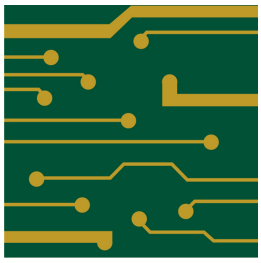
ANSI/HIBC 4.0

THE HEALTH INDUSTRY SUPPLIER STANDARD FOR RFID PRODUCT IDENTIFICATION



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HIBCC SUPPLIER STANDARD FOR RFID

4.0

Credits: This Standard was produced in collaboration with HIBCC Australia and EHIBCC representatives. Questions regarding the document should be directed to HIBCC or one of these offices.

This standard has been written as a technical specification for coding the HIBCC data structure on items in the healthcare supply chain. The document also provides guidance on how the HIBCC Supplier Labeling Standard is used in conjunction with other existing standards for RFID and Auto ID technologies

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2 Foreword

This RFID Standard was developed from work undertaken by HIBCC (Health Industry Business Communication Council) and its global international affiliates (EHIBCC and HIBCC AU) and associations. The first manifestation of this standard was a technical guideline for suppliers wishing to implement RFID technologies based on the HIBCC product identification system. At the core of this guideline was the seamless transition from existing bar coding technologies to RFID using well established ISO Standards. The development of this guideline into an approved ANSI standard is the next logical progression.

HIBCC and its affiliated organization EHIBCC, are recognized as standardization bodies by ANSI, CEN and ISO. HIBCC develops and maintains standards and guidelines for healthcare applications, including product identification standards for supply chain applications. The standards have been prepared by HIBCC technical committees consisting of HIBCC members and technical experts with an interest in the widespread use of the standards to achieve best practice systems for supply chain applications.

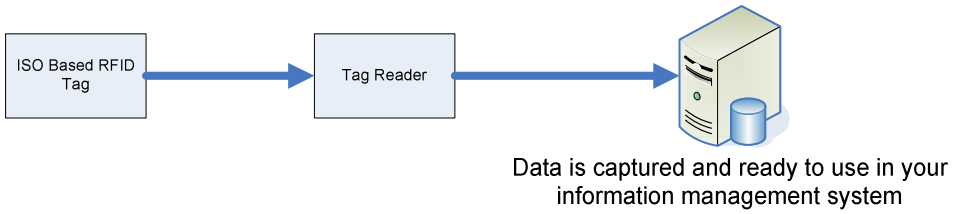
The scope of this technical standard is to detail the requirements for coding product identifiers using the HIBCC Labeler Identification Code (LIC) in conjunction with existing ISO standards for RFID air-interface and data protocols, and ANSI MH.10.8.2 data identifiers. In this way, companies wishing to implement RFID technology for tracking and tracing products through the supply chain, or add an RFID tag as an additional identifier, can do so in a manner prescribed by this standard.

3 Introduction

This document constitutes a standard for the usage of RFID technology with the framework of the HIBCC Supplier Labeling Standard in instances where barcoding or 2-dimensional symbologies do not adequately satisfy a company's requirement. The solution is designed to meet the general requirements for product tagging and for marking logistical units such as reusable containers or transport units.

The HIBCC approach for coding RFID tags for supply chain applications leverages existing ratified standards under ISO, including ISO 18000 for the air interface specifications, ISO/IEC 15418 (Incorporating ANS MH10.8.2 Data Identifiers), and ISO/IEC 15961, 15962 and 15963 for RFID data protocols. Any holder of a Labeler Identification Code (LIC) issued by HIBCC can use this standard for coding RFID tags.

The ISO approach to RFID implementation is based upon healthcare product supplier migration from existing barcode or 2-D symbologies to RFID. This can be accomplished by leveraging approved ISO standards and using Data Identifiers (DI) to code important medical supply chain data, such as lot/batch number, serial number, and expiration date. As the product moves through the supply chain, this important data can be captured directly from the product and used in information management systems. This approach is similar to that which has been used in barcoding applications, and has proven over time to be robust, reliable, safe and cost-effective.



The ISO approach is based on simplicity and direct access to information. The ISO tag is self-contained with all required information.

Figure 1 – ISO approach for RFID applications

4 Scope

This document is a technical specification for RFID item tagging, and defines the manner in which companies with a registered "LIC" can code their item and product identifiers on RFID tags. It specifies the methodology to enable unique identification of items and products for tracking and tracing where RFID is the chosen data carrier.

It provides specific recommendations for globally unique product and item identification, and also for secondary information such as lot, serial number and other related information. This will not modify the HIBCC Supplier Labeling Standard, but shall constitute a specification for the specific task of RFID tagging. It makes use of the currently practiced product numbering schemes avoiding mapping to additional numbering systems. It provides full compatibility with the Health Industry Barcode (HIBC) and with the Unique Identification Mark (UIM) as with all other standard numbering systems. The standard describes the key data elements to be carried in application level of RFID tags. It does not specify the technology for RFID air interface, data protocol nor RFID Tag memory management because this is already defined by existing ISO/IEC documents referenced by this standard.

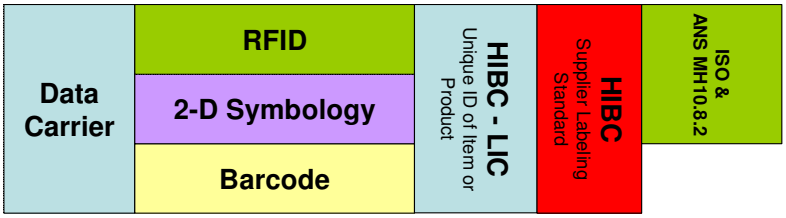


Figure 3 – Schematic: Scope of the eHIBC system. The same track & trace information may be carried by linear barcode, 2D symbols or RFID. The use of the the same Labeler Identification Code (LIC) avoids unnecessary modifications to databases.

5 Normative References

The following referenced documents are to be read in conjunction with the application of this document.

ISO/IEC 19762	Information Technology — Harmonized Vocabulary
ISO/IEC 7816-6	Registration of Electronic Manufacturers for RFID tags
ISO 22742	Packaging - Barcode and 2D symbologies for product packaging
ISO/IEC 15418	Automatic Identification – International Specification - EAN.UCC Applications Identifiers and ASC Data Identifiers
ISO/IEC 15434	Automatic Identification and Data Capture Techniques – International Specification – Syntax for high capacity data carriers
ISO/IEC 15459	Automatic Identification and Data Capture Techniques – International Specification - unique identifier for item management
ISO/IEC 15961	Automatic identification – Radio Frequency Identification for item management – Data protocol: application interface
ISO/IEC 15962	Automatic identification – Radio Frequency Identification for item management – Data protocol: data encoding rules and logical memory functions
ISO/IEC 15963	Automatic identification – Radio Frequency Identification for item management – Unique identification for RF tags
ISO/IEC 18000-2	Automatic identification – Radio Frequency Identification for item management – Air Interface protocol 130 kHz
ISO/IEC 18000-3	Automatic identification – Radio Frequency Identification for item management – Air Interface protocol 13.56 MHz
ISO/IEC 18000-4	Automatic identification – Radio Frequency Identification for item management – Air Interface protocol 2.4 GHz

ISO/IEC 18000-6	Automatic identification – Radio Frequency Identification for item management – Air Interface protocol 870-930 MHz (UHF)/Amd 1:2006 – Extension with Type C and updates of Type A and B.
ANS ASC MH10	Data Application Identifiers
ANS HIBC 2.3	Health Industry Bar Code Supplier Labeler Standard

6 The HIBCC RFID System

The HIBCC RFID system can be applied to:

- Items that require serialization, such as surgical instruments.
- Products that are required to be uniquely identified in the supply chain
- Logistical packaging units (such as pallets and cases) used for logistics and transport applications.

The HIBCC RFID system is broadly comprised of the following:

- The HIBCC Supplier Labeling Standard, together with the ASC ANS MH10.8.2 standard. These standards define he application data structure, and are independent of the technology or data carrier.
- The air interface standard – ISO 18000. This standard defines the frequencies and protocols for communication between RFID tags and readers.

6.1 The three key types of RFID Tags

The eHIBC can be characterized by 3 basic types of tag as follows:

TYPE	FUNCTION	NAME	EXAMPLE APPLICATIONS
Unique Item RFID Tag (UDI)	Serialized Item	HIBCC UDI Tag	Items that require unique serial numbers to uniquely differentiate all items, including like items. Re-usable medical products, such as surgical instruments and other such assets are an ideal candidate for serialized coding.
Product RFID Tag	Unique Product ID	HIBCC Product ID Tag	Medical products for track and trace applications. The data stored on the tag includes the unique product ID and may also include secondary data such as lot/batch and expiry date etc.
Transport RFID Tag	Serialized code for logistical/transport units	HIBCC Licence Plate Tag	These tags are placed on logistical packaging units (eg pallet, case, carton) used for transport and logistics applications. The serialized code is usually associated with an Advance Shipping Notice (ASN) that lists the contents of the logistical units, and the purchase orders that they relate to.

Table 1 – 3 Basic types of HIBCC RFID Tags

6.2 System Layers and Components

The system consists of several layers as follows:

- RFID technology layer with its air-interface, specified by ISO/IEC 18000
- Data protocol and RFID tag memory organization, specified by ISO/IEC 15961 and 15962
- Unique RFID Tag ID of the tag manufacturer, specified by ISO/IEC 15963
- Uniqueness of Item, Product and Transport Unit, specified by ISO/IEC 15459
- Data Identifiers, specified by ISO/IEC 15418, part ASC MH10.8.2
- Application data relevant to the type of tag (Item, Product or Transport)

A	**RFID TECHNOLOGY LAYER**			
	Air Interface	RFID Tag	ISO/IEC 18000-x	Parts 2,3,4 or 6
	RFID Tag Memory	Memory Management	ISO/IEC 15962	
	RFID Data Protocol	Data protocol	ISO/IEC 15961	
	Unique RFID Tag ID	UID	ISO/IEC 15963	
B	**DATA LAYER FOR TRANSMISSION**			
	Rules for unique Item ID's	Uniqueness	ISO/IEC 15459	
	Data Identifiers	DI's	ISO/IEC 15418	ASC MH10.8.2
	HIBCC Data Structure	Product ID and Secondary Data	ANSI/HIBCC-2	"+" reserved under ASC MH10.8.2 to HIBCC
	Data Elements	Application Data	Data	

Table 2 – Applicable ISO/IEC Standards for different technology layers in RFID Applications

6.3 Standard Frequencies

The standard frequencies at which the ISO 18000 air-interface specifications have been defined are as follows:

Air Interface Specification	
Frequency	**Applicable ISO/IEC Standard**
130KHz	18000-2
13.56MHz	18000-3
2.4GHz	18000-4
870-930 MHz	18000-6

Table 3 – ISO/IEC Air Interface Standards for different frequencies

The frequencies recommended by HIBCC for the 3 different tag applications are as shown in the table below.

NAME	TYPE	RECOMMENDED FREQUENCY	APPLICABLE AIR-INTERFACE STANDARD
HIBCC UDI Tag	Serialized Item	13.56MHz By agreement, 130KHz (especially for surgical instruments)	ISO/IEC 18000-3 ISO/IEC 18000-2
HIBCC Product ID Tag	Unique Product	13.56MHz By agreement 870-930MHz	ISO/IEC 18000-3 ISO/IEC 18000-6c
HIBCC Licence Plate Tag	Serialized Transport Unit	870-930MHz By agreement, 13.56MHz	ISO/IEC 18000-6c ISO/IEC 18000-3

Table 4 – Frequencies recommended by HIBCC for the different applications of RFID Tags

6.4 Data Protocol and RFID Tag memory organization

Data protocol and RFID Tag memory management are technology dependent issues where the following specifications always apply:

- ISO/IEC 15961 Automatic identification – Radio Frequency Identification for item management – Data protocol: application interface
- ISO/IEC 15962 Automatic identification – Radio Frequency Identification for item management – Data protocol: data encoding rules and logical memory functions

6.5 Unique RFID Tag ID (UID) of the Tag Manufacturer

A unique RFID TAG ID is always supplied by the electronic component manufacturer. It supplies uniqueness for the RFID Tag itself, used for technical purposes such as “Bulk Scanning”. The Tag UID is a fixed programmed serial number and might be used as an elementary ID if no application data is necessary or available.

6.6 Uniqueness of Item, Product and Transport Unit

In order for the RFID system to be robust and reliable, it is necessary that the application data coding can guarantee that items, products and transport units are unique.

6.6.1 Recommended Option

Cross enterprise and cross country uniqueness is specified by ISO/IEC 15459. This standard regulates the responsibility for the issuing of unique codes. Organizations wishing to be registered as Issuing Agencies are required to apply for a registration with the Netherlands Normalization Institute (NNI), who has been authorized by CEN and ISO to register organizations under ISO/IEC 15459. NNI assigns “Issuing Agency Codes” (IAC) to organizations who qualify to be registered as an authorized Issuing Agency.

The Issuing Agency Code assigned to HIBCC is the characters “RH”. The Issuing Agency Code assigned to EHIBCC is the characters LH. If you are a manufacturer that has registered your LIC with HIBCC, then you would use the code RH, and if you have registered with EHIBCC, then you would use LH.

Other Issuing Agencies authorized under ISO/IEC 15459 include:

Issuing Agency Code	Issuing Agency	Enterprise Identifier
0-9	EAN International (GS1)	EAN.UCC
LB	Telcordia Technologies, Inc	ANSI T1.220
UN	Dun & Bradstreet	DUNS
D	Allied Committee 135	CAGE
RH	Health Industry Business Communications Council	HIBCC
LH	European Health Industry Business Communications Council	EHIBCC
LD	Department of Defense	DODAAC

The full list of IAC’s can be accessed from http://www2.nen.nl/getfile?docName=196579

Table 5 – Issuing Agency Codes under ISO/IEC 15459

The coding hierarchy that applies under ISO/IEC 15459 is as follows:

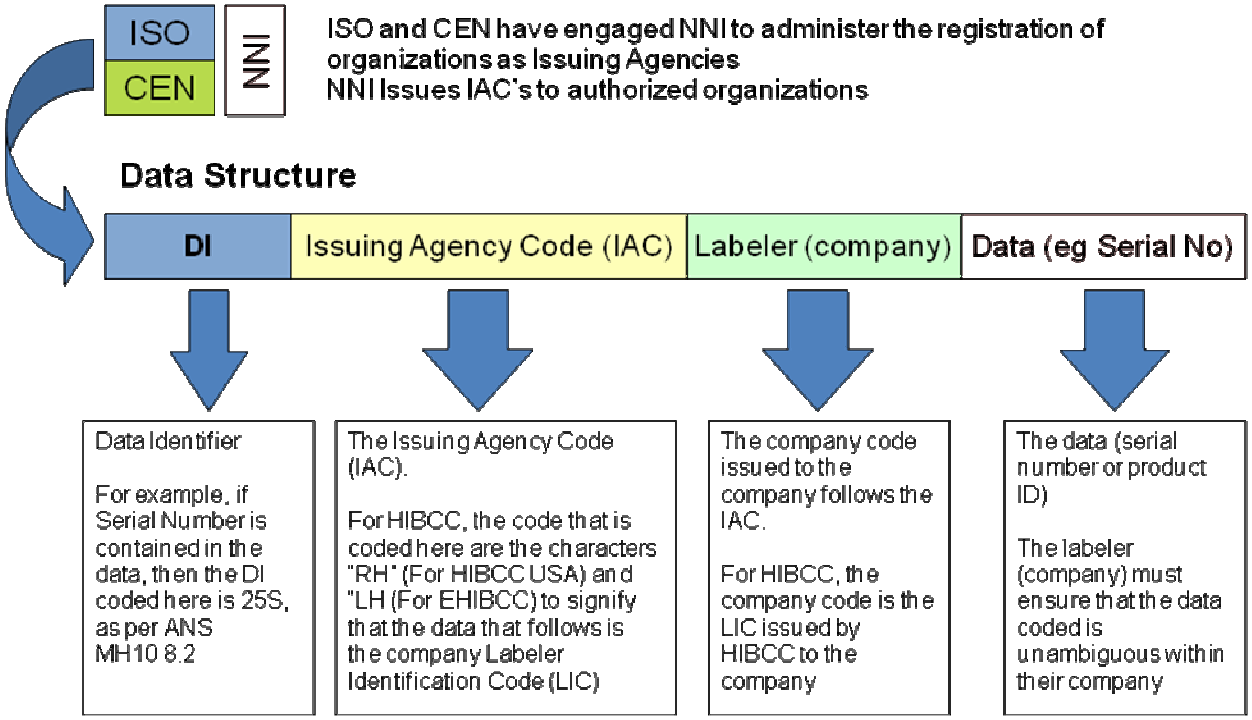


Figure 4 – Coding Hierarchy under ISO/IEC 15459

For example, assuming that the RFID tag is being placed on an item that required serialization, and the company has a valid LIC issued by HIBCC. The data string coded in Data Application Layer of the RFID Tag is as follows:

25SRHH123ABC0001

where,

25S = Data Identifier for Serial Number

RH = IAC for HIBCC

H123 = Labeler Identification Code (LIC) issued to company.

ABC0001 = The Serial No for the Item

6.6.2 Alternative Option

Alternatively, if preferred by the manufacturer or distributor, it is also acceptable to use existing structures defined by ANSI-HIBC-2. Under this option, the "+" character is the data identifier for data coded to the structure specified within ANSI/HIBC-2. Under ISO 15418 (incorporating MH10.8.2 Data Identifiers), the "+" character is reserved for HIBCC, thereby making the ANSI-HIBC-2 Data Structure valid for RFID.

This option is only applicable to the HIBCC LIC primary data structure and to the HIBCC LIC concatenated data structure. If information from the HIBCC secondary data structure (lot, serial number, quantity, expiration date) is desired, you must use the concatenated data structure. The rules for each of these data structures are specified in ANSI/HIBC-2. An example of a concatenated data structure using this method is as follows:

+H123000010/$$0109S123456R

Where,

+ = HIBCC data flag

H123 = LIC for manufacturer

00001 = Product item number

0 = Unit of Measure Indicator

/ = Data delimiter

$$ = Data identifier for structure that includes expiry date formatted as MMYY and Lot Number

0109 = Expiry date – January 2009

S123456 = Lot Number

R = Check Sum (optional for RFID)

Note: for RFID tags, it is not necessary to add the check sum that would otherwise apply to barcodes under ANSI/HIBC-2.

6.7 Compatibility with Barcoding and 2-D

The LIC issued by HIBCC is common across all the recognized data carriers. Therefore, the LIC that is applied on standard barcodes can also be used for RFID tags.

The table below illustrates the standard coding that applies across the 3 common data carrier technologies – barcode, 2-D and RFID.

DATA CARRIER	HIBCC SYSTEM IDENTIFIER	LIC	VARIABLE DATA
Barcode	"+" or "RH" or "LH" Note: It is more common and preferable to use the "+" for barcoding. However, there may be applications where the "RH" or "LH" is more practical. This includes applications that require data elements not currently specified in ANSI/HIBC-2. This includes serial number, production date, and other data elements. Consideration should be given to the size of the data string. The more data elements that are included will make the linear barcode very long and impractical. Under these circumstances, it is preferable to use a 2-D symbology.	H123	If "+" used, then must use HIBCC Supplier Labeling Standard. If RH or LH used, then use Data Identifiers specified in ANS MH10.8.2
2-D	"+" or "RH" or "LH"	H123	If "+" used, then must use HIBCC Supplier Labeling Standard. If RH or LH used, then use Data Identifiers specified in ANS MH10.8.2
RFID	"+" or "RH" or "LH"	H123	If "+" used, then must use HIBCC Supplier Labeling Standard. If RH or LH used, then use Data Identifiers specified in ANS MH10.8.2

Table 6 – Compatibility of barcodes and 2-D symbols with RFID

6.8 Common Data Identifiers Specified by ISO/IEC 15418, part ASC MH10

For identification of the data elements within the string Data Identifiers (DI) used in the application data shall be as specified by ISO/IEC 15418, part ASC MH10.

The following DI's apply depending on the application:

DI	description	Structure according to ISO/IEC 15459
25P	worldwide unique product code	DI – Issuing Agency Code – Company ID – Product code
25S	worldwide unique serial number	DI – Issuing Agency Code – Company ID – Serial number
25T	worldwide unique lot number	DI – Issuing Agency Code – Company ID – Lot number
nJ	worldwide unique transport unit	DI – Issuing Agency Code – Company ID – Transport Unit no. (serialized)
18V	worldwide unique vendor code	DI – Issuing Agency Code – Company ID – Organisational unit

Table 7 – Commonly Used Data Identifiers under ISO/IEC 15459

Examples of other DI's that can be used to add additional information:

26Q	Unit of Measure ID	Supplier assigned to indicate the Unit of Measure ID as per ANSI/HIBC-2 **NOTE: This Data Identifier (DI) is not currently within MH10.8.2. HIBCC is proposing that this DI is incorporated in MH10.8.2, and has submitted an application with ASC MH10 Data Identifier Maintenance Committee.**
Q	Quantity	Used where the unit of measure ID is 9, and a quantity needs to be specified. For example, the string: **26Q**9+**Q**5 indicates the Unit of Measure "9" where the Quantity within the package is 5. The "+" character here is the data delimiter.
14D	Expiration Date	The expiration date in the format YYYYMMDD.
1T	Lot	Lot Number
S	Serial Number	Serial Number
2L	Ship to Code	e.g. Postal code

Table 8 – Commonly used additional Data Identifiers

7 Serialized RFID - HIBCC UDI Tag

The HIBCC UDI Tag specifies the identity of an item by its unique serial number headed by company ID, Issuing Agency ID and the appropriate Data Identifier (DI).

In the case of a single item a unique serialized number applies, in case of more than one item of a lot or batch a unique lot number applies.

7.1 Unique Serialized Number

This section defines the data coding structure for items that require a unique serial number.

The data Identifier for a unique serial number is the DI "25S". This is followed by the Issuing Agency code (IAC), company ID (LIC) and the serial number.

The following table defines the data elements that make up the unique serial number for the application data on the item (eHIBC-I).

	Data Identifier (DI)	Issuing Agency Code	Labeler Identification Code (LIC)	Serial number an 1-13
worldwide unique serial number	25S	RH or LH	H123	123456789

Table 9 – Data elements required for creating unique serial number

The unique serial number as defined in the table above would be coded in a single string as follows:

25SRHH123123456789

Note: If manufacturer has a registered LIC with EHIBCC, then the "RH" in the example above is substituted with "LH".

This data can be also carried on a standard linear barcode, a 2-D barcode or RFID.

This format also satisfies the Department of Defense (DoD) requirements for "Unique Identification Mark (UIM)" using Datamatrix 2-D for items.

7.2 Unique Lot Number

This section defines the data coding structure for items that are from the same batch or lot, and therefore require a unique lot number to be coded on the RFID Tag.

The Data Identifier (DI) for a unique lot number is the DI "25T" followed by Issuing Agency code (IAC), LIC and lot number.

The following table defines the data elements that make up the unique lot number for the application data on the item (eHIBC-I).

	DI	Issuing Agency Code (IAC)	LIC	Lot number an 1-13
world wide unique lot number	25T	RH or LH	H123	1234567890

Table 10 – Data elements required for creating unique lot number

The unique lot number as defined in the table above would be coded in a single string as follows:

25TRHH1231234567890

Note: If manufacturer has a registered LIC with EHIBCC, then the "RH" in the example above is substituted with "LH".

This data can be also carried on a standard linear barcode, a 2-D barcode or RFID.

Note: The HIBCC UDI Tag data structure is not intended to be used with additional concatenated Data Identifiers, such as are allowed with HIBCC Product ID Tag, and explained in Section 8.1.

8 Product Identification RFID – HIBCC Product ID Tag

This section describes the typical coding for products in the supply chain.

A product RFID Tag carries a unique product code, and is structured similarly to the barcode ID as defined by the HIBCC Supplier Labeling Standard. The code includes the Data Identifier for Product ID, the IAC, the companies LIC and the Product Code.

The following table defines the data elements that make up the unique product code for the Product ID Tag.

	DI	Issuing Agency Code	LIC	Product code an 1 -13	Unit of Measure DI	Unit of Measure
worldwide unique product code	25P	RH or LH	H123	C123456789	26Q	0

Table 11 – Data elements required for creating unique product code

The unique Product Code as defined in the table above would be coded in a single string as follows:

25PRHH123C123456789+26Q0 (where the "+" is the data delimiter)

This data can be also carried on a standard linear barcode, a 2-D barcode or RFID.

Additional secondary data, such as lot/batch, serial number, expiry date or quantity can also be added to the code. Where this data is required, it shall be added to the code above in a concatenated format, following the example shown in 8.1 below.

If the manufacturer or distributor is using the alternative method of ANSI/HIBC-2, then the data structure should follow the rules specified in ANSI/HIBC-2 and explained in Section 6.6.2 above.

8.1 Unique Product Code applied with a Serialized Number

There may be applications where it is required to add a serial number to the product code. This may be required where a high degree of traceability is required, or where product "pedigree" needs to be established in the distribution chain. This is achieved by adding the serial number to the RFID tag in addition to the unique product code. In barcoding or 2-D applications, the serial number is added by concatenating the data string using a data delimiter. The data delimiter used to concatenate the unique product code with the serial number is the plus character "+". The table below (Table 12) illustrates how to concatenate the unique product code with the serial number.

	DI	Issuing Agency Code	LIC	Product code 1 to 13an	Unit of Measure DI	Unit of Measure	Serial Number DI	Serial Number
worldwide unique product code	25P	RH or LH	H123	C123456789	26Q	0	S	123456789

Table 12 – Concatenating Unique Product ID and Serial Number in a single barcode or 2-D symbol

In a barcode or 2-D symbol, this would be represented in a single string as follows:

25PRHH123C123456789+26Q0+S123456789

Therefore, a data string that includes Lot Number, Expiry Date, and Quantity (where the Unit of Measure is "9") would be structured in a concatenated format as shown below:

25PRHH123C123456789+26Q9+Q5+1TL123456789+14D20110101

Where;

25P = DI for Product ID

RH = IAC for HIBCC

H123 = Company's LIC

C123456789 = Product Identifier

26Q = Unit of Measure ID

9 = Unit of Measure (Variable quantity)

Q = DI for Quantity

5 = Quantity (5 units in the package)

1T = DI for lot number

L123456789 = Lot Number

14D = DI for expiry date

20110101 = expiry date (1st Jan, 2011)

+ = data delimiter

9 Serialized Unique Transport Unit – Licence Plate Tag

The Unique Transport serial number is structured in accordance with ISO/IEC 15459, where the coding rules are specified by the issuing agency supplying the company identification code.

Table 14 illustrates the coding rules for a serialized RFID tag placed on a unique transport (or logistical) unit, by a supplier using the HIBCC standards, therefore possessing a valid Labeler Identification Code (LIC).

	DI	Issuing Agency Code	Company ID 4 an	Serial number 1-20an
worldwide unique serial number	J	RH or LH	H123	F123456789

Table 14 – Data components required to create unique serial number for transport units

This would be represented in a single string as follows:

JRHH123F123456789

9.1 Coding different packaging levels in a transport (or logistical) unit

The default DI for transport units is the "J" identifier. There are alternative DI options to specify the packaging level and potential related EDI messages, or mixed or like item pallets.

The table below lists the alternative options available for serialized RFID tags for Transport Unit applications.

DI	Description
J	Unique Transport Item
1J	Lowest packaging level, unbreakable unit
2J	Highest packaging level where several "1J" units apply
3J	Lowest level of packaging, the unbreakable unit and which has EDI data associated with the unit
4J	Transport unit which contains multiple packages and which is associated with EDI data
5J	Mixed transport unit containing unlike items on a single customer transaction and may or may not have associated EDI data.
6J	Master transport unit containing like items on a single customer transaction and may or may not have associated EDI data.

Table 15 – Alternative options for coding unique transport units serial number

10 RFID Technology Specifics

10.1 Unique Identification of RFID tag electronics (UID)

For technical reasons, each RFID tag needs to have a fixed unique code to differentiate tags that are in close proximity, and to enable bulk scanning. This unique code is different than the application data coding discussed in the previous sections of this guideline.

The UID is a hardware based fixed number which might be used as an access key to data if appropriate, but it does not inform about item related data. The UID is assigned by the tag manufacturer according to ISO/IEC 15963 Automatic identification – Radio Frequency Identification for item management – Unique identification for RF tags. It includes either an Electronic manufacturer code according to ISO/IEC 7816-6 or another issuing agency code. It is unchangeable.

10.2 Rules for storing data elements in RFID tags

The rules for storing data to the RFID tags are specified in:

- ISO/IEC 15961 – Automatic identification – Radio Frequency Identification (RFID) for item management – Data protocol: Application interface.
- ISO/IEC 15962 Automatic identification – Radio Frequency Identification for item management – Data protocol: data encoding rules and logical memory functions.

10.2.1 Application Family Identifiers (AFI) and Application Sub Family (ASF) Identifiers

ISO/IEC 15961 specifies the application family identifiers (AFI) and Application Sub Family (ASF) for the application.

AFI's and ASF's are necessary for RFID applications, since it defines the type of data that is stored on the RFID tag, so that RFID tags can be differentiated for different application areas. For example, in a hospital, it is necessary to differentiate RFID tags used in patient wrist bands for patient identification, with consumable and other items.

Whilst many AFI's are yet to be defined by ISO/IEC 15961, the AFI's for items have been defined. The following table is a list of the AFI's and ASF's that have been defined:

AFI Code	ASF Code	Assigned to
10	1	ANS MH10.8.2 Data Identifiers for unique identifier for items
10	2	ANS MH10.8.2 Data Identifiers for unique identifier for transport units
10	3	ANS MH10.8.2 Data Identifiers for unique identifier for returnable transport items
11	1	ISO/IEC 15459 unique identifier for items
11	2	ISO/IEC 15459 unique identifier for transport units
11	3	ISO/IEC 15459 unique identifier for returnable transport items
12	1	IATA Baggage Tag

Table 16 – Application Family Coding

All other AFI's are reserved at this stage, and will be allocated as required.

The AFI's that apply to the HIBCC RFID tags are "10" and "11"

10.2.2 Access Method

The access method defines the manner in which data can be mapped on the RFID tag and be accessed from the RFID tag. ISO/IEC 15961 has defined the following access methods:

Access Method Code	Access Method	Description
0	No Directory	This is a structure that supports the contiguous abutting of all the data (concatenation), related object identifiers, and other data protocol overhead. Generally, all the data needs to be transferred across the air interface to abstract relevant data.
1	Directory	The data is encoded exactly as for **no Directory** but the RF tag supports an additional directory which is first read to point to the address of the relevant object identifier.
2	Self Mapping Tag	This can be selected if the RF tag has on-board processes to organize the data mapping.
3	Reserved for future definition by SC31	

Table 17 – Access Methods

Where a choice can be made, the following guidelines can be of assistance:

- The **no Directory** structure is better suited to RF tags with small memory capacity, because the directory itself is an overhead that needs to be encoded. It also is better suited where there are few data elements to be encoded, so that a continuous read function will transfer all the encoding to enable the data to be parsed to the appropriate elements.
- The **directory** structure is better suited to applications that call for selective reading, writing, or modifying one or few data elements from among many.

10.2.3 Data Format

The Data Format element defines the types of data being stored on the RFID tag. The Data Format is used to make more efficient use of encoding space or to restrict data to one class.

The data format that applies to the HIBCC RFID tags is the Data Identifier (DI) format defined by ISO/IEC 15418. The Data Format code for DI's is the number "10".

10.2.4 Overview of data elements in the HIBCC RFID tags

The table below illustrates the data elements that are coded for the 3 types of HIBCC RFID tag.

RFID Tag type	ISO/IEC15963 & ISO/IEC 7816-6	ISO/IEC 15961, 15962				ISO/IEC 15418 ASC MH10		Application Data (examples)
	Fixed UID with IC manufacturer ID	AFI	AFS	Access method	Data format	DI	Optional data	
eHIBC-I	RFID Tag (IC) Manufacturers responsibility	11	1	0	10	25S		RHH123S123456789
eHIBC-P		11	1	0 or 1	10	"25P" or "+"	1T, S,.Q	RHH123P123456789 +H12300001
eHIBC-T		11	2	0 or 1	10	J	2L	RHH123T123456789

Table 18 – Data elements required for the 3 different types of eHIBC

10.2.5 Examples of how data is stored in the RFID tag

For Licence Plate Tag (Transport) where the access method is with no directory, the data elements are as follows:

Data Element	Code
AFI	11
ASF	2
Access Method	0
Data Format	10
Data Identifier (DI)	J
Application Data	RHH123T123456789

Table 19 – Data stored on RFID Tag using ISO/IEC 15961 and 15962 without directory

The data is stored in memory blocks on the RFID chip. The memory blocks are defined by the application, and consist of the number of 8bit bytes that can be stored on the RFID tag chip. The figure below conceptually illustrates how the data in the table above is stored in the memory of the RFID tag:

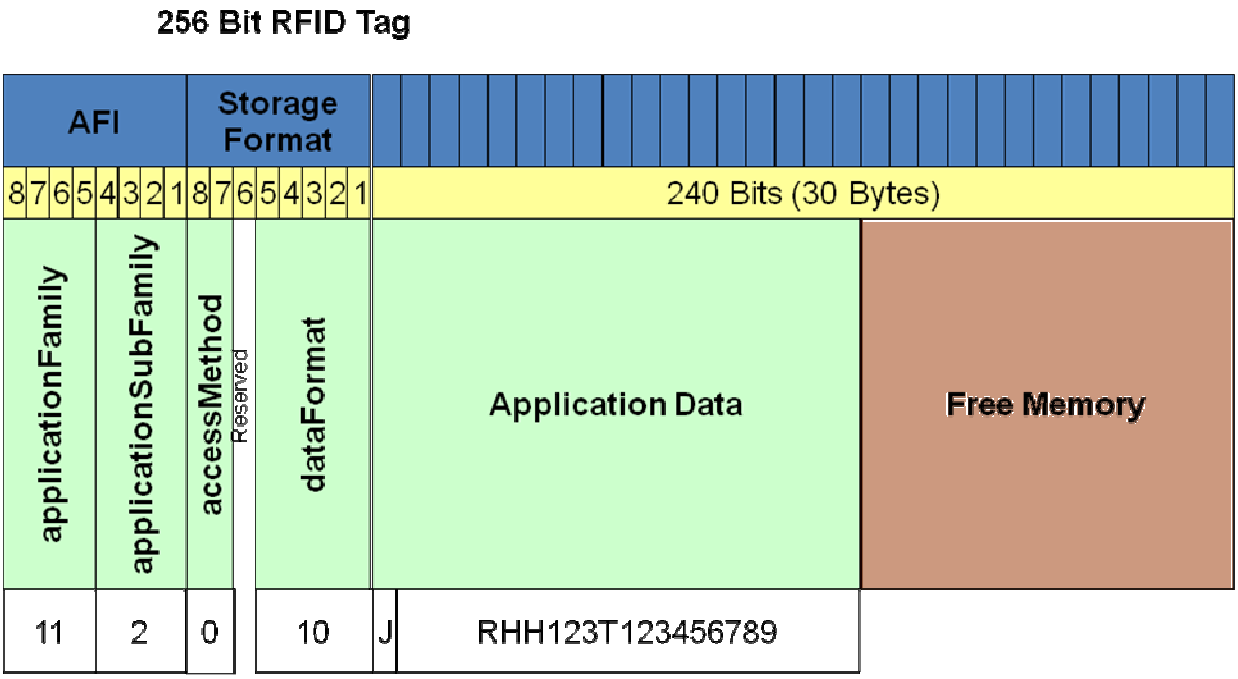


Figure 6 – Conceptual illustration of memory blocks and applicable data coding with no directory

For all rules associated with the data formatting, including the OID definitions, refer to ISO/IEC 15961 and ISO/IEC 15962.

For Licence Plate Tag where the access method is with a directory, the data elements are as follows:

Data Element	Code
AFI	11
ASF	2
Access Method	1
Data Format	10
Data Identifier (DI)	J
Application Data	RHH123T123456789

Table 20 – Data stored on RFID Tag using ISO/IEC 15961 and 15962 with directory

Data is stored exactly as with the No Directory access method, however, the RFID tag supports an additional directory which is first read to point to the address of the data elements. In this way, applications can be configured to extract only the data elements relevant to the application without having to transfer the entire string across the air-interface. Directories are more useful in applications that require multiple data fields. For example, where it is required to code Unique Product ID, Lot Number, Expiry Date etc. all in the one RFID Tag.

Figure 7 conceptually illustrates how the data in the table above is stored in the memory of the RFID tag when a directory is defined:

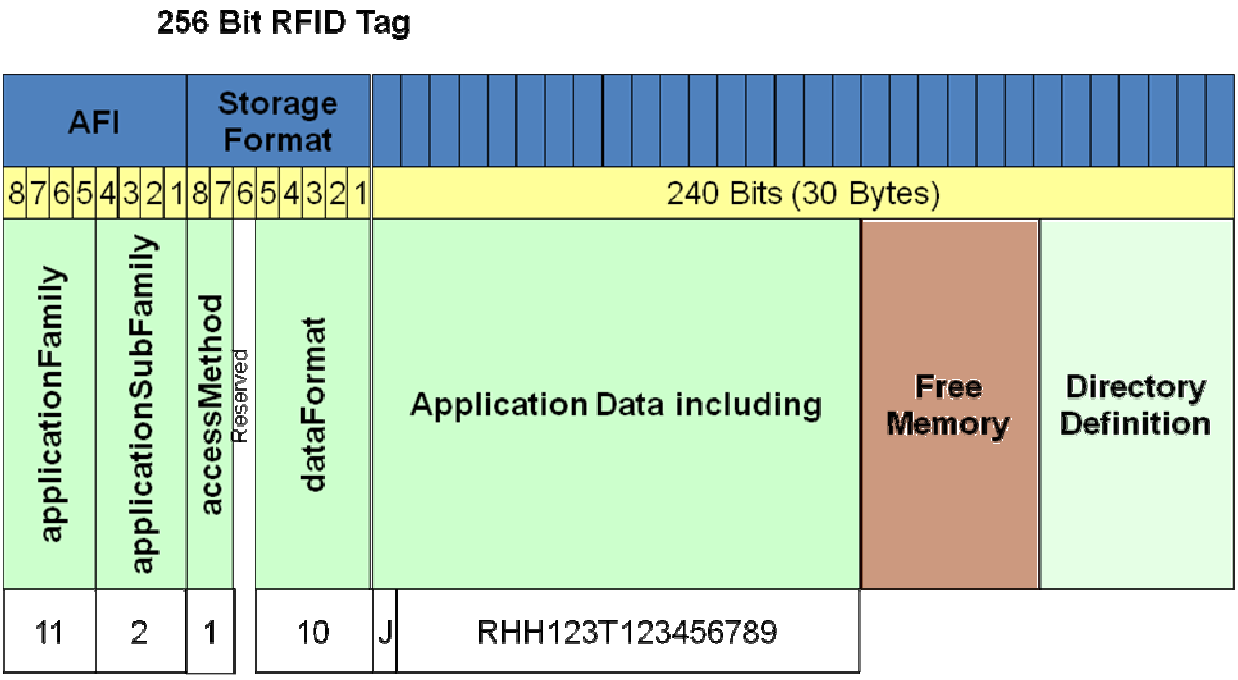


Figure 7 – Conceptual illustration of memory blocks and applicable data coding with directory

10.3 RFID Tag Specific Memory

RFID tags are either preprogrammed or programmable by the user application. Specific functions enable the identification of the electronic component and stored data.

10.4 Low to High capacity RFID Tags

Due to various memory capacities of RFID tags, the amount of data that is stored needs to take into consideration any memory constraints.

10.4.1 Low capacity tags – up to 128bit

Where low capacity tags are used, data encoded should be restricted to a single data element. This can be a serial number, lot number or product identifier as follows:

DI	Application	Data coded
25S	For eHIBC I - Unique Items	Company LIC and product serial number
25T	For eHIBC P – Unique Products	Company LIC and product code
J	For eHIBC T - Unique Transport Units	Company LIC and the transport units serial no.

Table 21 – Recommended data limitations for low capacity tags

10.4.2 Medium Capacity tags – greater than 128bit

Medium Capacity of more than 128 bit allow storage of concatenated information, such as Unique Product Code plus one other data element such as serial or lot number, quantity, packaging level, etc.. The use of the Memory Directory (Access Method = 1) will enable quick access to single data elements.

HIBCC recommends that high capacity tags are used wherever possible, since they are more scalable, and can include more data in a concatenated string.

10.4.3 High Capacity tags

High capacity RFID tags may allow storage of several hundred bytes. ISO/IEC 15962 applies for data protocol and memory control.

10.5 RFID read/write capability

This guideline covers only the essential data elements for the tracking and tracing of items, products and transport units in the supply chain, and for specific data capture applications within health provider organizations. By definition, the essential data elements are compatible with the data elements required in barcoding applications.

High capacity RFID tags, however, are capable of storing additional information. This additional information can be written to the tag by specific applications. Any additional information required by trading partners not defined in ISO/IEC 15418 (Data Identifiers as per ANS MH10.8.2), can only be achieved through mutual agreement.

11 Appendix 1 – Compatibility with EPC[1]

The HIBCC RFID system is designed to carry alphanumeric product codes whilst the EPC system is designed to carry the EAN/UCC data elements where the product code is numeric. Due to the Unique UID flag, both systems are compatible and guarantee uniqueness in the supply chain for reliable and robust tracking and tracing and data capture applications.

The table below illustrates the HIBCC RFID & EPC contents

RFID type	UID & control flags ISO/IEC 15963 15961, 15962	DI/ Header	Company ID	Unique product	Unique serial no.	Unique Transport Unit	Interpretation
HIBCC UDI	x	25S LH	4an		1-13an		ASCII
HIBCC-Product ID	x	25P LH	4an	1-13an			
HIBCC Licence Plate	x	J LH	4an			1-20an	
EPC GIAI	x	14	20 - 40		63 - 42		BIT
EPC SGTIN	x	14	20 - 40	24 - 4	38		
EPC SSCC	x	14	20 - 40			32 - 17	

Table 22 – Compatibility with EPC

[1] EPC is a trademark of EPC Global.

12 Appendix 2 – Conversion from the Health Industry Barcode to HIBCC RFID

Converting data formatted to ANSI/HIBC-2 into the MH10.8.2 recommended format requires that Data Identifiers as specified in MH10.8.2 are used to identify the different data elements. ANSI/HIBC-2 uses the "+" character as the main identifier for HIBCC coded data strings, and a combination of "$" signs and other flags to depict the different data components in the secondary data. These are replaced with DI's as illustrated in the table below:

HIBCC		**Interpretation with DI's according to ISO/IEC 15418 part ASC MH 10 Data Identifiers**	
DI HIBCC Product Code	+	25PRH	DI "25P" plus IAC for HIBCC codes « RH » or LH
Labeler Identification Code LIC	4an	4an	LIC
Product Code	1-13an	1-13an	Product Code
Packaging Index 0-9	0 to 8	26Q	Unit of Measure ID, 0 through 9, where 0 indicates the unit-of-use, 1 the default value for packages of non defined quantities, 2 to 8 defines specific packing levels above the unit of use, 9 points to a quantity field as default if associated quantity field is placed separately **NOTE:** HIBCC has applied for this DI with ASC MH10 Data Identifier Maintenance committee, and awaiting approval.
Separator	/	+	RFID specific Separator
Flags for Secondary Code	$ ($$)	Not applicable	
Lot number	data	1T	DI "1T" plus data
Expiration Date	YYJJJ MMYY MMDDYY YYMMDD Etc.	14D	DI "14D" plus date format YYYYMMDD. Note : Irrespective of the format used for expiry date in ANSI/HIBC-2, 14D must be used for the expiry date when using MH10.8.2, and the date must be formatted as YYYYMMDD.
Quantity field	2 or 5 n	Q	Used where Unit of Measure ID "9" is used, and the corresponding Quantity is required to be specified in the data string included in the RFID Tag,
Check digit Mod. 43	1n	Not applicable	

Table 23 – Data map from HIBCC Supplier Labeling Standard ANSI/HIBC 2.2 – 2006 to MH 10

By way of example, data carried in a barcode using the HIBCC standard (ANSI/HIBC 2.2 – 2006) would be translated to a RFID tag as follows:

Data string in barcode:

+H123P1234561/$$0906L123456S

The equivalent data string using ANS MH10.8.2 data identifiers becomes:

25PRHH123P123456+26Q1+14D20060930+1TL123456

Where,

25P = DI for Product ID

RH = IAC for HIBCC (If registered with EHIBCC, then LH applies)

H123 = LIC

P123456 = Product ID

26Q = Unit of Measure Indicator

1 = Unit of Measure ID

14D = DI for Expiration Date formatted as YYYYMMDD (Note, the last day of the month is coded where the date format used in ANSI/HIBC-2 is MMYY)

20060930 = Expiry Date

1T = DI for Lot Number

L123456 = Lot Number

+ = Data Delimiter for all data elements

Note that the data elements are essentially the same, with the only difference being the substitution or inclusion of Data Identifiers (DI's)

Now, by adding the RFID specific data elements, we are able to construct the RFID tag data for the HIBCC RFID. The RFID specific data components are:

11:1:0:10:25P:RHH123P123456+26Q1+14D20060930+1TL123456

Where,

11 = Application Family ID (AFI)

1 = Application Sub Family (ASF)

0 = Access Method

10 = Data Format

The remainder of the string is unchanged, however, with RFID, the data elements are identified by the use of Object ID;s (OID), and are not concatenated using the "+" sign as with barcodes or 2-D symbols. The "+" is used above for illustration purposes only. The colon ":" character is used above for legibility only to separate the data components. The colon is not included in the RFID data string.

Note: The string above when coded in binary would use 38 Bytes of memory (304 Bits). Therefore, where more data elements are required to be coded in the RFID Tag, it will be necessary to use high capacity Tags.

13 Appendix 3 – Glossary of Terms

- **ANSI**
  American National Standards Institute

- **ANSI/HIBC-2**
  The HIBCC Supplier Labeling Standard

- **ANSI/MH 10**
  An ANSI accredited committee responsible for the development of American national standards on unit-load & transport-package sizes, package testing standard, definitions & terminology, standardization of unit-load height, sacks & multi-wall bag standards, coding & labeling of unit-loads.

- **ANSI/MH 10/SC 8**
  An ANSI accredited committee responsible for the development of American national standards on the coding and labeling of transport packages and unit loads, product packaging, and radio frequency identification for returnable containers. ANSI/MH 10/SC 8 serves as the U.S. Technical Advisory Group (TAG) to ISO TC 122.

- **ASCII**
  American Standard Code for Information Interchange: a computer code, as described in ISO 646, consisting of 128 alphanumeric and control characters, each encoded with 7 bits (8 including parity check), used for the exchange of information between computerized systems.

- **character**
  See Character Set, Data Character, Symbol Character, Human Readable Character.

- **character set**
  The total range of letters, numbers, and symbols that can be encoded in a particular symbology. See Code Page, Code Set.

- **CEN**
  European Committee for Standardization
- **CIN**
  Company Identification Code, assigned by an Issuing agency (see IAC) under the rules of ISO/IEC 15459.

- **coded character set**
  A set of unambiguous rules establishing a character set and the relationship between the characters of the set and their byte values.

- **Data Identifier (DI)**
  A specified character string which defines the specific intended use of the data that immediately follows. The identifier shall be an alphabetic character or an alphabetic character preceded by up to three numeric characters as defined by ANSI MH10.8.2, Data Application Identifier Standard. A character (or set of characters) within a machine-readable symbol that defines the general category or specific use of the data that is encoded in the same machine-readable symbol. See ISO/IEC 15418/ANSIMH10.8.2.

- **EPC**
  Electronic Product Code, copyright by EPC Global, promoted for EAN/UCC RFID solutions.

- **HIBCC**
  Health Industry Bar Code.
  supported by HIBCC (Health Industry Business Communications Council), Arizona, Biltmore Circle, Suite 127, Phoenix, Arizona 85016, EHIBCC (European Business Communication Council), Jozef Israels Laan 3, NL 2596 AM The Hague, phone +31 70 3244754, www.ehibcc.com, EHIBCC-D, Koesener Str. 85, D-06618 Naumburg, phone +49 3445 78114 0, www.HIBC.de

- **Issuing Agency Code (IAC)**

Code assigned by the Netherlands Standardization Institute for Associations which qualified for issuing Company Identification Codes according to ISO/IEC 15459, such as EHIBCC, etc.

- **Labeler Identification Code (LIC)**
  The LIC is registered with EHIBCC under the rules of ISO/IEC 15459 for the purpose of building unique numbers for items and shipments.

- **NNI**
  Netherlands Normalization Institute. Authorized Agency by CEN and ISO to maintain a register, and manage applications for authorized Issuing Agencies and their respective Issuing Agency Codes (IAC's) under ISO/IEC 15459

- **reader**
  A device used to capture the data encoded in a machine-readable symbol or other automatic data capture media. Machine-readable symbol readers consist of two parts: the transducer that sends signals proportional to the reflectivity of each successive element of the symbol to the decoder, that examines the signals from the scanner and translates them into recognizable or computer-compatible data. The decoder itself is sometimes called a reader.

- **serial number**
  A code assigned by the Supplier to an entity for its lifetime, (e.g., computer serial number, traceability number, contract tool identification)

- **structure**
  The order of data elements in a message.

- **supplier**
  In a transaction, the party that produces, provides, or furnishes an item or service.

- **symbology identifier**
  A sequence of characters, generated by the decoder and prefixed to the decoded data transmitted by the decoder, that identifies the symbology from which the data has been decoded. See ISO/IEC 15424, *International Specification - Data Carrier/Symbology Identifiers.*

- **traceability identification**
  A code assigned to identify or trace a unique group of entities (e.g., lot, batch, item, revision/version or serial number).

- **two-dimensional (2D) symbols**
  Machine-readable symbols that must be examined both vertically and horizontally to read the entire message. Two dimensional symbols may be one of two types: matrix symbols and multi-row symbols. Two dimensional symbols have error detection and may include error correction features.

- **UPN**
  Universal Product Number is the term of the regulations of the US Department of Defense for coding Health Care products either with HIBCC ore UCC Bar Code.

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