental Conditions			
8a. Temperature	-20 to + 60C	-20 to +55 C	-40 to + 60C
8b. Humidity	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing	5% - 95% @ 50C for 8 hours Non Condensing
8c. Shock	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8d. Vibration	TIA/EIA 603 para 3.3.5	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.5
8e. Tag life	90 days	30 days	Reusable
8f. Chemical Resisitance	No		Yes--environmental
8g. Dirt, dust, precipitation	IP64		Yes--environmental
8h. Rough handling	TIA/EIA 603 para 3.3.4	Minimum same as FedEx packaging spec.	TIA/EIA 603 para 3.3.4
8i. Electromagnetic interference	Per ETSI, EMC and RTTE	per FAA requirements	Per ETSI, EMC and RTTE
9. Presence of metal		YES - < 1 in	
9a. Attached to metal?	No	No	No
9b. Metal storage racks/cages? - Proximity	No	YES	Yes (2" to 2')
10. Orientation (perpendicular / omni-directional)	Omni	Omni	Omni
11. Tag data			
11a. Read specific field without reading entire tag	Yes	Yes	Yes
11b. Data changed or appended during tag life	No	Yes	No
11c. Encryption	No	Yes	No
12. Obstructions	Yes	Yes	Yes
13. Handheld / Fixed position	Handheld	Handheld	Handheld
13a. Batch or RFDC	RFDC	RFDC	RFDC
14. Multiple tags read at same time?		Yes	

Company:	Canada Post Corp	FedEx Services	USPS
14a. Read a continuous flow of multiple tags	Yes	Yes	Yes
14b. Write a continuous flow of multiple tags	Yes	Yes	na
15. Reclaimable / reusable tag	No	No	Yes
16. Unique tag ID	Yes	Yes	Yes
17. Visible / embedded (plastic, cardboard, wood, metal	visible on pkg	Visible	Visible/Embedded
18. Requisite mounting apparatus		Adhesive backed	Low Probability
19. Requisite tag size (height, width, thickness)	flat on pkg	flat on pkg	Dependant on 18
	H = 100 mm max	Must go through a	
	W = 100 mm max	thermal printer.	
	T = 5 mm max	Min. label size 3x4"	
20. Singulation (Identify one tag from among many)	Yes	Yes	Yes
21. Spatial Separation / Tags to One and the Other	min 5 mm	2in	5 mm to 6 in.
22. Movement Speed During Write	na	Stationary	See 4a/b above
23. Movement Speed During Read	Stationary	Stationary	See 3a/b above
24. Group Select	Yes	Yes	Yes
25. Requisite reader size (height, width, thickness)	Handheld - Fits in Portable Data Terminal	Handheld	Handheld - Fits in Portable Data Terminal
	H = 25 mm max	Fit into current	
	W = 25 mm max	courier hand held	
	T = 25 mm max	terminal	
26. Maximum number of tags in field	Up to 500	20	Up to 500
27. Comments	Similar to carrier pickup	Must be able to deactivate tags permanently at delivery	Implementation in this area is conceptualized; no plans for implementation discussed as yet

Company:	USPS
	Dock Operations
1. Tag to Reader Distance	
1a. Minimum	5 ft
1b. Maximum	12 ft
1c. Maximum distance for handheld reader, if different	
2. Read-only / Read-write	Read/Write
3. Tag stationary or moving when read	
3a. If moving, what speed	1-2 mph (walking spd.)
3b. Tags per second when reading	>=40 at once
4. Tag stationary or moving when written	Stationary & Moving
4a. If moving, what speed	1-2 mph (walking spd.)
4b. Tags per second when writing	>=40 at once
5. Number of characters transferred during read	Up to 300
6. Number of characters transferred during write	Up to 300
7. Number of characters being stored on tag	Up to 300
8. Environmental Conditions	
8a. Temperature	-40 to +60 C
8b. Humidity	5% - 95% @ 50C for 8 hours Non Condensing
8c. Shock	TIA/EIA 603 para 3.3.4
8d. Vibration	TIA/EIA 603 para 3.3.5
8e. Tag life	Reusable
8f. Chemical Resisitance	Yes--environmental
8g. Dirt, dust, precipitation	Yes--environmental
8h. Rough handling	TIA/EIA 603 para 3.3.4
8i. Electromagnetic interference	Per ETSI, EMC and RTTE
9. Presence of metal	
9a. Attached to metal?	Yes
9b. Metal storage racks/cages? - Proximity	Yes (2" to 2')
10. Orientation (perpendicular / omni-directional)	Omni
11. Tag data	
11a. Read specific field without reading entire tag	Entire
11b. Data changed or appended during tag life	Changed/Appended
11c. Encryption	Yes
12. Obstructions	Yes
13. Handheld / Fixed position	Fixed Position
13a. Batch or RFDC	RFDC
14. Multiple tags read at same time?	

Company:	USPS
14a. Read a continuous flow of multiple tags	Yes
14b. Write a continuous flow of multiple tags	Yes
15. Reclaimable / reusable tag	Yes
16. Unique tag ID	Yes
17. Visible / embedded (plastic, cardboard, wood, metal	Visible
18. Requisite mounting apparatus	High Probability
19. Requisite tag size (height, width, thickness)	Dependant on 18
20. Singulation (Identify one tag from among many)	Yes
21. Spatial Separation / Tags to One and the Other	5 mm to 6 in.
22. Movement Speed During Write	See 4a/b above
23. Movement Speed During Read	See 3a/b above
24. Group Select	Yes
25. Requisite reader size (height, width, thickness)	Fixed mount on ceiling or at door
26. Maximum number of tags in field	Up to 40
27. Comments	Added this field to identify unique requirements for possibly reading/writing tags on containers or handling units

ANNEX B (NORMATIVE)
LABEL ADHESIVE CHARACTERISTICS

B.1 GENERAL

Observed or calculated values obtained from analysis, measurement, or test shall be rounded off in accordance with the Rounding-Off Method per ASTM E 29 to the nearest unit in the last right-hand place of figures used in expressing the specified limit.

Where reference is made to an ASTM designation in this specification, the issue listed in the latest published ASTM index to standards shall apply unless otherwise specified.

B.2 REQUIREMENTS

The labels shall be capable of meeting the symbology requirements as defined within these guidelines and B.2, Requirements when tested in accordance with Clause B.3, Methods of Test.

B.2.1 Adhesion characteristics

The labels shall show no evidence of delamination, bubbles, adhesive migration or degraded image quality for the text or the RF tag. When a release liner is used, the label adhesive shall also enable the label to be easily removed from the release liner to the back of a page, where pages are stacked, or to the underside of the release liner for roll form labels.

The minimum initial adhesion strength two hours after application shall be 0.23 Newton/mm (25.0 oz/inch).

The minimum adhesion strength after test panel application and conditioning shall be 0.44 Newton/mm (40.0 oz/inch).

The label base material shall be capable of resisting tearing during the adhesion testing specified in Clause B.3 of this standard.

The labels shall show no evidence of delamination, bubbles, adhesive migration or degraded image quality for the text.

B.2.2 Use and protection

Label protection against moisture, weathering, abrasion, etc., may be required in harsh environments and is encouraged wherever practicable. Laminates, sprays, window envelopes, and clear plastic pouches are examples of possible protection methods.

In choosing any protection method, however, care must be taken to assure that labels meet print quality requirements of this Annex when the label or tag is in its final configuration affixed to the package.

B.2.3 Storage conditions

Labels affixed to packages that are to be stored for prolonged periods and which are intended to be subsequently scanned, should be stored in areas which do not consistently maintain temperatures above 120 degrees F (49 degrees C) without being protected.

B.2.4 Longevity

Labels should continue to be scannable on the package and meet the print quality requirements of this standard for a minimum period of 6 months in a protected environment.

B2.5 Blank label stock contamination

Blank label stock purchased for the use of on-site printing shall be free of dust and particulate contamination.

B.3 METHOD OF TEST

B.3.1 Adhesive strength

Obtain a rubber-covered steel roller and prepare at least 2 stainless steel panels per ASTM D 1000, Method A.

B.3.1.1 Label test panel preparation

Remove labels from the release liner and apply at least four labels to an ASTM stainless steel test panel, and roll per ASTM D 1000, taking care to leave approximately 3 mm (0.125 inch) of release liner on each label for clamping purposes.

B.3.1.2 Initial adhesion strength

Remove at least three labels from the release liner, apply them to 1 or more stainless steel panels, and roll per ASTM D 1000, taking care to leave approximately 3 mm (0.125 inch) of release liner on each label for clamping purposes. In 2 hours (±10 minutes, measure the adhesion strength to conform to the requirements of B.2.1 using a crosshead tensile tester making a 90-degree peel (Figure B.1) at a rate of 50 mm (2 inch) per minute using a wire length of approximately 762 mm (30 inch). Calculate the average value of adhesion.

B.3.1.3 Short term 49 degrees centigrade 95% RH – temp/humidity

Place the panel in an oven maintained at 49 degrees Centigrade (120 degrees Fahrenheit) and a controlled relative humidity of 95% non-condensing. At the end of 96 hours remove the panel and allow it to cool at room temperature. Within 1 to 3 hours of removing the panel from the conditioning chamber, measure the bar code print quality of the labels on one panel as defined within these guidelines as appropriate and the adhesion strength of the labels on the other panel in accordance with clause B.3.1 and sub-clauses to determine conformance with the requirements of clause B.2.1. Determine the adhesion strength by measuring the adhesive strength of at least 3 test labels and averaging the results for the overall value. The labels shall show no evidence of self-lifting, delaminating, smudging, or discoloring after conditioning.

B.3.2 Blank label stock contamination

Prior to installing the roll of blank label stock into an on-site printer, a minimum of 50 consecutive labels shall be visually inspected for evidence of dust or particulate contamination. Use either a piece of black cloth or velvet and wipe lightly over the face of the 50 labels, examine the cloth or the velvet for particles or paper, dust or other foreign material. If any particulate is evident to the unaided eye, the test has been failed and the blank label stock shall be considered nonconforming. Nonconforming stock shall not be used.

B.3.3 Recyclability

When possible, the label material should be compatible with the waste stream of the substrate material to which it is attached for recyclabilty.
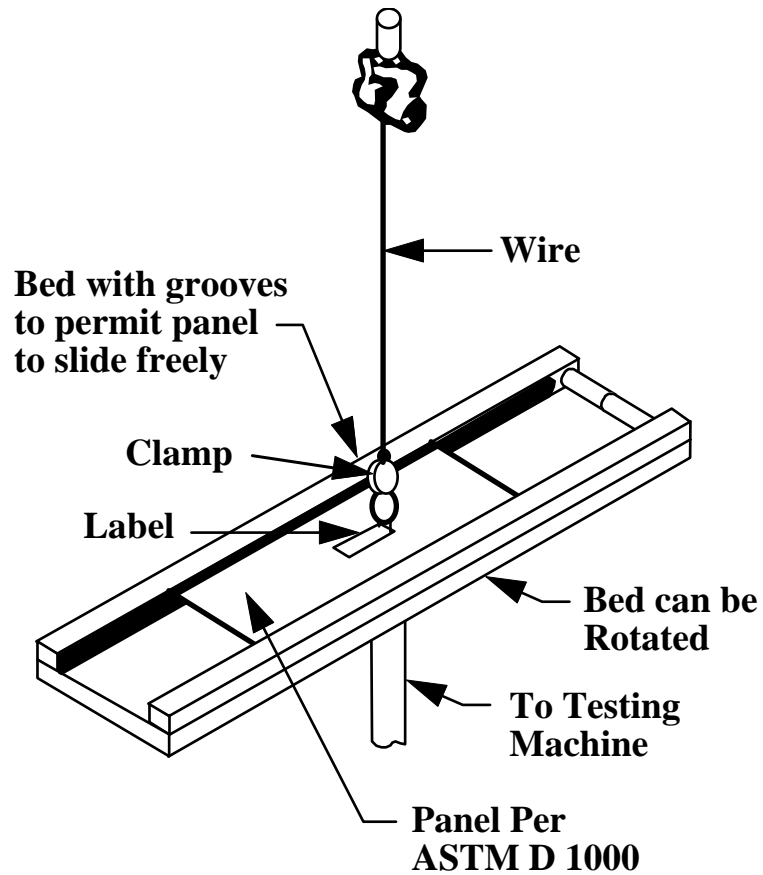
Wire

Bed with grooves to permit panel to slide freely

Clamp

Label

Bed can be Rotated

To Testing Machine

Panel Per ASTM D 1000

Figure B.1 – Adhesion tester

ANNEX C (NORMATIVE)
TESTING

C.1 TESTING OF TAG UNDER VARIOUS ENVIRONMENTAL CONDITIONS

The tag shall function correctly during and after each of the following tests:

Low temperature – IEC 60068-2 (MIL-STD-810 Method 502.2); minimum temperature of -50⁰C.

High temperature – IEC 60068-2 (MIL-STD-810 Method 501.2, Procedure II); cycled between +70⁰C and +38⁰C, temperatures specified in 4.6.1.

Mechanical shock – IEC 60068-2 (MIL-STD-810 Method 615.3, Procedure I); 30g for 11 ms, half-sine pulse.

Random vibration – IEC 60068-2 (MIL-STD-810 Method 520.0, Procedure II); 2 hour duration, axis up to 3g at -50⁰C, ambient, and +70⁰C ambient.

Humidity – IEC 60068-2 (MIL-STD-810 Method 507.2); 95% non-condensing.

Rain – IEC 60068-2 (MIL-STD-810 Method 506.1, Procedure II).

Salt fog – IEC 60068-2 (MIL-STD-810 Method 509.2, Procedure I).

Drop shock – IEC 60068-2 (MIL-STD-810 Method 516.3, Procedure II); height 3.3 m, impact surface 5 cm plywood backed with concrete.

Sand and dust – IEC 60068-2 (MIL-STD-810 Method 510.2).

Electromagnetic environment – The tag shall survive and maintain the integrity of stored data in a maximum peak field strength of 50 V/m for 60 s.

C.2 TESTING OF READING EQUIPMENT

The testing of reading equipment shall be agreed between the user and the supplier.

C.3 TESING OF THE COMPLETE SYSTEM

Testing of the combined system requirements shall be carried out to prove the ability of the system to function properly under normal operating conditions at locations where the system is intended to operate.
a) Normal operating conditions include the following:
b) Temperature: between -50⁰C and +70⁰C;
c) Humidity: up to 100% condensing;
d) Random vibration: frequencies as specified in IEC 68.2 (Mil. Std. 810D Method 520.0, Procedure II) at amplitudes up to 0.29g.

ANNEX D (NORMATIVE)
EXAMPLES

D.1   LABEL EXAMPLES

The following shows examples of labels that may include an RFID tag.

D.1.1   Ship to (Optional)

The "Ship to" data element refers to the address of the party to which items are to be delivered. When used, it shall be represented in a maximum of five lines of human readable characters comprised of no more than 35 alphanumeric (an..35) characters each. Figure D.1 shows the layout of a possible label using "J" ANSI MH10.8.2 Data Identifier license plate and additional trading partner data in 2D symbols.

Figure D.1 – Label using "J" ANSI MH10.8.2 Data Identifier license plate and additional trading partner data in 2D symbols (not to scale)

ANNEX E (INFORMATIVE)
RECOMMENDED LABEL LOCATIONS ON VARIOUS CONTAINERS
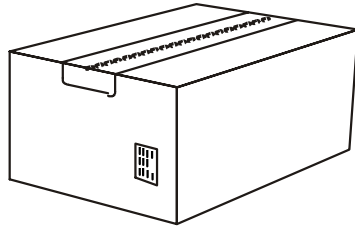
a) Box or carton with transport package label
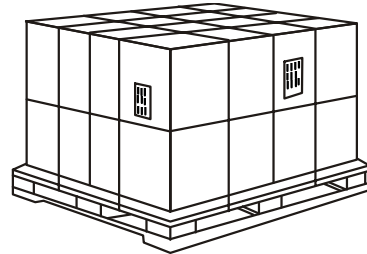
b) Pallet with two unit load labels
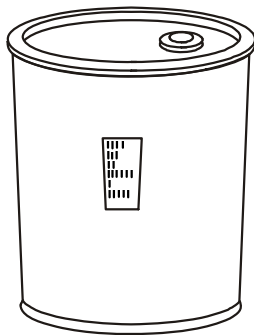
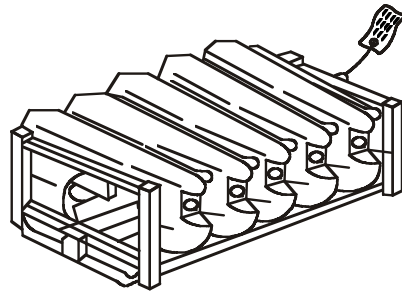**c) Drum, barrel, or cylindrical container**
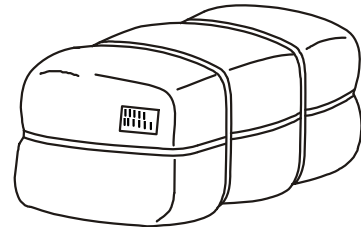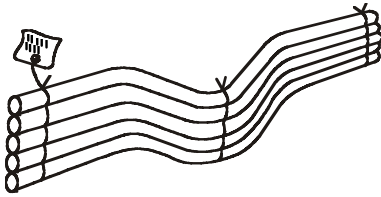
d) Bale
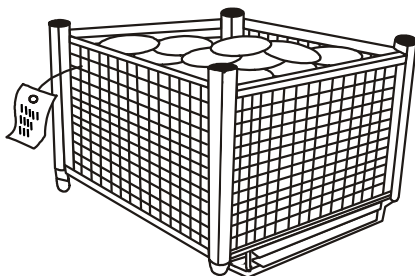
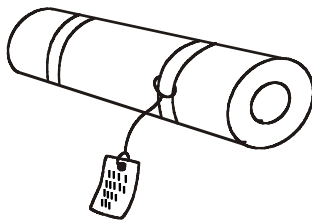**e) Basket, wire mesh container**
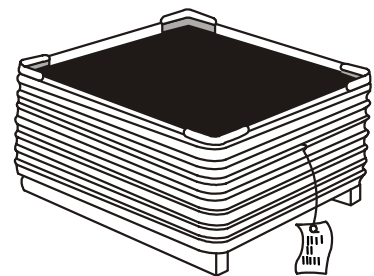
f) Metal bin or tub
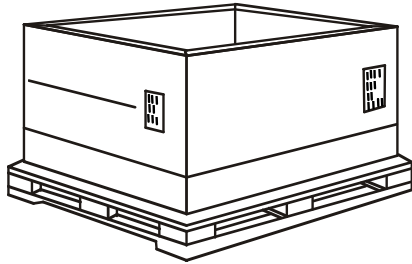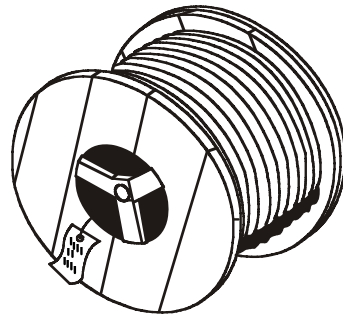
g) Pallet box

h) Rack

i) Bundle
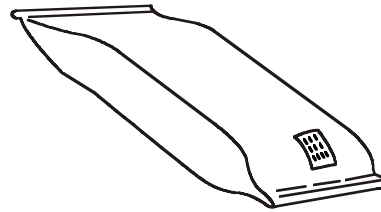
j) Bag

k) Roll or coil

l) Reel of cable

Figure E.1 – Label placement on various packages