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Information technology — Radio frequency identification for item management — Unique identification for RF tags

Technologies de l'information — Identification par radiofréquence pour la gestion des objets — Identification unique des tags RF

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Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 15963 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 31, *Automatic identification and data capture techniques*.

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Introduction

ISO/IEC 15963 is one of a series of International Standards and Technical Reports developed by ISO/IEC JTC 1/SC 31 for the identification of items (Item Management) using radio frequency identification (RFID) technology.

ISO/IEC 15963 describes numbering systems for the unique identification of RF tags.

It is intended to be used in conjunction with other International Standards developed by SC 31 for "RFID for item management" such as ISO/IEC 18000 and ISO/IEC 15962.

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Information technology — Radio frequency identification for item management — Unique identification for RF tags

1 Scope

ISO/IEC 15963 describes numbering systems that are available for the identification of RF tags.

A unique ID is required as part of the write operation to RFID tags. The unique ID guarantees that the information written to a tag is unambiguously written to the correct data carrier (tag). A unique ID is also required in many read situations where the contents of the tag are tied to a specific item and that item needs to be unambiguously identified. Further discussion and explanation are given in Clause 5.

The unique ID may also be used

— for the traceability of the integrated circuit itself for quality control in their manufacturing process,

— for the traceability of the RF tag during its manufacturing process and along its lifetime,

— for the completion of the reading in a multi-antenna configuration,

— by the anti-collision mechanism to inventory multiple tags in the reader's field of view,

— for the traceability of the Item to which the RF tag is attached.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

ISO 6346, *Freight containers — Coding, identification and marking*

ISO/IEC 7816-6, *Identification cards — Integrated circuit cards — Part 6: Interindustry data elements for interchange*

ISO/TS 14816, *Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure*

ISO/IEC 19762-1, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 1: General terms relating to AIDC*[1)]

ISO/IEC 19762-3, *Information technology — Automatic identification and data capture (AIDC) techniques — Harmonized vocabulary — Part 3: Radio frequency identification (RFID)*[1)]

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ANS INCITS 256, *Radio Frequency Identification (RFID)*

General EAN.UCC Specifications (EAN International, Brussels)

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 19762-1, ISO/IEC 19762-3 and the following apply.

3.1
RF tag unique identifier
number that uniquely identifies an RF tag

3.2
RF tag issuer
company or organization that allocates the RF tags to the items they identify

3.3
IC manufacturer
company that manufactures the RF tag integrated circuit

3.4
RF tag manufacturer
company that manufactures the RF tag in a ready-to-use configuration

3.5
allocation class
8-bit value used to classify companies or organizations allowed to allocate unique tag identification

3.6
IC manufacturer registration number
number allocated to IC manufacturers according to ISO/IEC 7816-6 or ANSI ASC INCITS T6

3.7
RF tag issuer registration number
number allocated to RF tag issuers according to ISO 6346, ISO/TS 14816, or EAN.UCC

4 Symbols and abbreviated terms

AC	Allocation Class
AID	Application IDentifier
ANS	American National Standard
ANSI	American National Standards Institute
ASC	Accredited Standards Committee
EAN.UCC	a set of standards administered by EAN International
IC	Integrated Circuit
ID	IDentifier
INCITS	InterNational Committee for Information Technology Standards
LSB	Least Significant Bit

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MSB Most Significant Bit

RFU Reserved for Future Use

UID Unique (RF tag) IDentifier

5 The use of unique identifiers

This International Standard addresses those cases when a unique identifier (UID) is required as part of the read or write operation from or to RFID tags. The UID guarantees that the information transacted with a tag is unambiguously transacted with the correct data carrier (tag). A UID may be required in many read or write situations where the contents of the tag are tied to a specific item and that item needs to be unambiguously identified. There are some situations, however, when a UID is not required for reading or writing. These situations include circumstances where the presence of the information is all that is required and the tie to a specific asset is not required.

A UID does not need to be a permanent unique identifier in all situations. It is sufficient at times to identify a tag unambiguously by data contents, physical position or reply timing. In these situations a virtual ID tag is sufficient to uniquely identify a tag.

6 Possible ways to uniquely identify an RF tag

When a UID is required, it can be done in several ways. The following subclauses list and explain some of them.

6.1 Virtual ID

A virtual tag ID is a temporary ID based on tag parameters that may vary over the life of the tag. It may take several forms. A virtual ID is also known as a logical ID or a session ID. Several tags could have the same virtual ID at different times, but all tags at the same time for the same interrogator should have a different virtual ID, allowing an unambiguous identification of each tag at any time relative to any given interrogator.

The technical means to achieve and guarantee such uniqueness is outside of the scope of this International Standard. However, 6.1.1, 6.1.2 and 6.1.3 discuss possible approaches.

6.1.1 Data as a unique ID

Data is a possible way to implement a virtual ID where the tag contains data that when read is unique in time and location to a single tag. An example is a tag that contains date and time information. The time information can be unique to a single tag from a manufacturer, but is not guaranteed to be unique over all tags at all times. Another situation is a closed application where tag data describes only one set of information. Taken globally, the tag bit pattern might be repeated, but in a closed application the tag data uniquely identifies a single tag.

6.1.2 Time as a unique ID

Time is a possible way to implement a virtual ID where bit patterns alone do not necessarily identify a single tag unambiguously. Tag response time slot can be part of a uniquely identifying parameter set. For example, some tags use time slots to differentiate between several tags appearing to a reader at the same time. If these time slots are fixed for a single interrogation exchange, then the time slot may be used to help define a single tag at a particular time.

NOTE If the time slots are randomly defined each time a tag responds, then time slots are not suitable for determining a unique tag ID.

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6.1.3 Position as a unique ID

In some applications, tag position may define a unique tag ID at a particular time. For instance, some tags have a read and write distance of only a few millimetres. In this case it is difficult to have more than one or two tags in the interrogation zone at any time. Thus any tag continually in the reading zone may be considered unique at that single time and location. A common example of this case is the tag used for fare collection on public transportation or telecommunication charges.

6.2 Permanent unique ID

When a completely and globally unique ID is required, it shall be programmed into the tag, and therefore becomes permanent.

Annex A contains an example of a manner to specify a permanent unique ID.

6.2.1 Benefits of permanent unique ID versus virtual ID

The advantage of a virtual (session) ID is the reduced number of identification bits required. The disadvantage is the absence of a unique ID, independent of the reader, application, time or data configuration used. The virtual ID is unique only at a specific time and location, and is sufficient to allow the identification of a singular tag relative to time and space.

The advantage of a permanent unique ID is that it guarantees a single ID over all application, space and time situations.

It is the only identification method where a completely unique ID is guaranteed in all situations.

6.2.2 Selection of the size of a permanent unique ID

Several criteria must be taken into account when selecting the size (i.e. the number of bits) of a permanent unique ID:

a) To comply and coexist with existing ISO/IEC standards, so that the uniqueness is guaranteed globally, and that the objectives of the ISO standards are met.

b) To structure it such that it's technical implementation is optimized. This results for RF tags in the selection of an "N power 2" number of bytes (1, 2, 4, 8).

c) To guarantee a number of combinations large enough to ensure that no two tags will be allocated the same ID within the maximum expected lifetime of a tag, under reasonable conditions, e.g. 10 years.

d) To ensure that individual ID assignments can be delegated to IC or tag manufacturers in an efficient manner.

e) To limit it to the absolute minimum size (i.e. number of bits) required to meet the above criteria, as its size might penalize the performance of the interrogator-to-tag communication by increasing the number of bits to transmit. As an example, a small number of bits (e.g. 32 bits) may be sufficient for applications with a small number of tags.

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Annex A
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Numbering system of a permanent unique identifier (UID)

A.1 General

This annex contains an example of a numbering system for RF tags using permanent unique identifiers (UIDs). For the realization of such a numbering system it is necessary to incorporate the specification below and the specification of associated registration procedures in an international standard.

In order to ensure the uniqueness of the RF tag identifier, the following rules specify its structure and length.

A.2 UID issuer identifier

To ensure the uniqueness of each UID, each UID issuer must be uniquely identified. Five classes of issuer will be defined.

The length of the RF tag unique identifier is assigned by the registration authorities identified below. It consists of three fields, as shown in Table A.1.

Table A.1 — Structure of the permanent unique identifier (UID)

AC	UID issuer registration number	Serial number
8 bits	Size defined by AC value	Size defined by AC and UID issuer value

MSB **LSB**

A.3 Allocation class (AC)

The size of the allocation class is 8 bits. Five classes of UID issuer are defined as shown in Table A.2.

Table A.2 — Classes of unique identifier (UID) issuer

Allocation class value	Class	UID issuer identifier size	Serial number size	Registration authority (of UID issuer registration number)
'11100000'	ISO/IEC 7816-6	8 bits	48 bits	APACS (ISO/IEC 7816-6 registration authority)
'11100001'	ISO/TS 14816	per NEN	per NEN	NEN (ISO/TS 14816 registration authority)
'11100010'	EAN.UCC	per EAN.UCC	per EAN.UCC	EAN.UCC
000xxxxx	INCITS 256	per ANS INCITS 256	per ANS INCITS 256	ANSI ASC INCITS T6
'11100011' to '11101111'	RFU	N/A	N/A	Reserved for future use by ISO

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A.4 UID issuer registration number

The UID issuer registration number is assigned by either the registration authority for ISO/IEC 7816-6 (for IC card manufacturers), the registration authority for ISO/TS 14816 (for freight container and transport applications), the registration authority for EAN.UCC standardized numbering, or the registration authority for ANS INCITS 256.

A.5 Serial number

The UID issuer issues the serial number and has the responsibility to ensure its uniqueness.

It shall be unique in the sense that the issuer does not re-issue a number until a sufficient period of time has passed so that the first number has ceased to be of significance to any user.

The serial number is a binary value. The length of the unique tag ID is dependent upon the specific allocation class used.

A.6 Allocation classes

A.6.1 In support of ISO/IEC 7816-6

The IC manufacturer is registered in ISO/IEC 7816-6 through application to the registration authority.

If AC = '11100000', the unique identifier is allocated by an IC manufacturer, identified by an 8-bit (1 byte) number.

The IC manufacturer shall be registered in ISO/IEC 7816-6 through application to the registration authority.

The AC is followed by the 8-bit IC manufacturer registration number and a 48-bit serial number allocated by the IC manufacturer. See Table A.3.

Table A.3 — ISO/IEC 7816-6 unique identifier

Allocation class	IC manufacturer registration number	Serial number
8 bits	8 bits	48 bits
'11100000'	As registered in ISO/IEC 7816-6	Allocated by the IC manufacturer
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A.6.2 In support of ISO/TS 14816

If AC = '11100001', the unique identifier is issued by an RF tag manufacturer in support of ISO/TS 14816, identified consistent with ISO/TS 14816.

The RF tag manufacturer shall be registered in accordance with the procedures defined in ISO/TS 14816.

The AC is followed by the convention shown in Annex B.

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Table A.4 — ISO/TS 14816 unique identifier

AC	RF tag issuer registration number	Serial number
8 bits	As defined ISO/TS 14816	As defined ISO/TS 14816
'11100001'	As defined ISO/TS 14816	As defined ISO/TS 14816

MSB **LSB**

A.6.3 In support of EAN.UCC standardized numbering

If AC = '11100010', the unique identifier is issued by an RF tag manufacturer in support of EAN.UCC standardized number, consistent with the General EAN.UCC Specifications.

The RF tag manufacturer shall be registered in accordance with the procedures defined in the General EAN.UCC Specifications.

NOTE The Electronic Product Code (EPC) is a code structure, and part of the EPC Network, which is managed by EPC global. The EPC has been expressly designed to uniquely and unambiguously identify items using standardized, managed, serialized codes, with RFID tags as the data carriers. It is anticipated that EPC structure(s) will be standardized by EAN.UCC and published in the *General EAN.UCC Specifications*.

The AC is followed by the convention shown in the *General EAN.UCC Specifications*.

Table A.5 — EAN.UCC unique identifier

AC	RF tag issuer registration number	Serial number
8 bits	As defined in the *General EAN.UCC Specifications*	As defined in the General *EAN.UCC Specifications*
'11100010'	As defined in the *General EAN.UCC Specifications*	As defined in the *General EAN.UCC Specifications*

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A.6.4 In support of ANS INCITS 256

If AC = '000xxxxx', the unique identifier is issued by an IC manufacturer in support of ANSINCITS 256.

The IC manufacturer shall be registered in accordance with the procedures defined in ANSI ASC INCITS T6.

The AC is followed by the convention shown in ANS INCITS 256. The total length of this unique identifier including allocation class (AC), IC manufacturer registration number, and serial number is 64 bits (or in relation to 18000-7: 32 bits).

Table A.6 — ANS INCITS 256 unique identifier

AC	IC manufacturer registration number	Serial number
8 bits	As defined in ANS INCITS 256	As defined in ANS INCITS 256
'000xxxxx'	As defined in ANS INCITS 256	As defined in ANS INCITS 256

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A.6.5 Reserved for future use

If AC = ‘11100011’ to ‘11101111’, the unique identifier is reserved for future use (RFU) by this standard.

The tag manufacturer shall be registered in accordance with the procedures defined by the registration authority of that standard.

Table A.7 — Reserved for future use (RFU) unique identifier

AC	RF tag issuer registration number	Serial number
8 bits	RFU	RFU
‘11100111’ to ‘11101111’	RFU	RFU

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Annex B
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ISO/TS 14816 – Numbering systems for supply chain applications of RFID

Within supply chain applications for RFID, there are several numbering structures that are used by ISO TC 104, ISO TC 122, and ISO TC 204. These structures are shown in Table B.1, below.

Table B.1 — Coding structure identifiers (CSI)

CSI	Length	Coding structure data field			
0	Variable	Reserved for CEN/ISO			
		Not defined			
1	7 octets / 56 bits	Country code[a]	Issuer identifier	Service number	
		10	14	32	
2	6 octets / 48 bits	Manufacturer identifier	Service number		
		16	32		
3	22 octets / 176 bits	Start time	Stop time	Geographic limit	Application limit
		80	80	8	8
4	Variable	Country code[a]	Alphabet indicator	License plate #	
		10	8	Not defined	
5	17 octets / 136 bits	Vehicle identification (chassis) number			
		126			
6	Variable	Reserved for CEN/ISO			
		Not defined			
7	93 bits	Freight container numbering			
		93			
8	Variable	Country code[a]	Tax code		
		10	Not defined		
9	Variable	Reserved for CEN/ISO			
		Not defined			
…	Variable	Reserved for CEN/ISO			
		Not defined			
30	Variable	Reserved for CEN/ISO			
		Not defined			
31	Variable	Reserved for CEN/ISO (extension)			
		Not defined			

[a] Country code is in accordance with ISO 3166-1.

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Information on these assignments can be found at the following URLs:

http://www.nni.nl/cen278/14816main.html

http://www.nni.nl/cen278/14816_Manufacturer_by_ID.html

http://www.nni.nl/cen278/14816_NRAI_register_by_country.html

Maintenance of CSI-7 is in accordance with ISO 6346, whose Registration Authority is the International Container Bureau (BIC).

Registration Authority
c/o International Container Bureau
167, rue de Courcelles
F-75017 Paris
France
Tel: +33 1 47 66 03 90
Fax: +33 1 47 66 08 91
E-mail: bic@bic-code.org

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