

United States Department of Defense Suppliers' Passive RFID Information Guide

Version 8.0

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What's New in this Version

Date of Change	Version	Reason for Change	Summary of Change
3/05	7.0	Policy Update	Updated policy information to detail our phased implementation approach
3/05	7.0	Completed Milestones	Removed items in the “Upcoming Milestones” section that have already passed.
3/05	7.0	EPC update	Updated the definition of EPC Technology to reflect the approval of Gen 2 and note that this type of technology still needs to become readily available.
3/05	7.0	Additional Information	Added the section entitled “Number Formats and Representations”.
3/05	7.0	Data Construct Update	Changed the binary header that specifies that the tag is encoded as a DoD-96 Identity Type
3/05	7.0	Additional Information	Updated terminology in the graphic for the example encoding of a 96-bit tag to focus more on binary elements.
10/05	8.0	EPCglobal Update	Changed “Tag Data Construct” to “Identity Type” to be consistent with EPCglobal terminology.
10/05	8.0	EPCglobal Update	Revised Section 3.7 – Identity Types to reference the EPC™ Tag Data Standards document for instructions on use of EPCglobal Identity Types, including General Identifier (GID-96).
10/05	8.0	Data Construct Update	Updated Figure 2 – Example encoding of a 64-bit tag. The incorrect CAGE code was used in Step 5 in the example resulting in the encoding CE71 133ECEFC1C35 should actually be CE71133E 31FC1C35.
10/05	8.0	Implementation Approach Update	Updated implementation timeline (Section 2.2).
10/05	8.0	Credit Card Requirement Update	Updated Guidelines and Requirements (Section 3.0) to include information concerning exemption of credit purchases from the RFID requirement.
10/05	8.0	Tag Placement Picture Update	Updated Figure 6 in Section 3.8 (Tag Placement) to include a 2 cm border.
10/05	8.0	ASN Information	Updated Section 3.4 with new ASN information.

DoD Suppliers' Passive RFID Information Guide

1. Introduction

1.1 Background

The United States Department of Defense (DoD) is dedicated to becoming an early adopter of passive Radio Frequency Identification (RFID) technology. RFID is a truly transformational technology that will play a vital role in achieving the DoD vision for implementing knowledge-enabled logistic support to the warfighter through fully automated visibility and asset management. Our goal is to employ mature and emerging supply chain technologies to optimize the supply chain. RFID is an integral part of a comprehensive Automatic Identification Technology (AIT) technology suite facilitating accurate, hands-free data capture. RFID, as a part of the AIT technology suite, supports DoD business processes in an integrated end-to-end supply chain enterprise.

In order to achieve this goal, we require cooperation and concerted efforts from many entities, primarily our suppliers and the diverse U.S. military community. The final policy, released in July 2004, requires passive RFID tagging at the case, pallet and the item packaging (unit pack) level, with appropriate contract clause, in accordance with the implementation plan, downloadable from <http://www.dodrfid.org/supplierimplementationplan.htm>. The DoD amended the Defense Federal Acquisition Regulations Supplement (DFARS) via a final rule published on September 13, 2005 to be effective beginning November 14, 2005. This rule requires suppliers to affix passive RFID tags at the case and pallet level for shipments of certain commodities to two specific locations (detailed later in this guide). The DoD has many contracts with its suppliers that are renewed and recompeted regularly. As these new contracts become effective, the requirement for RFID will be included, according to the supplier implementation plan (www.dodrfid.org).

DoD has been actively delivering RFID related information and requirements to its supplier community. Throughout this effort, DoD amended the Defense Federal Acquisition Regulation Supplement (DFARS) clause to include RFID relevant information, held two supplier summits to discuss RFID concepts and concerns, and established open channels of communication with our supplier community.

This document serves as a summary of the Department of Defense's requirements and guidelines related to passive RFID implementation for our supplier community. This guide will be updated as necessary as the technology and supporting business processes evolve.

1.2 Potential Benefits of RFID technology

The benefits associated with RFID technology are numerous for both the Department of Defense and our suppliers. The incorporation of passive RFID technology into certain business processes

will allow the DoD to have hands-free data capture enabling the efficient recording of material transactions as well as gaining increased efficiencies within our supply chain by streamlining our supply chain, improving business functions, and better supporting global war-fighting requirements.

Typically, RFID benefits are seen in the areas of inventory management and visibility, operational improvements, shrinkage and asset tracking. Within each area, there are substantial benefits for the DoD as well as our suppliers, including collaborative benefits. Highlighted benefits include:

Supplier Benefits:

- Improve planning
- Produce faster demand responses
- Reduce the Bull Whip Effect
- Streamline Business Processes
- Improve efficiency in the recall of defective items
- Increase your ability to ensure that your product(s) remain stocked on DoD's shelves
- Receive faster payments for your supplied goods

DoD Benefits:

- Improve inventory management
- Improve labor productivity
- Eliminate duplicate orders
- Replace manual procedures
- Automate receipt and acceptance
- Improve inventory and shipment visibility and management
- Reduce shrinkage
- Enhance business processes within the DoD
- Improve asset tracking

We expect that each supplier will explore its own unique benefits, and determine the most cost effective way to incorporate RFID technology into the organization.

2. Implementation

The DoD views RFID as a means to facilitate accurate, hands free data capture in support of business processes in an integrated DoD supply chain enterprise that, in turn, serves as an integral part of a comprehensive suite of AIT technology. The key to future functionality of the unique item data in the DoD Supply Chain will be the ability to temporarily associate “conditional state” information about the item – whether for transportation, supply management, maintenance, distribution or disposal. In order to accomplish this goal as the available technology matures, the DoD expects to fully embrace the use of EPC technology as well as approved EPC identity types (previously known as tag data constructs) in a supporting DoD data environment. The efficiencies RFID creates are quickly being realized as a valuable component of the suite of Automatic Identification Technology (AIT). Active RFID has already improved the ability to track and trace materiel through the supply chain. Combining the passive RFID technology will create greater efficiencies and data accuracy. Leveraging RFID to the fullest extent possible will improve the ability to get the warfighter the right materiel, at the right place, at the right time, and in the right condition.

Our combined efforts will lay the foundation for improving supply chain efficiencies. The DoD is working with various industry associations to ensure that its suppliers’ implementation approach aligns with the requirements of the policy.

2.1 Definitions

For clarification, the following definitions apply to passive RFID technology and tags in support of the DoD requirement to mark/tag material shipments to DoD activities in accordance with the DoD RFID policy:

EPC Technology: Passive RFID technology (readers, tags, printers, etc.) that is built to the most current published EPCglobal Class 0 and Class 1 specifications and that meets interoperability test requirements as prescribed by EPCglobal™. EPC Technology will include Ultra High Frequency Generation 2 (UHF Gen 2) technology when equipment based on this specification is readily available commercially.

Unit Pack for UID (Unique Identification) Items A MIL-STD-129 defined unit pack, specifically, the first tie, wrap, or container applied to a single item, or to a group of items, of a single stock number, preserved or unpreserved, which constitutes a complete or identifiable package.

Bulk Commodities: These items shall not be tagged in accordance with passive RFID tagging requirements. Bulk commodities are products carried or shipped in rail tank cars; tanker trucks; other bulk, wheeled conveyances; or pipelines.

Examples of bulk commodities are:

- Sand
- Gravel
- Bulk liquids (water, chemicals, or petroleum products)
- Ready-mix concrete or similar construction materials
- Coal or combustibles such as firewood
- Agricultural products – seeds, grains, animal feeds, and the like

In addition, munitions and explosives shall not be tagged until the following certification requirements are met for the passive RFID tag: electromagnetic effects on the environment (E3) and Hazards of Electromagnetic Radiation to Ordnance (HERO).

Case: Either an exterior container within a palletized unit load or an individual shipping container.

Exterior Container: A MIL-STD-129 defined container, bundle, or assembly that is sufficient by reason of material, design, and construction to protect unit packs and intermediate containers and their contents during shipment and storage. It can be a unit pack or a container with a combination of unit packs or intermediate containers. An exterior container may or may not be used as a shipping container.

Shipping Container: A MIL-STD-129 defined exterior container which meets carrier regulations and is of sufficient strength, by reason of material, design, and construction, to be shipped safely without further packing (e.g., wooden boxes or crates, fiber and metal drums, and corrugated and solid fiberboard boxes).

Palletized Unit Load: A MIL-STD-129 defined quantity of items, packed or unpacked, arranged on a pallet in a specified manner and secured, strapped, or fastened on the pallet so that the whole palletized load is handled as a single unit. A palletized or skidded load is not considered to be a shipping container.

2.2 Implementation Approach

Considering the volume of contracts and the variety of commodities managed, the DoD has developed a plan for passive RFID tagging that delivers best value to the warfighting customer. This implementation plan provides a roadmap that targets critical distribution functions within the defense distribution depots, depot maintenance operations and strategic aerial ports.

RFID technology will be implemented through a phased approach, applied both to supplier requirements and DoD sites. Shipments of goods and materials will be phased in by procurement methods, classes/commodities, location and layers of packaging for passive RFID.

For DoD suppliers, the following implementation approach will be followed:

Commencing 2005

RFID tagging will be required for all DoD manufacturers and suppliers who have new contracts, issued with the appropriate contract clause, according to the following implementation guidelines:

The following Classes of Supply will require RFID tags to be placed on all individual cases, all cases packaged within palletized unit loads, and all palletized unit loads:

- Class I Subclass – Packaged Operational Rations
- Class II – Clothing, Individual Equipment, and Tools.
- Class VI – Personal Demand Items
- Class IX – Weapon Systems Repair Parts & Components

When these commodities are being shipped to the following locations:

- Defense Distribution Depot, Susquehanna, PA (DDSP) [DoDAACs: W25G1U and SW3124]
- Defense Distribution Depot, San Joaquin, CA (DDJC) [DoDAACs : W62G2T and W3224]

Commencing 2006

RFID tagging will be required for all DoD manufacturers and suppliers who have new contracts, issued with the appropriate contract clause, according to the following implementation guidelines:

The following Classes of Supply will require RFID tags to be placed on all individual cases, all cases packaged within palletized unit loads, and all palletized unit loads (pending appropriate safety certification):

- Class I – Subclass – Packaged Operational Rations
- Class II – Clothing, Individual Equipment, and Tools
- Class III(P) – Packaged Petroleum, Lubricants, Oils, Preservatives, Chemicals & Additives
- Class IV – Construction & Barrier Equipment
- Class VI – Personal Demand Items
- Class VIII –Medical Materials (except Pharmaceuticals)
- Class IX – Weapon Systems Repair Parts & Components

When these commodities are shipped to DDSP, DDJC and the following:

DEFENSE LOGISTICS AGENCY (DLA)
Defense Distribution Depot, Albany, GA
Defense Distribution Depot, Anniston, AL
Defense Distribution Depot, Barstow, CA
Defense Distribution Depot, Cherry Point, NC
Defense Distribution Depot, Columbus, OH
Defense Distribution Depot, Corpus Christi, TX

Defense Distribution Depot, Hill Air Force Base, Ogden, UT
Defense Distribution Depot, Jacksonville, FL
Defense Distribution Depot, Tinker Air Force Base, Oklahoma City, OK
Defense Distribution Depot, Norfolk, VA
Defense Distribution Depot, Puget Sound, WA
Defense Distribution Depot, Red River, TX
Defense Distribution Depot, Richmond, VA
Defense Distribution Depot North Island, San Diego, CA
Defense Distribution Depot, Tobyhanna, PA
Defense Distribution Depot, Warner Robins, GA

USTRANSCOM

Air Mobility Command Terminal, Charleston Air Force Base, Charleston, SC
Air Mobility Command Terminal, Dover Air Force Base, Dover, DE
Air Mobility Command Terminal, Travis Air Force Base, Fairfield, CA

USA

Shipments sent to the individual Service Maintenance facilities via the co-located DLA depot (addresses shown above) will be tagged.

USMC

Shipments sent to the individual Service Maintenance facilities via the co-located DLA depot (addresses shown above) will be tagged.

USN

Shipments sent to the individual Service Maintenance facilities via the co-located DLA depot (addresses shown above) will be tagged.

USAF

Shipments sent to the individual Service Maintenance facilities via the co-located DLA depot (addresses shown above) will be tagged.

Commencing 2007

RFID tagging will be required for all DoD manufacturers and suppliers who have new contracts, issued with the appropriate contract clause, according to the following implementation guidelines:

All classes of supply that will require RFID tags on all individual cases, all cases packaged within palletized unit loads, all pallets, and all unit packs for unique identification (UID) items.

RFID tagging will be required on commodities that will be tagged which are shipped to any DoD location that has been instrumented.

3. Guidelines and Requirements

The cost of implementing and operating RFID technology is considered a normal cost of business.

Per current DoD regulations, DoD Purchase Cards may be used to acquire items on existing government contracts as well as acquire items directly from suppliers that are not on a specific government contract.

At the current time, Wide Area Workflow (WAWF) is not capable of handling Advance Shipment Notices (ASNs) for items purchased with the use of a DoD Purchase Card. As such, at this time, items purchased with a DoD Purchase Card are exempt from this requirement. However, when the DoD has the capability to accept Advance Shipment Notices for those items procured with the DoD Purchase Card this exemption will be lifted.

The DoD will not endorse any technology or software provider. Suppliers should evaluate available technology and software.

3.1 Contract/Solicitation Requirements

All solicitations awarded with the appropriate contract clause will require that passive RFID tags be affixed at the case, pallet, and UID item packaging level for material delivered to the Department of Defense, in accordance with the implementation plan, which is located above in the section entitled: *“Implementation Approach.”* The plan is also available at: <http://www.dodrfid.org/supplierimplementationplan.htm>. The cost of compliance is an allowable cost under the contract. Additionally, suppliers shall ensure that : (1) the data encoded on each passive RFID tag is unique (i.e. the binary number is never repeated on any and all contracts); (2) each passive tag is readable at the time of shipment; and (3) the passive tag is affixed at the appropriate location on the specific level of packaging.

3.2 Case and Pallet Tagging

After November 14, 2005, cases and pallets of material (except bulk commodities as defined in the Definitions section of this document) will be tagged at the point of origin (manufacturer/vendor) with passive RFID tags for those contracts that contain the appropriate DFARS clause. The RFID tag and data written to the tag must meet the published DoD standards as outlined in the following sections.

3.3 Item Level (UID) Tagging

All items that require a Unique Identification (UID) will be tagged on the item packaging (UID Pack) at origin (manufacturer/vendor) with a passive RFID tag commencing in calendar year 2007 for those contracts that contain the appropriate clause.

Please note that this requirement for RFID tagging of UID items does not replace or affect the current process of assigning and placing unique identification on these items.

3.4 Advance Shipment Notice (ASN) Transactions

The current acceptable method for ASN submission is through Wide Area Workflow (WAWF). The RFID DFARS clause requires that all vendors who are contractually obligated to affix passive RFID tags to material must also send an ASN via WAWF. The ASN is not a new process/transaction, but it is the same existing Material Inspection Receiving Report (MIRR) transaction being sent to WAWF with additional data (RFID data elements) added to the transaction. In April 2005, WAWF added the RFID tag ID as an additional data element in the MIRR.

If you have questions about WAWF, please visit <https://wawf.eb.mil> or contact the DISA Customer Service Center (WAWF Help Desk) at 1-866-618-5988 or 801-605-7095.

WAWF Guides

The WAWF guides can be found at the WAWF Training website at: <https://wawftraining.eb.mil>

- Go to <https://wawftraining.eb.mil>
- Click on Logon to WAWF (Registered user only) ***Note: Click this hyperlink even if you are not a registered user.*
- At the WAWF – Logon page, enter the following account information: Either User ID = Vendor11 and the Password = Vendor1\$ (Case sensitive) or User ID = Vendor22 and the Password = Vendor2\$ (Case Sensitive).
- Click the 'Submit' button.
- Once logged in, users should click on the link entitled: “FTP/EDI Guides & Other Supporting Documents” located in the menu bar on the left side of the Web page.

The five files pertinent to the RFID initiative are:

1. Receiving Report User Defined Format (UDF) Vendor FTP
2. Receiving Report for Pack Update UDF Vendor FTP
3. Combo Invoice & RR UDF Vendor FTP
4. 856 WAWF 4010 EDI Detail Receiving Report
5. 856 Pack Update WAWF 4010 EDI Detail Receiving Report for Pack Update.

EDI and FTP Testing Assistance

To obtain assistance in EDI or FTP testing, vendors must initiate a trouble ticket with the DISA Customer Service Center (WAWF Help Desk) at 1-866-618-5988 or 801-605-7095. The Customer Service Center will put the vendor in contact with the Joint Interoperability Test Command (JITC), who provides EDI and FTP testing assistance.

Additional Information

The Advance Shipment Notice (ASN) transaction enables the sender to relate the passive RFID tag ID at various levels of detail to the contents and configuration of a shipment. The tag ID is written to the tag in binary format. However, within the ASN, you must provide the ID of every RFID tag in a shipment and must represent this passive tag ID in a hexadecimal format. Typically, the hexadecimal format is the format used by passive RFID software in printers and readers thus the binary to hexadecimal translation process should be done automatically by the software.

3.5 Tag Classes and Sizes

The RFID tags listed in **Table 1** will be utilized for initial shipments from suppliers in compliance with appropriate contractual requirements to tag items shipped to DoD receiving points commencing in calendar year 2005.

When the UHF Gen 2 EPC technology is approved and has completed any required compliance and/or interoperability testing, the DoD will establish firm tag acceptance expiration dates (sunset dates) for EPC Version 1 (Class 0 and 1) tags and will accept only UHF Gen 2 EPC tags thereafter. The DoD goal is to migrate to the use of an open standard UHF Gen 2 EPC tag, Class 1 or higher, that will support DoD end-to-end supply chain integration.

Class	User Memory Size (bits)	Sunset Date
0	64	At a minimum, 2 years from the general commercial availability and product maturity of EPCglobal certified UHF Gen 2 tags.
0	96	At a minimum, 2 years from the general commercial availability and product maturity of EPCglobal certified UHF Gen 2 tags.
1	96	At a minimum, 2 years from the general commercial availability and product maturity of EPCglobal certified UHF Gen 2 tags.

Table 1 - Acceptable RFID tags and Anticipated Sunset Dates

3.6 Number Formats and Representations

The following sections of this document discuss the specific details of generating the unique number or ID that must be programmed in each RFID tag, either by a manufacturer in the case of Class 0 read-only tags, or by anyone possessing the appropriate equipment in the case of Class 1 read-write tags. In this guide, numbers may be represented in binary, decimal or hexadecimal format as indicated in the surrounding text. It should be noted that the RFID tag stores its ID in electronic memory which stores data in binary format. Generating the ID being programmed to the tag involves the setting of specific bit patterns in specific positions of the tag memory and thus the contents of the RFID tag are often represented in binary format. However, once determined by the encoding process, this ID can be represented in any base (e.g. 1110 (binary) = 14 (decimal) = E (hexadecimal)).

After the contents of the tag have been determined by the encoding process, suppliers may either order a tag pre-programmed with this ID or program the tag themselves. If ordering a pre-programmed tag, you will provide this ID to the tag supplier in the format specified by the supplier. If programming the tag yourself, the specific software that is used to write the ID to the tag will determine the required number format, often hexadecimal. If you are uncertain of the required number representation required by your software, contact the software provider for details.

Regardless of how the supplier procures the RFID tag, when it is applied to goods being supplied to the DoD, the supplier must transmit an ASN indicating the relationship of this ID to a specific shipment as previously discussed. Within this ASN, a supplier must provide the ID of every RFID tag in a shipment and this ID must be represented in hexadecimal format.

3.7 Identity Types

Suppliers to DoD must encode an approved RFID tag using the instructions provided in the EPC™ Tag Data Standards document. Suppliers that are EPCglobal™ subscribers and possess a unique EPC™ company prefix may use any of the identity types and encoding instructions described in the EPC™ Tag Data Standards document to encode tags. Please consult the EPC™ Tag Data Standards document at: http://www.epcglobalinc.org/standards_technology/specifications.html for details.

Suppliers that choose to employ the DoD Identity Type will use their previously assigned Commercial and Government Entity (CAGE) code and encode the tags per the rules that follow. Regardless of the selected encoding scheme, suppliers are responsible for ensuring that each tag contains a unique identifier.

3.7.1 DoD Identity Type Option

This option should be selected by any DoD supplier that is:

- Not a member of EPCglobal and does not intend to join

- Has already been assigned a CAGE (Commercial Government Entity) code

Similar to the unique company prefix assigned to EPCglobal members/subscribers, the CAGE code is a unique identifier assigned and managed by the DoD. It is a sequence of five alphanumeric characters used to uniquely identify the supplier amongst all other suppliers. It is used to ensure that the RFID tag from a given supplier cannot contain the same identifier as those from another supplier.

The supplier’s CAGE code is required for encoding of all RFID tag classes and sizes. **Table 2** summarizes the selection of an encoding scheme for either 64 or 96 bit tags based on the type of object being tagged and its usage. From these criteria, select an encoding scheme from **Table 2** and then use the appropriate following section to properly encode the tag.

Tag Requirement	Identity Type	When Used
Unit Pack for UID Item	DoD-64 DoD-96	On item packaging for items meeting the DoD criteria for assignment of UID
Case, Transport Package, Palletized Unit Load	DoD-64 DoD-96	Items shipped as either pure or mixed case, pallet

Table 2 - Selecting the proper Identity Type

3.7.2 DoD-64 Identity Type

This identity type should be used to encode 64-bit Class 0 and Class 1 tags for shipping goods to the DoD. The 64-bit tag is broken into a number of fields as indicated in **Table 3**. The details of what information to encode into these fields is explained below. After all the field values have been determined, the entire contents of the tag can be viewed as a single unique number used to identify a shipment to the DoD.

Header	Filter	Government Managed Identifier	Serial Number
8 bits	2 bits	30 bits	24 bits

Table 3 – DoD-64 Identity Type encoding

Fields:

Header – specifies that the tag data is encoded as a DoD 64-bit tag construct, use binary number 1100 1110.

Filter – identifies a pallet, case, or UID item associated with tag, represented in binary number format using the following values:

- 00 = pallet

- 01 = case
- 10 = UID item
- 11 = reserved for future use

Government Managed Identifier – For suppliers, this field will be encoded with their CAGE code. This code identifies the supplier and ensures uniqueness of serial number across all suppliers, and is represented in truncated ASCII format. In order to properly fit the CAGE code within the allocated 30 bit Government Managed Identifier field of the DoD-64 Identity Type, it is necessary to compress the CAGE code using a simple algorithm involving the truncation of the two most significant bits of the standard 8-bit ASCII representation of the characters of the CAGE code. Once truncated, the remaining 6 bits still uniquely identify the original ASCII characters and can be properly decoded after the encoding scheme. **Table 4** details the mapping scheme for this compression.

Serial Number – uniquely identifies up to $2^{24} = 16,777,216$ tagged items, represented in binary number format. After the serial number is converted into binary format, it must be left padded with zeros to 24 bits total. It is the responsibility of the supplier to insure that this is a unique number across all shipments to the DoD.

CAGE code character	Truncated binary value
A	00 0001
B	00 0010
C	00 0011
D	00 0100
E	00 0101
F	00 0110
G	00 0111
H	00 1000
I	Invalid CAGE character
J	00 1010
K	00 1011
L	00 1100
M	00 1101
N	00 1110
O	Invalid CAGE character
P	01 0000
Q	01 0001
R	01 0010
S	01 0011
T	01 0100
U	01 0101
V	01 0110
W	01 0111
X	01 1000
Y	01 1001
Z	01 1010

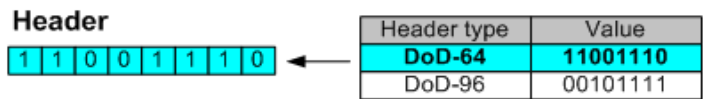
0	11 0000
1	11 0001
2	11 0010
3	11 0011
4	11 0100
5	11 0101
6	11 0110
7	11 0111
8	11 1000
9	11 1001
SPACE	10 0000

Table 4 - Truncated ASCII character to CAGE code character mappings

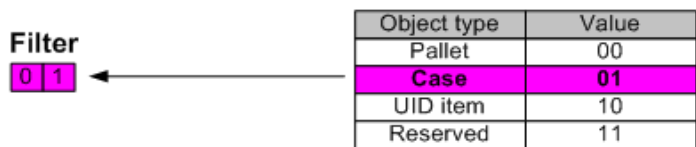
In order to clarify the steps required to encode a tag using the DoD-64 identity type, an example follows. Refer to **Table 7** for hexadecimal conversion assistance.

Encoding example: A supplier with **CAGE code 1D381** wishes to encode a **64-bit tag** for use on a **case** of goods that is uniquely identified with the number **16,522,293**

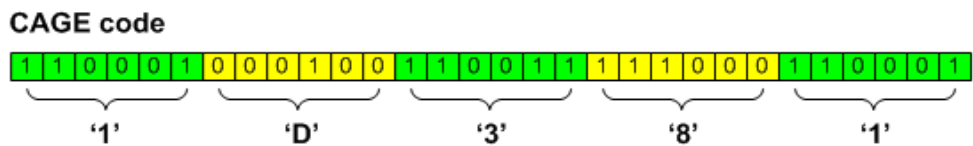
Step 1 Select DoD header value based on tag size



Step 2 Select filter value based on object being tagged



Step 3 Encode CAGE chars using mapping table values



Step 4 Encode unique serial number

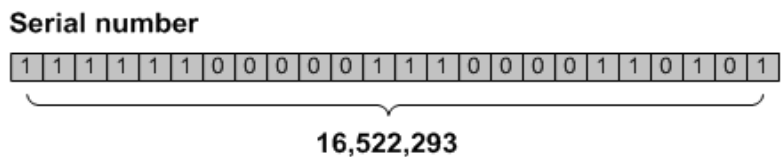
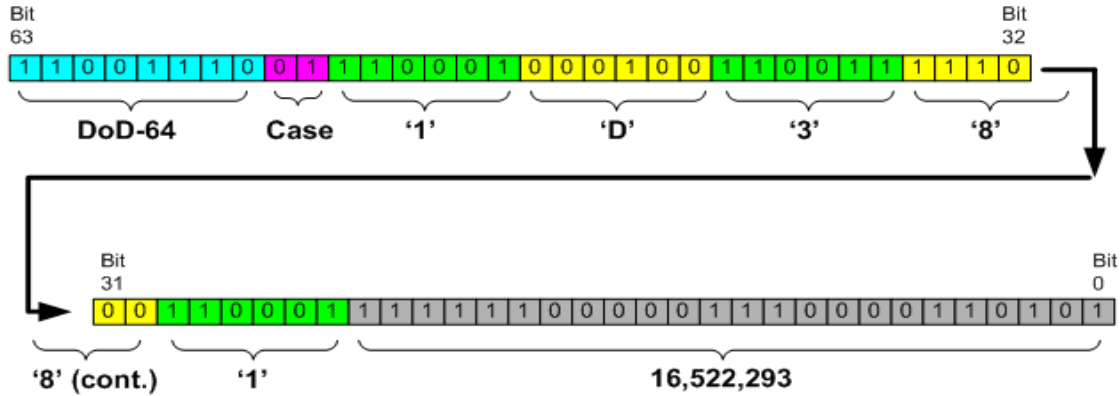
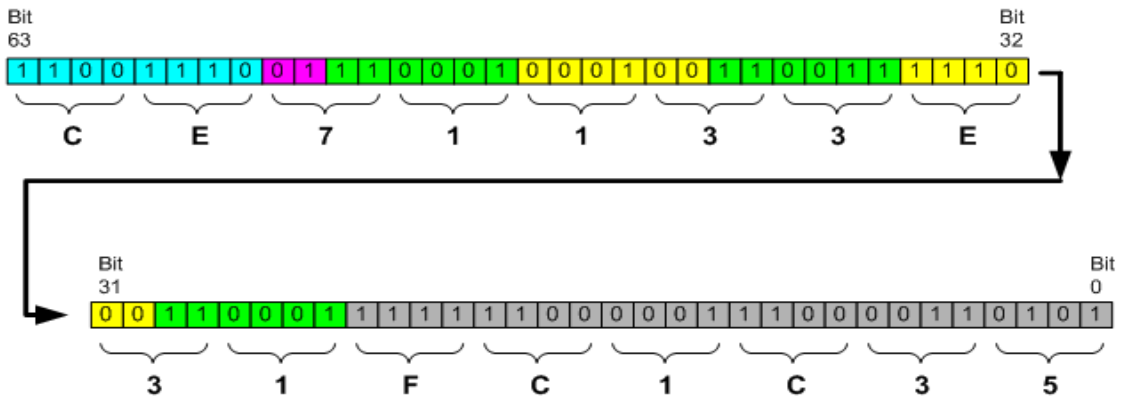


Figure 1 - Example encoding of a 64-bit tag (Steps 1-4)

Step 5 Place the fields into the proper order within the 64-bits of the tag



Step 6 Convert the 64-bit binary (base 2) number into hexadecimal (base 16) format for encoding



The result is a unique number expressed in hexadecimal format that can be written to the tag: **CE71133E31FC1C35**. This is the same number that must be communicated in an ASN EDI document via WAWF.

Figure 2 - Example encoding of a 64-bit tag (Steps 5-6)

3.7.3 DoD-96 Identity Type

This identity type should be used to encode 96-bit Class 0 and Class 1 tags for shipping goods to the DoD. The 96-bit tag is broken into a number of fields as indicated in **Table 5**. The details of what information to encode into these fields is explained below. After all the field values have been determined, the entire contents of the tag can be viewed as a single unique number used to identify a shipment to the DoD.

Header	Filter	Government Managed Identifier	Serial Number
8 bits	4 bits	48 bits	36 bits

Table 5 – DoD-96 Identity Type format

Fields:

Header – specifies that the tag data is encoded as a DoD 96-bit tag construct, use binary number 0010 1111

Filter – identifies a pallet, case, or UID item associated with tag, represented in binary number format using the following values

- 0000 = pallet
- 0001 = case
- 0010 = UID item
- all other combinations = reserved for future use

Government Managed Identifier – For suppliers, this field will be encoded with their CAGE code. This code identifies the supplier and ensures uniqueness of serial number across all suppliers, and is represented in standard 8-bit ASCII format. For the DoD-96 identity type, an ASCII space char must be prepended to the CAGE code to make the code a total of 6 ASCII chars. **Table 6** can be used to determine the correct binary value of any valid CAGE code character.

Serial Number – Uniquely identifies up to $2^{36} = 68,719,476,736$ tagged items, represented in binary number format. After the serial number is converted into binary format, it must be left padded with zeros to 36 bits total.

CAGE code character	Binary value
A	0100 0001
B	0100 0010
C	0100 0011
D	0100 0100
E	0100 0101
F	0100 0110
G	0100 0111
H	0100 1000
I	Invalid CAGE character
J	0100 1010
K	0100 1011
L	0100 1100
M	0100 1101
N	0100 1110
O	Invalid CAGE character
P	0101 0000
Q	0101 0001
R	0101 0010
S	0101 0011
T	0101 0100
U	0101 0101
V	0101 0110
W	0101 0111
X	0101 1000
Y	0101 1001
Z	0101 1010
0	0011 0000
1	0011 0001
2	0011 0010
3	0011 0011
4	0011 0100
5	0011 0101
6	0011 0110
7	0011 0111
8	0011 1000
9	0011 1001
SPACE	0010 0000

Table 6 - ASCII character to CAGE code character mappings

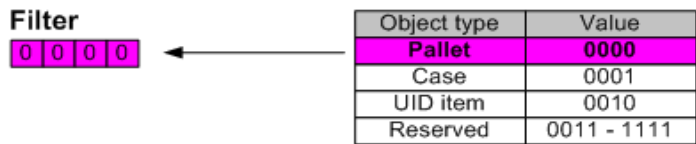
The following figures outline the steps of encoding a 96-bit tag using the DoD-96 identity type. Refer to **Table 7** for hexadecimal conversion assistance.

Encoding example: A supplier with **CAGE code 2S194** wishes to encode a **96-bit tag** for use on a **pallet** of goods that is uniquely identified with the number **12,345,678,901**

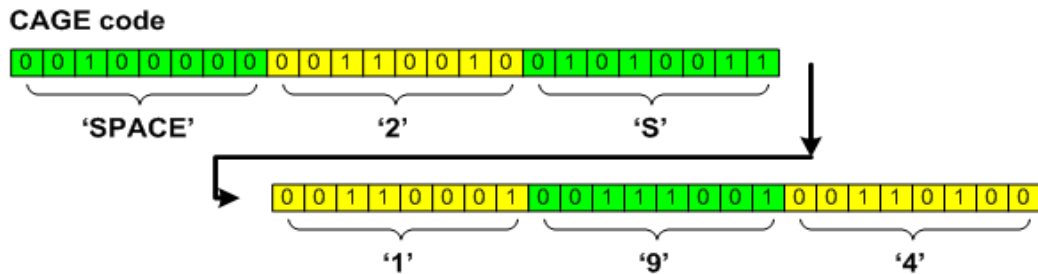
Step 1 Select DoD header value based on tag size



Step 2 Select filter value based on object being tagged



Step 3 Encode CAGE using ASCII values, remembering to pad a SPACE char on the left side



Step 4 Convert unique serial number to binary, left pad to 36 bits

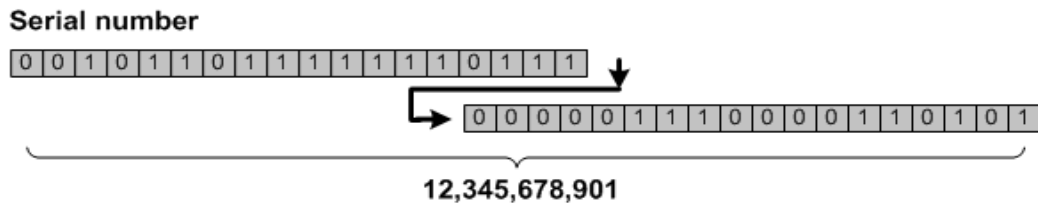


Figure 3 - Example encoding of a 96-bit tag (Steps 1-4)

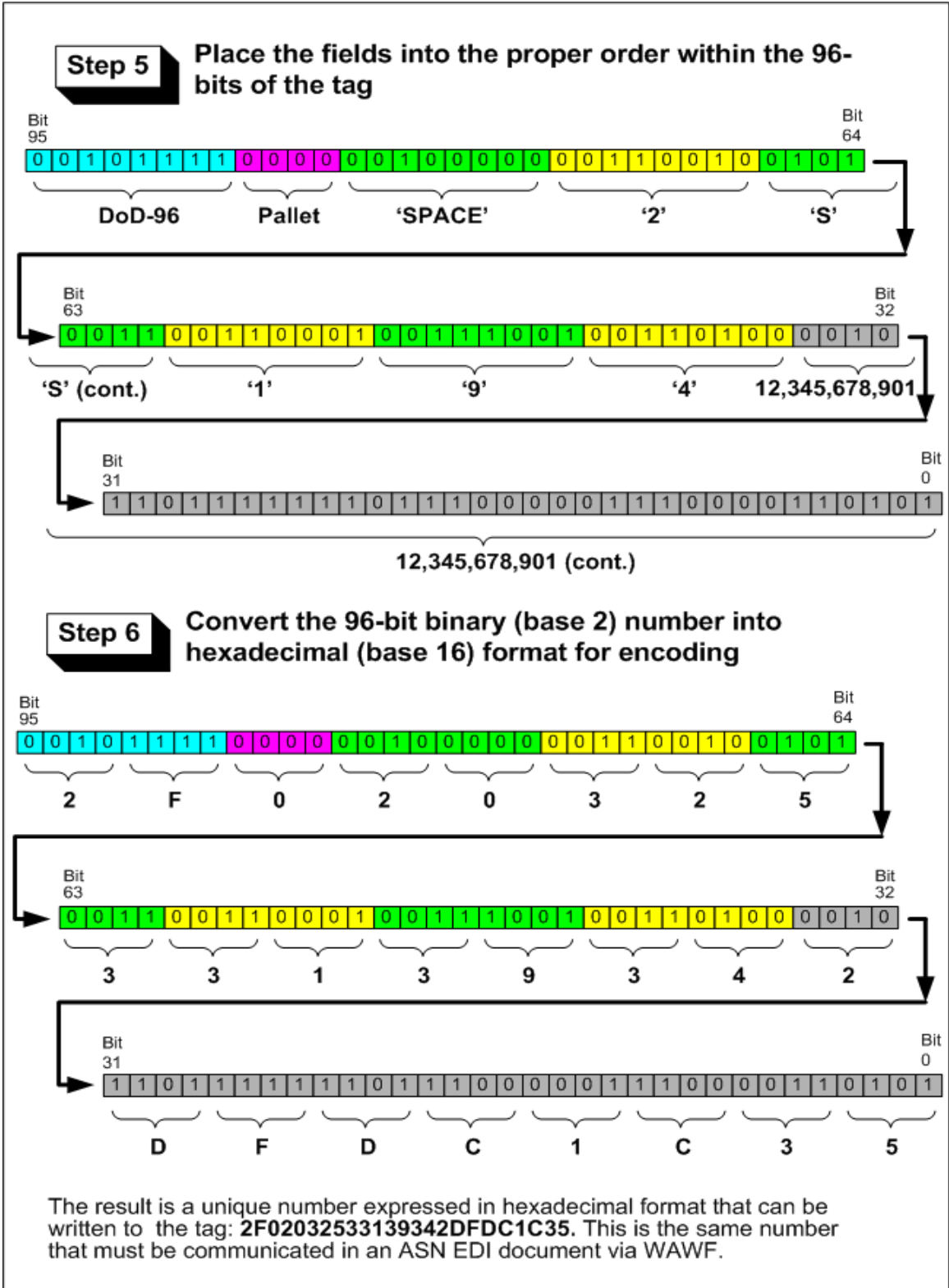


Figure 4 - Example encoding of a 96-bit tag (Steps 5-6)

3.8 Tag Placement

The transponder (RF tag) may be integrated with the shipping label (RFID-enabled labels), or may be an independent entity (where a separate shipping label would also be necessary).

All address labels and RF tags should be affixed at a suitable location where there is a minimum risk of damage and highest potential for successful interrogation.

The bottom edge of the address label containing the unit load information should be within the range of 81 cm to 122 cm (32 to 48 in) from the bottom of the pallet. If the loaded pallet is less than 51 cm (20 in) in height, the label should be placed as high as possible on the pallet, but not closer than 5 cm (2 in) to the natural top of the unit load.

Each unit load shall have one RF tag, independent or part of an address label, which contains the unit load information. Additionally, if the pallet is reusable, there may be a RF tag containing a unique returnable asset identifier.

RFID-enabled labels shall be applied to shipping containers or palletized unit loads as per the standards presented in MIL-STD-129.

- The address label shall be placed on the identification-marked side and right of center on a vertical face, allowing a minimum of 5 cm (2 in) from all edges. An additional address label may be placed on the identification-marked end for styles which, because of their configuration, allow access by materials handling equipment only to the end of the container.
- The RFID-enabled label should not be placed over a seam nor should sealing tape or bands be placed over the label in a manner that interferes with the scanning of the label bar codes or reading the transponder data.
- The RFID-enabled label should not be placed in a manner that overlaps any other existing RF transponder. There should be at least a 10 cm (4 in) separation.
- The RFID-enabled label on a palletized unit load should not be attached to an exterior container if the cargo within the exterior container will not be removed for receipt processing and storage.
- If RFID-enabled address labels are not used, then attach a separate passive RFID tag and a separate address label(s).
- The passive RFID tag should be placed on the identification-marked side and right of center on a vertical face, allowing a minimum of 5 cm (2 in) from all edges.
- A passive RFID tag should not be placed in a manner that overlaps any other existing radio frequency (RF) transponder. There should be at least a 10 cm (4 in) separation.

- The passive RFID tag on a palletized unit load should not be attached to an exterior container if the cargo within the exterior container will not be removed for receipt processing and storage.

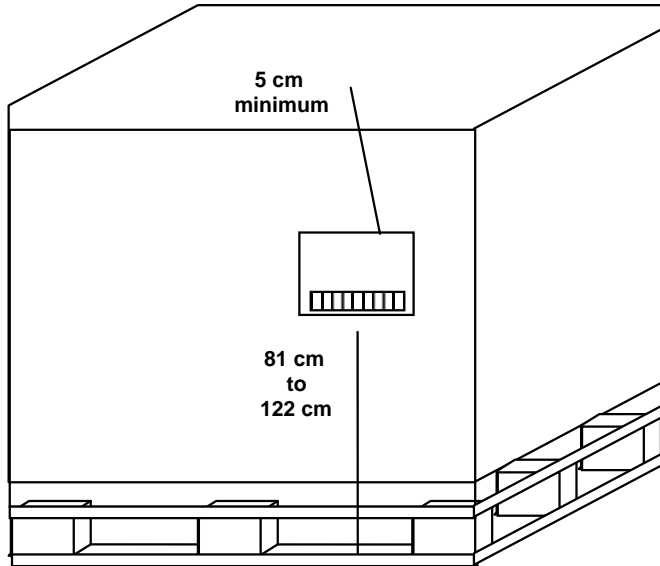


Figure 5 - RFID-enabled label placement on palletized unit load

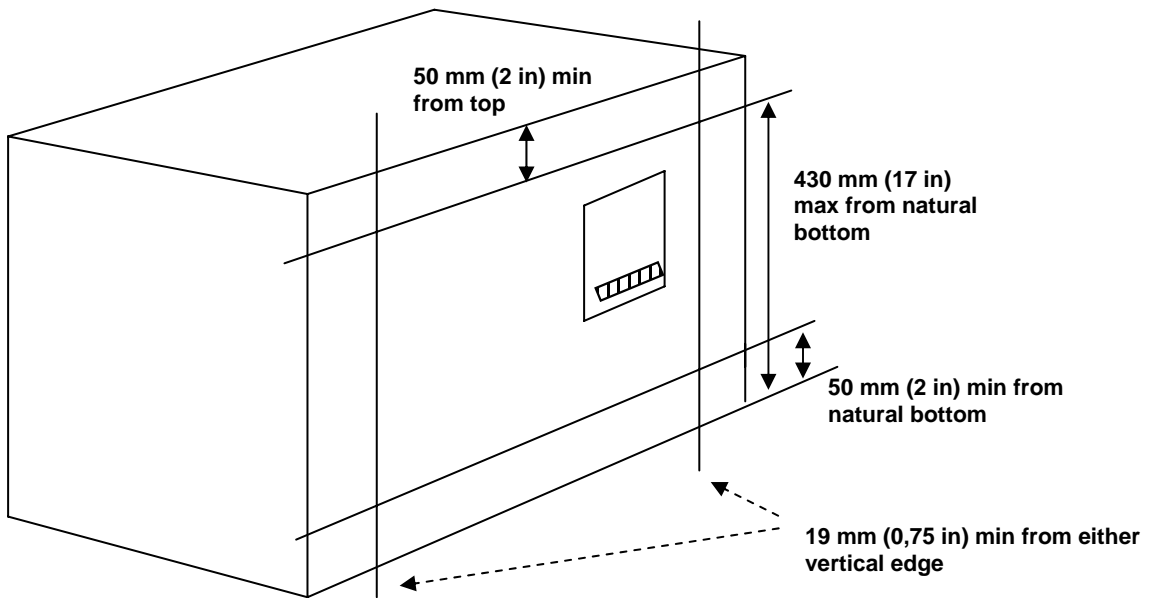


Figure 6 - RFID-enabled label placement on case

3.9 Performance Requirements

For reference, below are our minimum readability performance requirements:

RF tags are expected to meet the Department of Defense's user requirements for:

Portal: For the palletized unit load passive RFID tag, the passive RFID tags on the shipping containers and exterior containers within the palletized unit load, and the UID item unit pack passive RFID tags that are passing through a portal, the read distance shall be at least 3 meters (3.3 yards), reading passive RFID tags at 10 miles per hour (e.g., forklift).

Conveyor: For an individual shipping container passive RFID tag, an individual exterior container passive RFID tag, and the UID item pack passive RFID tag moving on a conveyor, the read distance shall be at least 1 meter (1.1 yards), reading passive RFID tags at 600 feet per minute.

RFID tags may either be permanent or temporary. It is up to the supplier to determine which tag type is best for your organization. Please keep in mind that both of these tag types have their own benefits and possible drawbacks. However, all tags must be durable (properly attached to item/case/pallet) and secure enough to make it through the DoD supply chain without jeopardizing usability.

4. Frequently Asked Questions

For the answers to frequently asked questions as well as additional information regarding the RFID policy please refer to the Department of Defense website <http://www.dodrfid.org>. The website contains FAQs, background information, and Policy to assist your efforts in being RFID compliant.

5. Future Amendments

Future policy amendments may be needed in order to keep up with evolving RFID standards, technology, and the business environments. DoD RFID policies and business rules will continue to be refined as passive RFID capabilities are implemented over the next few months.

Please check for updates to the Supplier Implementation Plan (<http://www.dodrfid.org/supplierimplementationplan.htm>) and this Supplier Passive RFID Information Guide (<http://www.dodrfid.org/supplierguide.htm>), for implementation dates and details as well as detailed information concerning the applicable commodities.

6. Contacts

We strongly encourage suppliers to investigate RFID benefits and applications within their organizations as soon as possible. Below are contacts that will help suppliers in the effort.

- Visit EPCglobal on the internet: <http://www.epcglobalinc.org/>
- Additional information and RFID FAQs are available at <http://www.dodrfid.org>

Please note: This guide is subject to updates and information contained in this guide is subject to change. Please use <http://www.dodrfid.org> to keep abreast of the most current requirements.

7. Acronyms

ASN	Advance Shipment Notice
CAGE	Commercial and Government Entity
EPC	Electronic Product Code
RFID	Radio Frequency Identification
UID	Unique Identification

8. Number Conversion Table

The following table is included as a convenience to the user. It can be used to determine the hexadecimal and binary representations of the decimal numbers 0-15 inclusive.

Decimal	Hex	Binary	Decimal	Hex	Binary
0	0	0000	8	8	1000
1	1	0001	9	9	1001
2	2	0010	10	A	1010
3	3	0011	11	B	1011
4	4	0100	12	C	1100
5	5	0101	13	D	1101
6	6	0110	14	E	1110
7	7	0111	15	F	1111

Table 7 - Numeric conversion