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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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 18000-1 was prepared by Joint Technical Committee ISO/IEC JTC 1, Subcommittee SC 31, Working Group 4, *Information technology -Automatic identification techniques, RFID for item Management.*

The ISO 18000 series of standards comprise :

— *Information technology AIDC techniques - RFID for item management - Part 1 - Definition of parameters to be standardized.*

— *Information technology AIDC techniques - RFID for item management - Part 2 - Parameters for air interface communications below 135 kHz*

— *Information technology AIDC techniques - RFID for item management - Part 3 - Parameters for air interface communications at 13.56 MHz*

— *Information technology AIDC techniques - RFID for item management - Part 4 - Parameters for air interface communications at 2.45 GHz*

— *Information technology AIDC techniques - RFID for item management - Part 6 - Parameters for air interface communications at 860-930 MHz*

— *Information technology AIDC techniques - RFID for item management - Part 7 - Parameters for Active Air Interface Communications at 433 MHz*

This Standard, ISO 18000 Part 1: *Definition of Parameters to be Standardized.* **sets the framework and formula for the subsequent parts and provides information regarding radio regulator contacts and examples of Architecture frameworks.**

Introduction

This Standard has been developed by ISO/IEC SC31 WG4, Radio Frequency Identification for Item Management, in order to provide parameter definitions for communications protocols within a common framework for internationally useable frequencies for Radio Frequency Identification (RFID), and, where possible, to determine the use of the same protocols for ALL frequencies such that the problems of migrating from one to another are diminished; to minimise software and implementation costs; and to enable system management and control and information exchange to be common as far as is possible.

Informative Annexes to this Standard provide contact information in respect of the radio regulations within which such systems have to operate, and some informational views of system architectures within which RFID for item management is likely to be used. (Annexes A and C).

Vision statement

This Standard (ISO 18000-1) defines of a common set of parameters that are necessary (at any frequency) in order to avoid contention or interference with other RFID systems, to establish the highest degree of interoperability as is practicable, and to ease migration between technical solutions and their supporting software. The Standard envisions common methods of determination and description.

Mission statement

The mission of this Standard (18000-1) is to determine common parameters to be defined in an item identification air interface Standard; the method and means of their definition, and to provide a common format for their elaboration and definition. Subsequent Parts of this Standard (ISO 18000 –2 to ISO 18000 –n), shall provide the parameter definitions, at different frequencies, for each of the parameters required by this Standard in accordance with the common format herein determined, and may also, where appropriate, provide regional definitions with geographical constraints. If any parameter defined in this Standard is inappropriate at a particular frequency, it shall be specifically and expressly stated in that Part of the Standard that the named and referenced parameter is not appropriate at that frequency. This Standards to additionally provide relevant information in respect of radio regulations bodies and some examples of conceptual system architectures within which RFID for Item Management is likely to be used

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1 Scope

1.1 The Scope of this Standard is to define the Parameters that shall be determined in any Standardised Air Interface Definition in the ISO 18000 series. The subsequent parts of the 18000 series of Standards shall provide the specific values for definition of the Air Interface Parameters for a particular frequency/type of air interface from which compliance to (or non compliance with) this Standard can be established. This Standard also provides description of example conceptual architectures in which these air interfaces are often to be utilized.

1.2 This Standard limits its Scope to transactions and data exchanges across the air interface at **Reference Point Delta**. (See Section 6, fig 1. below). The means of generating and managing such transactions, other than a requirement to achieve the transactional performance determined within this Standard, are outside the scope of this Standard, as is the definition or specification of any supporting hardware, firmware, software or associated equipments.

1.3 Standardisation of other Reference Points is outside the scope of this Standard. (See fig 1. below)

1.4 This standard is an enabling standard which supports and promotes several RFID implementations without making conclusions about the relative technical merits of any available option for any possible application.

2 Conformance

2.1 Claiming conformance

In order to claim conformance with this Standard it is necessary to comply to all of the clauses of this Standard except those marked 'optional' and it is also necessary to operate within the local National Radio regulations (which may require further restrictions) and, if appropriate, to hold a valid licence from the appropriate owner of intellectual property associated with the MODES defined herein.

2.2 General conformance requirements

General conformance requirements shall be determined within ISO (TR) 18047 Information Technology-AIDC Techniques-RFID device conformance test methods.

2.3 Command structure and extensibility

Standards in the ISOP/IEC 18000 series include definition of the structure of command codes between an Interrogator and a Tag and indicate how many positions are available for future extensions.

Command specification clauses provide a full definition of the command and its presentation.

Each Command is labelled as being 'mandatory' or 'optional'.

In accordance with ISO 18000-1, the clauses of each 18000 series Standard shall make provision for ‘custom’ and ‘proprietary’ commands.

2.3.1 Mandatory commands

A Mandatory command shall be supported by all tags that claim to be compliant and all interrogators which claim compliance shall support all mandatory commands.

2.3.2 Optional commands

Optional commands are commands that are specified within the Standard. Interrogators shall be technically capable of performing all optional commands that are specified in the Standard (although need not be set up to do so). Tags may or may not support optional commands.

If an optional command is used, it shall be implemented in the manner specified in the Standard.

2.3.3 Custom commands

Custom commands may be enabled by a Standard, but they shall not be specified in that Standard.

A custom command shall not solely duplicate the functionality of any mandatory or optional command defined in the Standard by a different method.

2.3.4 Proprietary commands

Proprietary commands may be enabled by a Standard, but they shall not be specified in that Standard.

A proprietary command shall not solely duplicate the functionality of any mandatory or optional command defined in the Standard by a different method.

3 Normative references

3.1 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 3309

Information Technology - Telecommunications and Information Exchange between Systems - High Level Data Link Control (HDLC) Procedures - Frame Structure

ISO 8802-2 :1989

Information Technology - Telecommunications and Information Exchange between Systems, Local and Metropolitan Area Networks - Specific Requirements - Part 2: Logical Link Control

ISO/IEC 8824 -1: 1995

Information technology - Abstract Syntax Notation one (ASN.1): Specification of Basic Notation.

ISO/IEC 8824 -1: 1995 Amd 1996

Information technology - Abstract Syntax Notation one (ASN.1): Specification of Basic Notation. Amendment 1 Rules of Extensibility.

ISO/IEC 8824 -2: 1995

Information technology - Abstract Syntax Notation one (ASN.1): Information object specification.

ISO/IEC 8824 -2: 1995 Amd 1996

Information technology - Abstract Syntax Notation one (ASN.1): Information object specification. Amendment 1 Rules of Extensibility.

ISO/IEC 8824 -3: 1995

Information technology - Abstract Syntax Notation one (ASN.1): Constraint specification.

ISO/IEC 8824 -4: 1995

Information technology - Abstract Syntax Notation one (ASN.1): Parameterisation of ASN.1 specifications.

ISO/IEC 8825 -1: 1995

Information technology - ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).

ISO/IEC 8825 -2: 1996

Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER),

ISO/IEC 15961 (To be published)

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ISO/IEC 15962 (To be Published)

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ISO 17261

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ISO 18047 (To be published)

Information Technology-AIDC Techniques-RFID device conformance test methods.

ISO/IEC 19762

Information Technology AIDC Techniques- Harmonised Vocabulary

IEEE 802.11

Standard for Wireless LAN: Medium Access Control (MAC) and Physical Layer (PHY) Specification"; Institute of Electrical and Electronics Engineers; 1997. Move to Normative

EN 300 220-1,

Part 1: Technical characteristics and test methods

EN 300 220-2,

Part 2: Supplementary parameters not intended for conformity purposes

EN 300 220-3,

Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD);Radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW; range 9 kHz to 25 MHz and inductive loop systems

Part 3: Harmonized EN covering essential requirements of article 3.2 of the R&TTE Directive

EN 300 330

Electromagnetic compatibility and Radio spectrum Matters (ERM); Short Range Devices (SRD); Technical Characteristics and test methods for Radio equipment in the frequency in the frequency range 9 KHz to 30 MHz.

EN 300 440 *(note: this is being amended and the title, range and definitions are modified later when available).*

Radio Equipment and Systems (RES); Short range devices; Technical characteristics and test methods for radio equipment to be used in the 1 GHz to 25 GHz frequency range"; European Technical Standards Institution ETSI, TC RES, STC RES8, December 1995.

UPU S23

Radio Frequency Identification (RFID) and Radio Data Capture (RDC) Systems Air Interfaces : Communications and Interfaces : Definition of Parameters to be Standardized.

4 Terms and definitions

4.1 The principal Terms and Definitions for this Standard are detailed in ISO/IEC 1976, Information Technology AIDC Techniques-Vocabulary

4.2 For the purposes of this part of ISO 18000 (All Parts) the following terms and definitions apply.

1.1.0
MODES (Standardized)
Different Standardized RFID Systems for Item Identification operating within the same frequency range. Such systems may or may not be interoperable, but shall not significantly interfere with each other. A Standard providing parameter definitions for a particular frequency range may have one or several MODES.

1.2.0
Significant Interference
Significant Interference exists if a system of one Standardized MODE (working within the most widespread regulated power emissions) is likely to impede the successful operation of a system of another Standardized MODE (working within the most widespread regulated power emissions), *in likely expected operating situations.*

1.3.0
Marginal measurable interference
Marginal measurable interference is interference that does not impede operation *in likely expected operating situations*, or that could be avoided by simple and inexpensive design improvement, shall not be considered cause to reject a MODE."

5 Symbols and abbreviated terms

5.1 The principal Symbols and abbreviated terms for this Standard are detailed in ISO/IEC 19762 "Information Technology AIDC Techniques-Vocabulary".

5.2 For the purposes of this part of ISO 18000 (All Parts) the following terms and definitions apply.

2.1.0
AFI
Application Family Identifier

2.2.0
API
Application Programming Interface

2.3.0
CW
Continuous Wave

2.4.0
DFMFM
Double Frequency Modified Frequency Modulation

2.5.0
DLL
Data Link Layer (OSI Model)

2.6.0
DSFID
Data Storage Format Identifier

2.7.0
EOF
End Of Frame

2.8.0
FCC
Federal Communications Commission (of USA)

2.9.0
FTDMA
Frequency and Time Division Multiple Access

2.10.0
LPB
Long Power Break

2.11.0
MFM
Modified Frequency Modulation

2.12.0
MFR Tag ID
Unique Identifier known in some places as UID.

2.13.0
n/a
Not applicable

2.14.0
PJM
Phase Jitter Modulation

2.15.0
PN
Pseudo-Noise (as in PN Code)

2.16.0
SOF
Start Of Frame

2.17.0
TRAM
Temporary Random Access Memory

2.18.0
VICC
Vicinity integrated circuit card

6 Architectures, references and exclusions

6.1 Communications architecture

6.1.1. This Standard limits its Scope to transactions and data exchanges across the air interface at **Reference Point Delta**. (See Figure 6.1. below). The means of generating and managing such transactions, other than a requirement to achieve the transactional performance determined within this Standard, are outside the scope of this Standard, as is the definition or specification of any supporting hardware, firmware, software or associated equipments.

Standardisation of other Reference Points are outside the scope of this Standard. (See fig 1. Below)

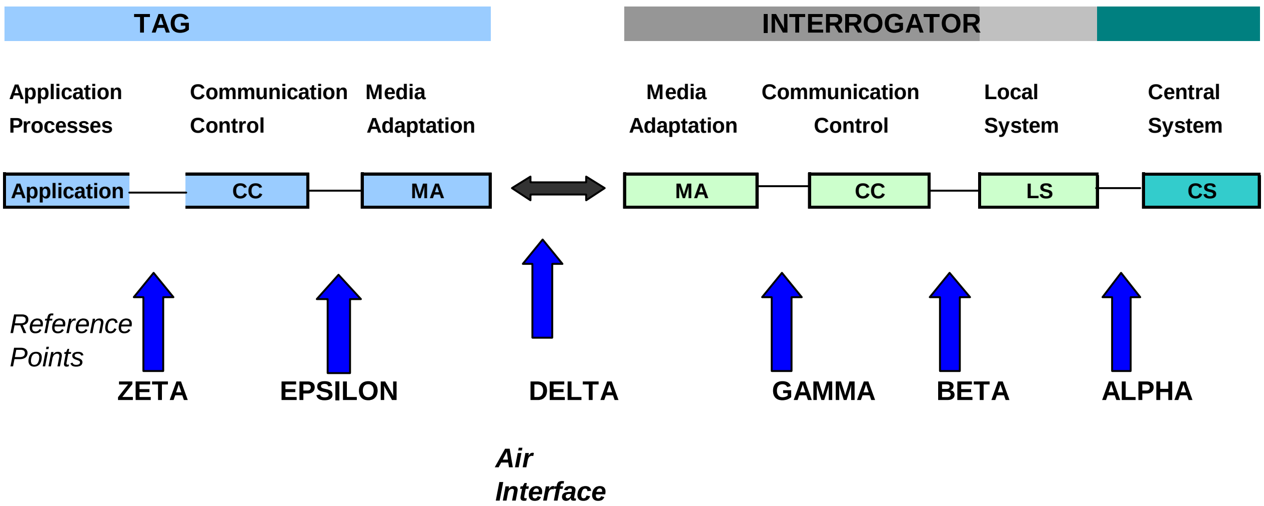

Figure 1 : RFID Reference Communications Architecture

6.1.2 **Entity blocks**

- **Central System**. This block contains all centralised functions of General Distribution Logistic Model applications.
- **Local System.** This is the local (roadside) Entity that handles the "real-time" and distributed parts of the General Distribution Logistic Model application.
- **Fixed Communication Control**. Communication block that handles the medium independent part of the communication link.
- **Media Adaptation.** The medium dependent Entity
- **On-board Communication Control**. Communication control that handles the medium independent part of the communication link .
- **Application Processes.** This Entity symbolises several in-vehicle applications, of which the General Distribution Logistic Model may be only one application process.

6.1.3 **Reference points.**

- **ALPHA.** Alpha is the reference point which delimits the functions of the central system and the local system.
- **BETA.** The reference point where data, commands, etc. are passed from the fixed communication control to the local system function, and vice-versa.
- **GAMMA.** Between fixed communication control and media adaptation.
- **DELTA.** Between on-board and fixed equipment. This reference point usually corresponds with an air interface in the nature of Dedicated Short Range Communication.
- **EPSILON.** Between media adaptation and on-board communication control.
- **ZETA.** Reference point between on-board communication control and application processes.

6.1.4 Figure 2 Describes the nature of the General Distribution Logistic Model context negotiation and transaction at **Reference Point Delta.**

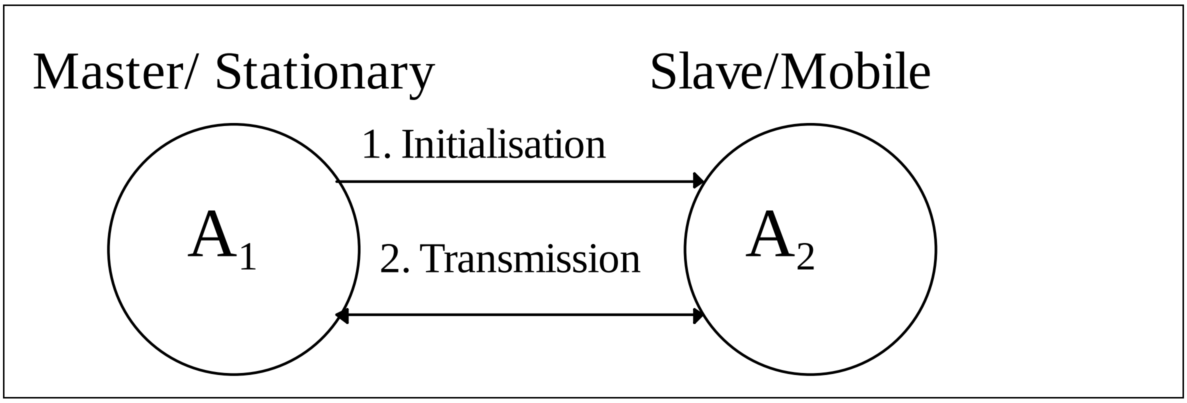

Figure 2 Simplified context negotiation (typical tag transaction)

The communication starts with the Master A_1 downloading a message to the slave A_2, referring to a list of predetermined contexts defined by (Protocol, Encoding, Applications) triplets. The slave, if prepared to handle any of these, can start the transmission referring to the chosen application.

6.1.5 Interaction sequence

An example of the interaction sequence for General Distribution Logistic Model can be defined as described in Figure 3.

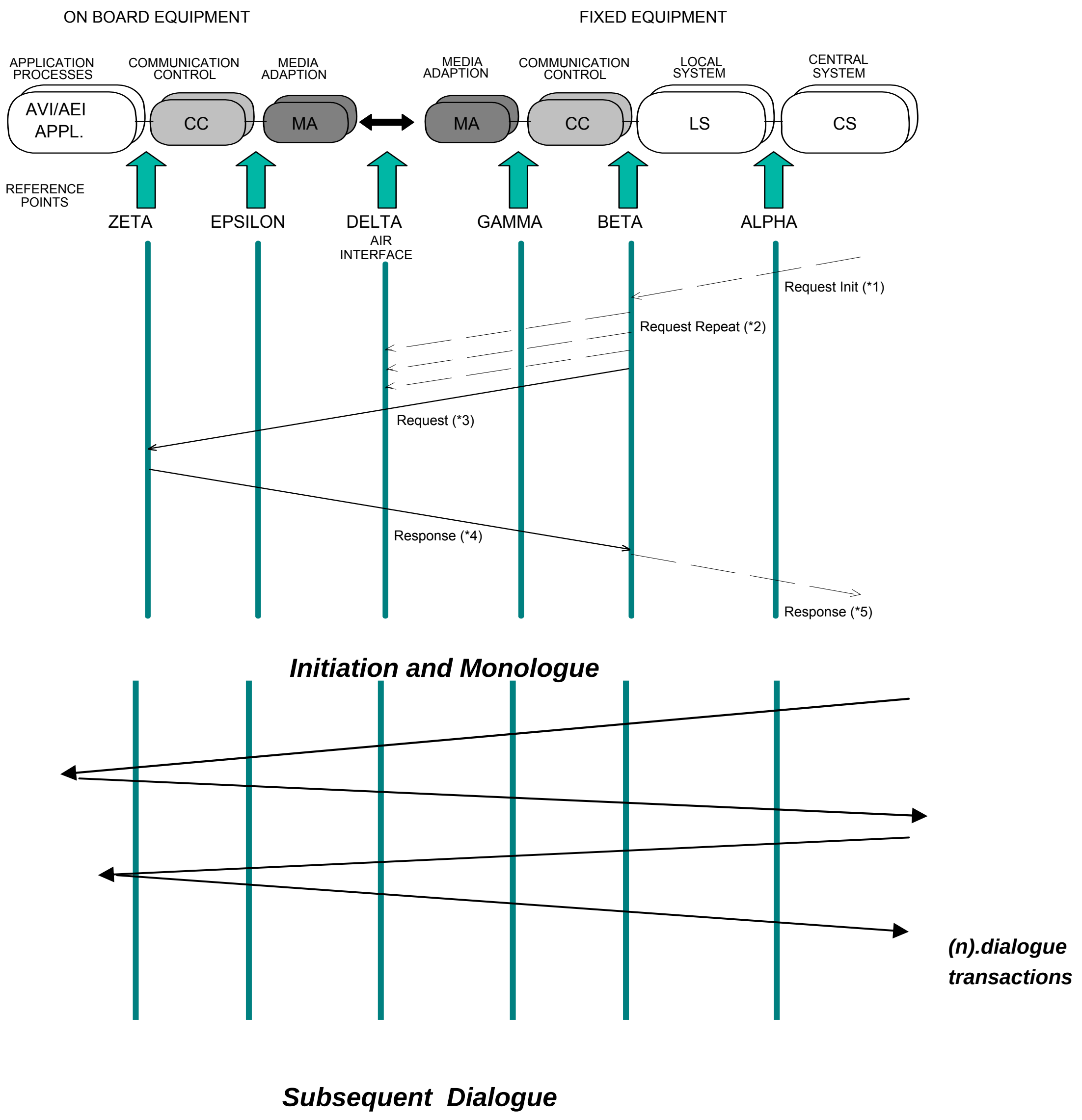

Figure 3 Functional (information flow) interaction sequence diagram for generic general distribution logistic model communications systems

The Application Information Flow is not defined herein, but some of these aspects may be addressed in subsequent additions to this Standard.

6.2 System specification

System Specification is not defined within this Standard which relates solely to the interface between an interrogator and a Transponder.

6.3 Interface specification

Standards ISO 18000-2 to ISO 18000-n (Interface Specifications at different frequencies) define, describe and specify interface(s) in physical and procedural terms in conformance to Standard parameters defined below.

6.4 Application architecture

Application architecture specification is outside the scope of this version of the Standard. Some example typical conceptual architecture views and contexts in which RFID for item Management are likely to be used are shown in Annex C.

6.5 Information and data architecture

Information/data architecture aspects are addressed in ISO 15961.

6.6 Implementation architecture

This family of Standards provide assistance and guidance to those implementing Item Identification systems using RFID. The 'implementation' level of architecture is the mapping of functions into physical boxes at one or a number of locations. These are a function for commercial consideration, rather than Standardisation, and the Implementation Architecture is specifically excluded from this family of Standards.

6.7 System security architecture

System Security Architecture is not defined within this Standard.

6.8 Resilience considerations

Resilience considerations are not defined within this Standard.

6.9 Unique Identification

In subsequent Parts of the 18000 series Standards unique identification (UID) may be required. Annex D provides a preferred form of UID. For some Parts this may be defined as a normative requirement, in other Parts it may be advisory or not preferred. Whether this form of UID is mandatory, Advisory or not applicable in any specific Part shall be determined in the Normative Clauses of that Standard.

7 Requirements

7.1 Context (general)

There are a number of different frequency ranges that an RFID system may legally use in any country. Whilst steps are being taken to harmonise frequency regulations throughout the world, there remain differences in frequency, bandwidth and allowed maximum power which will affect performance of systems in any specific location.

Different applications also require different performance characteristics. Some, for example, may require very short read or write range, others longer reading ranges. Some may require very high tag populations within the reading range, others few, or perhaps even only one.

This family of Standards (ISO 18000) provides a framework within which developers of Application Standards, and users of such Standards, may select one or more Standardized options that meet their requirements in the region, or regions, of use.

NOTE: *Users of this Standard and its subsequent parts are required to ensure that the option(s) chosen are legal within the radio regulations of the countries where it is intended to operate the system. An informative Annex to this Standard (Annex A) provides some guideline assistance of the situation as at the time of publication of this Standard, but the responsibility remains for the supplier and user to ensure conformance to National regulations*

RFID Application Standards for Item Management may specify the use of one or more Standardised Air Interfaces to meet specific application requirements.

In order to maximise interoperability, a Standard set of Parameters shall be determined for each approved frequency, or a limited range of options (to be called "MODES") shall be determined.

7.2 Instruction to developers of subsequent parts of this standard

7.2.1 Developers of the subsequent parts of this Standard are instructed to limit the number of permitted modes to those of different characteristics, and, within the Standard, to specifically explain the differences in characteristics and the likely impact on performance that may be expected. *(For example : MODE 1 is usually most suited to longer read ranges, whilst MODE 2 is most suited for high tag in read zone populations. MODE 3 is Read only etc.)* . Where practicable a tabular comparison shall also be made.

7.2.2 Where protocol sets are offered for Standardization where there is little technical or characteristic difference between options, Standards developers are requested to try to determine a compromise single MODE accommodating both parties. Where such accommodation is not possible or agreeable to the parties, the matter to be referred to the Working Group for decision.

7.2.3 Standards developers have a duty to ensure that no "significant interference" exists between Standardized MODES. "Significant Interference" exists if a system of one Standardized MODE (working within the most widespread regulated power emissions) is likely to impede the successful operation of a system of another Standardized MODE (working within the most widespread regulated power emissions), *in likely expected operating situations.*

Marginal measurable interference is interference that does not impede operation *in likely expected operating situations*, or that could be avoided by simple and inexpensive design improvement, shall not be considered cause to reject a MODE.

7.2.4 Where the air interface requires a tag to be battery assisted, this shall be explicitly stated.

7.2.5 Active RFID modes shall be clearly identified as such in the standard.

7.2.6 Tag Talk First (TTF) Modes shall be clearly identified as such in the standard.

7.2.7 Installers of RFID systems are advised that they should make best efforts to be a good neighbour in installing any systems, bearing in mind that there may be other systems sharing the same bandwidth and are advised to take precautions to minimise interference to other systems. Installers are equally advised to be prepared to handle interference within the bandwidth from other users up to transmission powers permitted by local regulations.

7.2.8 Where particular local regulations are likely to cause a problem of interference in one country, but are unlikely to cause a general problem, this shall not be considered cause to reject a MODE. (For example, a country allowing a particularly high power emission may make interference between MODES possible where such interference would not cause "significant interference" in most countries, or one country enforcing particularly low power emission regulations may cause one system to be interfered with in the presence of a different, more sensitive, MODE). Annex A to that Standard shall state clearly the countries where such local problems may be expected.

Systems that can only operate with power emission levels that are so high that they likely to cause interference problems in the majority of countries shall not be acceptable as ISO Standard MODES.

7.2.9 Standards Developers are instructed to take into account any *approved* Standards or regulations from recognised International or Regional Standards or Regional or National Regulatory Bodies in respect of Human Exposure to Electromagnetic Fields (EMFs) from Devices used in Radio Frequency Identification (RFID) and similar applications.

Where particular National regulations exist, that are not adopted by other countries, such regulations should be declared in Annex A of the Standard, stating that operation in the determined country(ies) is not permitted or significantly limited in power emission.

NOTE: *(Discussion Drafts or Working Draft Proposals in respect of Human Exposure to Electromagnetic Fields (EMFs) from Devices used in Radio Frequency Identification (RFID) and similar applications need not be taken into account unless the developers believe that they are likely to come into force without significant amendment).*

Systems that can only operate with power emission levels that are so high that they likely to exceed emission levels in a*pproved* Standards/Regulations of *recognised* International or Regional Standards/Regulatory Bodies shall not be acceptable as ISO Standard MODES.

NOTE: *Recognised International or Regional Standards Bodies include : ISO, IEC, CEN, CENELEC, CEPT, ETSI, IEEE, FCC, ARIB, ITU.*

7.3 Context (OSI)

RFID applications utilise an air interface (interface “Delta” in fig 1 above). Because the transactions across this interface are usually time constrained, and the read zone is also usually limited either by antenna design and the amount of power emitted, a specific protocol architecture is determined. In OSI terms this may be described as a reduced protocol stack as shown below, built up by the application layer, the data link layer, and the physical layer. Such an architecture is very common for real-time environments.

In a bi-directional system, the Air Interface protocol stack is set up in accordance with the master-slave principle, where the Interrogator as the master organises the entire communication process. The Air Interface Definitions enable compliant communication systems to serve multiple Interrogators and multiple applications in parallel.

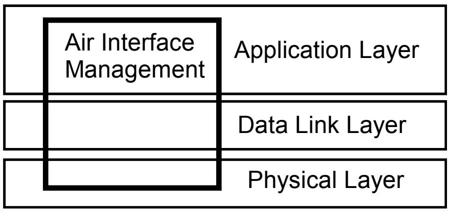

Figure 4: Air Interface protocol stack

Subsequent parts of this Standard (ISO 18000-2 to ISO 18000-n) will provide parameter definitions for that frequency operating within Global radio regulations, and may also, where appropriate, provide regional definitions with regional limitations.

Where the value (or choice of values) required to meet a parameter requirement for conformance to a particular Air Interface Definition is fixed, it (they) shall be stated clearly together with the degree of tolerance to any deviation. Where a range of values is permissible, the upper and lower limits shall be stated.

Parameter tables are required in a consistent format (as defined within this Standard). If a parameter determined in any Standard in this series is optional or not relevant, this shall be stated in the appropriate Parameter Table displayed within that Standard. Unless so stated it may be assumed that values for that parameter are required and that the Standard is incomplete without them.

There is a practical necessity to use different frequencies. In developing these RFID Standards, consideration has been made throughout to ensure that, wherever possible, the same protocols are used throughout to minimise the costs of migration or simultaneous function of equipment operating at different frequencies but within a single common system.

In the subsequent parts of ISO 18000, providing parameter definitions, the specifications for Layer 7 (Application Layer) shall be, as far as possible, common, and where different from the common approach, the differences shall be highlighted and explained. Layer 7 (Application Layer) issues dealt with in this family of Standards are only those required to achieve a successful interaction between Interrogator and Tag. Data Standards as they relate to application data shall be dealt with in other relevant Standards (such as ISO 15962) specific application requirements are not dealt with in the ISO 18000 series determining air interface protocols.

In Layer 1, (Physical) whilst the physical control and management methods differ, in some cases significantly, those protocols that are common shall be defined in the same way, and the objectives and outputs of these operations shall also be common.

7.4 Bi-directional systems

A Bi-Directional System requires both the sending and receiving of signals by one or both parties (Interrogator & Tag). This Standard determines all of the parameters that may be expected in a complex two way exchange of data (read/write) between fixed equipment and on board equipment. Most RFID systems are bi-directional, whether they be read only or read/write. Unless otherwise stated, specifications in subsequent parts of this Standard relate to bi-directional systems.

7.5 Uni-directional systems

A Uni-Directional signal requires only one party to transmit and the other to receive. Where such options are Specified as MODES in the subsequent parts of this Standard, it shall be clearly identified in the title of the MODE that the specification relates to a Uni-Directional system. The same parameters shall be specified in the same way, although there will be many parameters noted as *"Not applicable in this option" (See 6 below)* In such systems the interrogator is a passive radio receiver and may emit no signals to initiate a transaction (if it does so it shall be considered as a bi-directional system and must not interfere with other Standardized MODES at that frequency).

The active transmitter shall not cause any "*significant Interference*" (See 7.2.3. above) to any bi-directional Standardized MODE operating within the same frequency range.

7.6 Relationship to other standards

This is one of a series of Standards defining Automatic Identification Standards, where RFID techniques are used for item management. The ISO 18000 series is marshalled under the title : *Information technology AIDC techniques – RFID for item management - Air interface.*

This Standard (ISO 18000) is in several parts. This part, *Part 1 — Definition of parameters to be standardized,* determines the Parameters to be Standardized, whilst the subsequent parts provide determination of the values for particular frequency ranges.

Other relevant Standards include :

ISO/IEC 18000, Part 2, Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 2 - Parameters for Air Interface Communications below 135 kHz

ISO/IEC 18000, Part 3, Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 3 - Parameters for Air Interface Communications at 13.56 MHz

ISO/IEC 18000, Part 4, Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 4 - Parameters for Air Interface Communications at 2.45 GHz

ISO/IEC 18000, Part 5, Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 5 - Parameters for Air Interface Communications at 5.8 GHz

ISO/IEC 18000, Part 6, Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 6 - Parameters for Air Interface Communications at 860 – 930 MHz

ISO/IEC 18000, Part 7, Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 5 - Parameters for Air Interface Communications at 433 MHz

ISO/IEC 15962, Information Technology AIDC Techniques - RFID for Item Management - Data Syntax

ISO/IEC 18046, Information Technology - AIDC Techniques - RFID device performance test methods

ISO/IEC 18047, Information Technology - AIDC Techniques - RFID device conformance test methods

7.7 Parameters

All Air Interface Definitions for RFID Systems for Item Identification shall provide a description of the parameters listed in this Clause and shall define the requirements of at least these parameters using the criteria listed below.

The presented requirements shall distinguish between default and optional parameter definitions.

All measurements shall be made within a frame of reference within which either the Interrogator or the Tag is static relative to the measuring equipment.

Some Air Interface Definitions may not require all of the parameters to be defined. Any parameters that are not applicable at a particular frequency determination (or option therein) shall be explicitly and overtly described in the Standard *as "n/a"* .

Where solutions do not require all of the parameters to be used (for example in a read only system), those parameters that *are* used shall comply to the common Standard requirements for that Air Interface Definition in any particular application Standard.

In Parameter definition Standards each mode shall be described in a table conforming to the layout and sequence of the parameter definitions Table provided in Annex B of this Standard.

7.8 Physical and media access control parameters

The air interface links comprise the link from interrogator to tag (defined in 7.8.1) and the tag to interrogator (defined in 7.8.2).

7.8.1 Interrogator to tag link

7.8.1.1 Operating frequency range (Int:1)

This determines the range of frequencies over which the communications link will operate.

7.8.1.1.1 Default operating frequency (Int:1a)

This determines the operating frequency at which the interrogator and tag establish communications. The value shown is the centre frequency of the modulated signal or range of signals. All compliant tags and interrogators shall support operation at the default operating frequency.

7.8.1.1.2 Operating channels (for spread spectrum systems) (Int:1b)

This determines the number and value of the interrogator to tag link operating frequencies. The values provided shall be the centre frequencies of the modulated signals.

7.8.1.1.3 Operating frequency accuracy (Int:1c)

This determines the maximum deviation of the carrier frequency from the specified nominal frequency, expressed in ppm. Example: 1 ppm of a 2450 MHz carrier allows the carrier frequency to be in the range of 2450 MHz ± 2.45 kHz

7.8.1.1.4 Frequency hop rate (for frequency hopping [FHSS] systems) (Int:1d)

This determines the inverse of the dwell time at an FHSS centre frequency.

7.8.1.1.5 Frequency hop sequence (for frequency hopping [FHSS] systems) (Int:1e)

This determines as a pseudo-randomly ordered list of hopping frequencies used by the FHSS transmitter to select an FHSS channel.

7.8.1.2 Occupied channel bandwidth (Int:2)

This determines the bandwidth of the communications signal occupying a specified channel. This bandwidth is may or may not be equivalent to the channel spacing, although the channel spacing may equal, but shall not exceed the occupied channel bandwidth.

***Note**: Allowed channel spacing for FHSS systems is regulated by the appropriate national regulatory body, e.g., in the U.S. FCC Part 15, section 15.247: the channel spacing shall be the greater than or equal to the 20dB bandwidth of the signal, between the limits of 25 kHz and 1 MHz.*

The occupied channel bandwidth may be narrower than the channel spacing to allow for frequency tolerance or to provide for other guard bands necessary for reliable communication links.

For FHSS and narrowband operation, the occupied channel bandwidth shall be the maximum allowed bandwidth (measured in Hz) of the modulated signal in an occupied channel.

For Direct Sequence Spread Spectrum (DSSS) operation, the occupied channel bandwidth shall be the maximum allowed null-to-null bandwidth (Frequency difference between the main lobe nulls) of the DSSS signal in an occupied channel.

7.8.1.2.1 Minimum receiver bandwidth (Int:2a)

This determines the minimum range of all or individual frequencies that are to be received by the receiver.

7.8.1.3 Interrogator transmit maximum EIRP (Int:3)

This determines the maximum EIRP transmitted by the interrogator antenna, expressed in dBm. 0 dBm equals 1mW.

7.8.1.4 Interrogator transmit spurious emissions (Int:4)

Are determined as undesired frequency outputs, including harmonics, sub-harmonics, local oscillator, inter-modulation products, and other parasitic emission unintentionally emitted by the interrogator.

7.8.1.4.1 Interrogator transmit spurious emissions, in-band (for spread spectrum systems) (Int:4a)

Are determined as spurious emissions that occur within the allowed range of carrier frequencies.

7.8.1.4.2 Interrogator transmit spurious emissions, out-of-band (Int:4b)

Are determined as spurious emissions that occur outside the allowed range of carrier frequencies.

7.8.1.5 Interrogator transmitter spectrum mask (Int:5)

This shall be the maximum power or field strength emitted by an interrogator transmitter as a function of the frequency.

7.8.1.6 Timing (Int:6)

7.8.1.6.1 Transmit to receive turn around time (Int:6a)

This determines the maximum time after the tag has completed transmission of a reply to an interrogation until the time the tag is ready to receive another interrogation.

7.8.1.6.2 Receive to transmit turn around time (Int:6b)

This determines the maximum time after the tag has completed reception of an interrogation until the tag begins a reply transmission.

7.8.1.6.3 Dwell time of interrogator transmit power on ramp (Int:6c)

This determines the maximum time required for the interrogator transmit power to increase from 10% to 90% of the steady-state transmit output power level.

7.8.1.6.4 Decay time of interrogator transmit power down ramp (Int:6d)

This determines the maximum time required for the interrogator transmit power to decrease from 90% to 10% of the steady-state transmit output power.

7.8.1.7 Modulation (Int:7)

This determines the keying of the carrier wave by coded data. It shall be described in accordance with commonly understood methodologies. Some examples are Amplitude Shift Keying (ASK), Phase Shift Keying (PSK) and Frequency Shift Keying (FSK), linear amplitude modulation (AM), and frequency modulation (FM).

7.8.1.7.1 Spreading sequence (for direct sequence [DHSS] systems) (Int:7a)

This determines the sequence of data coding elements (chips) used to encode each logical data bit.

7.8.1.7.2 Chip rate (for spread spectrum systems) (Int:7b)

This determines the frequency at which the spreading sequence modulates the carrier.

7.8.1.7.3 Chip rate accuracy (For spread spectrum systems) (Int:7c)

This determines the allowed variation in chip rate, expressed in ppm.

7.8.1.7.4 Modulation index (Int:7d)

This shall be defined as [a-b]/[a+b] where a and b are the peak and minimum signal amplitude respectively. The value of the index shall also be expressed as a percentage.

7.8.1.7.5 Duty cycle (For OOK modulation) (Int:7e)

This is defined as the ratio of the duration (time) that a signal is ON to the total period of the signal.

7.8.1.7.6 FM deviation (For FM modulation) (Int:7f)

This determines as the difference between the maximum instantaneous frequency of the modulated wave and its carrier frequency.

7.8.1.8 Data coding (Int:8)

This determines the baseband signal presentation,*(i. e. a mapping of logical bits to physical signals. Examples are bi-phase schemes (Manchester, FM0, FM1, differential Manchester), NRZ and NRZI.)*

7.8.1.9 Bit rate (Int:9)

This determines the number of logical bits per second, independent of the data coding, expressed in bits per second.

7.8.1.9.1 Bit rate accuracy (Int:9a)

This determines the maximum deviation of the bit rate from the specified nominal bit rate, expressed in ppm.

7.8.1.10 Interrogator transmit modulation accuracy (Int:10)

This determines the peak vector error magnitude measured during each chip transmission period.

7.8.1.11 Preamble (Int:11)

Shall provide the specific Layer 1 (physical) address, independent of Layer 2 (Data link). It shall be determined as either an unmodulated carrier wave or a modulated carrier, in which case the requirement refers to the channel after coding.

7.8.1.11.1 Preamble length (Int:11a)

This determines the length of the preamble measured in number of bits.

7.8.1.11.2 Preamble waveform (Int:11b)

This determines the signal shape of the preamble as it is on the channel.

7.8.1.11.3 Bit sync sequence (Int:11c)

This determines the series of bits generated by the physical layer that a receiver uses to synchronize to the incoming bit stream.

7.8.1.11.4 Frame sync sequence (Int:11d)

This determines a series of bits generated by the physical layer that indicates the start of a data link layer (Layer 2) message packet.

7.8.1.12 Scrambling (for spread spectrum systems) (Int:12)

An operation performed on all bits transmitted by the physical layer for the purposes of bit timing generation and improving spectral quality.

7.8.1.13 Bit Transmission order (Int:13)

The order of bit transmission, either Least Significant Bit (LSB) first or Most Significant Bit (MSB) first.

7.8.1.14 Wake-up process (Int:14)

This parameter shall define whether or not an RF tag is to use a wake up process. When a wake up process is used this parameter:

(a) indicates to the RF tag that it is within a communication zone, i.e. that it may now communicate with an interrogator;

(b) switches the RF tag main circuitry from standby mode (sleep mode) to the active mode.

Comment: *This is a feature often used to allow the RF tag to save battery power, but may also be used to minimize the number of RF tag awake in the field at any time to increase the multiple read capability of the system.*

7.8.1.15 Polarization (Int:15)

This determines orientation of the emitted/received wave by the antenna.

7.8.2 Tag to interrogator link

Each Standard Shall provide, for each MODE, a table that defines:

7.8.2.1 Operating frequency range (Tag:1)

Definition as per Clause 7.8.1.1 (Int:1)

7.8.2.1.1 Default operating frequency (Tag:1a)

Definition as per Clause 7.8.1.1.1 (Int:1a)

7.8.2.1.2 Operating channels (for spread spectrum systems) (Tag:1b)

Definition as per Clause 7.8.1.1.2 (Int:1b)

7.8.2.1.3 Operating frequency accuracy (Tag:1c)

Definition as per Clause 7.8.1.1.3 (Int:1c)

7.8.2.1.4 Frequency hop rate (for frequency hopping [FHSS] systems) (Tag:1d)

Definition as per Clause 7.8.1.1.4 (Int:1d)

7.8.2.1.5 Frequency hop sequence (for frequency hopping [FHSS] systems (Tag:1e)

Definition as per Clause 7.8.1.1.5 (Int:1e)

7.8.2.2 Occupied channel bandwidth (Tag:2)

Definition as per Clause 7.8.1.2 (Int:2)

7.8.2.3 Transmit maximum EIRP (Tag:3)

Definition as per Clause 7.8.1.3 (Int:3)

7.8.2.4 Transmit spurious emissions (Tag:4)

Definition as per Clause 7.8.1.4 (Int:4)

7.8.2.4.1 Transmit spurious emissions, in-band (for spread spectrum systems) (Tag:4a)

Definition as per Clause 7.8.1.4.1 (Int:4a)

7.8.2.4.2 Transmit spurious emissions, out-of-band (Tag:4b)

Definition as per Clause 7.8.1.4.2 (Int:4b)

7.8.2.5 Transmit spectrum mask (Tag:5)

Definition as per Clause 7.8.1.5 (Int:5)

7.8.2.6 Timing (Tag:6)

7.8.2.6.1 Transmit to receive turn around time (Tag:6a)

Definition as per Clause 7.8.1.6.1 (Int:6a)

7.8.2.6.2 Receive to transmit turn around time (Tag:6b)

Definition as per Clause 7.8.1.6.2 (Int:6b)

7.8.2.6.3 Dwell time or transmit power on ramp (Tag:6c)

Definition as per Clause 7.8.1.6.3 (Int:6c)

7.8.2.6.4 Decay time or transmit power down ramp (Tag:6d)

Definition as per Clause 7.8.1.6.4 (Int:6d)

7.8.2.7 Modulation (Tag: 7)

Definition as per Clause 7.8.1.7 (Int:7)

7.8.2.7.1 Spreading sequence (for direct sequence [DHSS] systems) (Tag: 7a)

Definition as per Clause 7.8.1.7.1 (Int:7a)

7.8.2.7.2 Chip rate (for spread spectrum systems) (Tag: 7b)

Definition as per Clause 7.8.1.7.2 (Int:7b)

7.8.2.7.3 Chip rate accuracy (for spread spectrum systems) (Tag: 7c)

Definition as per Clause 7.8.1.7.3 (Int:7c)

7.8.2.7.4 On-off ratio (Tag: 7d)

For ASK modulation (including OOK): the ratio of peak amplitude to minimum amplitude of the ASK modulated signal.

7.8.2.7.5 Sub-carrier frequency (Tag: 7e)

Frequency used to modulate the carrier frequency, the sub-carrier is modulated or coded with the data information.

7.8.2.7.6 Sub-carrier frequency accuracy (Tag: 7f)

The maximum deviation of the sub-carrier frequency due to any cause. Normally it is expressed in % or in parts per million (ppm) of the sub-carrier frequency.

7.8.2.7.7 Sub-carrier modulation (Tag: 7g)

Keying of the subcarrier by coded data, as described in accordance with commonly understood methodologies. Some examples are Amplitude Shift Keying (ASK), Phase Shift Keying (PSK) and Frequency Shift Keying (FSK), linear amplitude modulation (AM), and frequency modulation (FM).

7.8.2.7.8 Duty cycle (Tag: 7h)

Definition as per Clause 7.8.1.7.5 (Int:7e)

7.8.2.7.9 FM deviation (Tag: 7i)

Definition as per Clause 7.8.1.7.6 (Int:7f)

7.8.2.8 Data coding (Tag: 8)

Definition as per Clause 7.8.1.8 (Int:8)

7.8.2.9 Bit rate (Tag: 8)

Definition as per Clause 7.8.1.9 (Int:9)

7.8.2.9.1 Bit rate accuracy (Tag: 9)

Definition as per Clause 7.8.1.9.1 (Int:9a)

7.8.2.10 Tag transmit modulation accuracy (for frequency hopping [FHSS] systems) (Tag: 10)

Definition as per Clause 7.8.1.10 (Int:10)

7.8.2.11 Preamble (Tag: 11)

Definition as per Clause 7.8.1.11 (Int:11)

7.8.2.11.1 Preamble length (Tag: 11a)

Definition as per Clause 7.8.1.11.1 (Int:11a)

7.8.2.11.2 Preamble waveform (Tag: 11b)

Definition as per Clause 7.8.1.11.2 (Int:11b)

7.8.2.11.3 Bit sync sequence (Tag: 11c)

Definition as per Clause 6.1.1.11.3 (Int:11c)

7.8.2.11.4 Frame sync sequence (Tag: 11d)

Definition as per Clause 7.8.1.11.4 (Int:11d)

7.8.2.12 Scrambling (for spread spectrum systems)(Tag: 12)

Definition as per Clause 7.8.1.12 (Int:12)

7.8.2.13 Bit transmission order (Tag: 13)

Definition as per Clause 7.8.1.13 (Int:13)

7.8.2.14 Reserved (Tag: 14)

This category purposefully left blank

7.8.2.15 Polarization (Tag: 15)

Definition as per Clause 7.8.1.15 (Int:15)

7.8.2.16 Minimum tag receiver bandwidth (Tag: 16)

The minimum range of frequencies that are to be received by the tag receiver.

7.9 Protocol and collision management parameters

7.9.1 The parameters defined in this Clause refer to a protocol definition (specification), NOT to an actual product implementation.

7.9.2 Transaction times are design parameters, not performance parameters. They shall refer to the physical and data link layers services they are using (e.g. data rates).

7.9.3 Time as defined shall not include Host-Interrogator transaction times, but shall include Interrogator-Tag guard times, return times, framing etc.

7.9.4 This Clause relates only to bi-directional systems (including "Tag talk First" systems where the tag transmits as soon as it received remote power from the interrogator). If does not relate to uni-directional systems where the tag transmits to a duty cycle that is regardless of the presence of a receiver.

7.9.5 Read write transaction

Within this Clause of the Standard a Read or Write transaction is the operation consisting of sending a Read or Write request (implicit or explicit) to the tag and receiving back the data (Read) or acknowledgement (Write) that the operation was performed correctly.

7.9.6 Protocol parameters

7.9.6.1 WTF: Who talks first (P1)

This determines whether the tag starts transmitting (modulating) as soon as it is remotely powered by the interrogator (TTF: Tag-Talks-First) or if it waits for the reception of a logical information (e.g. SOF or Command) before starting the transmission (RTF: Reader-Talks-First).

7.9.6.2 Tag addressing capability (P2)

This determines whether a tag can be individually addressed (generally through its UID) or not.

7.9.6.3 Tag unique identifier (UID) (P3)

Tag Unique Identifier shall be defined as a binary value which shall ensure a worldwide uniqueness.

Tag Unique identifier ranges shall be assigned according to rules determined by either an ISO or ISO/IEC.

The responsibility for ensuring that UID's are properly issued and verified shall lie with the IC or tag manufacturer.

7.9.6.3.1 UID size (P3a)

This determines the UID size (measured in bits)

7.9.6.3.2 UID format (P3b)

This determines the UID format and state which ISO/IEC standard it is compliant with.
(e.g. ISO/IEC 7816-5, ISO 14816, ISO 6346).

7.9.6.4 Read size (P4)

This determines the minimum and maximum data size (in bytes) which can be read in one transaction according to the protocol specification. The modulo shall also be specified (e.g. multiple of 8 bits or multiple of 1 byte).

7.9.6.5 Write size (P5)

This determines the minimum and maximum data size (in bytes) which can be written in one transaction according to the protocol specification. The modulo shall also be specified (e.g. multiple of 8 bits or multiple of 1 byte).

7.9.6.6 Read transaction time (P6)

This shall specify the time to perform a Read transaction. It shall be expressed in milliseconds.

NOTE: *It is recommended that the time is expressed for data sizes of 1, 4, 8, 16 and 32 bytes (within Read size limits).*

7.9.6.7 Write transaction time (P7)

Time to perform a Write transaction. Expressed in milliseconds.

NOTE: *It is suggested that the time is expressed for data size of 1, 4, 8, 16 and 32 bytes (within Write size limits).*

7.9.6.8 Error detection (P8)

Indicates whether or not the protocol includes an error detection mechanism, and which one (e.g. LRC, CRC). Both interrogator-to-tag and tag-to-interrogator shall be specified.

7.9.6.9 Error correction (P9)

This shall indicate whether or not the protocol includes an error correction mechanism, and which one.

Both interrogator-to-tag and tag-to-interrogator shall be specified.

7.9.6.10 Memory size (P10)

This shall indicate the minimum and maximum tag memory size that can be accessed using Read and Write functions.

7.9.6.11 Command structure and extensibility (P11)

This shall describe the structure of the command code (when applicable) from the interrogator to the tag and indicate how many positions are available for future extensions.

7.9.7 Collision management parameters

7.9.7.1 Type (A1)

This determines whether the collision management method is Probabilistic or Deterministic

Probabilistic: all tags that can physically communicate with the interrogator can be inventoried with a probability PA1 (PA1<1). This probability generally varies with the number of tags and possibly with the interrogator request parameters (e.g. number of slots).

Deterministic: all tags that can physically communicate with the interrogator can be inventoried without exception (PA1=1).

7.9.7.2 Linearity (A2)

This shall indicate how the total inventory time for N tags varies with N (where N = the number of Tags in the Read Zone). It may be proportional to N (with tolerances) or exponential to N. A threshold may exist (e.g. linear till 10 tags and then exponential).

7.9.7.3 Tag inventory capacity (A3)

This determines the maximum number of tags (Algorithmic capacity) that can be simultaneously present in a read zone and still be identified.

For a probabilistic mechanism, it indicates the maximum number of tags that can be simultaneously present and identified with a probability PA1 of 0.99 (99%).

For a deterministic mechanism, it indicates the maximum number of tags that can be simultaneously present and identified with a probability PA1 of 1 (100%).

8 Modulation

8.1 Each mode of each part of the ISO 18000 series of Standards shall describe the modulation technique.

9 Patents and Intellectual Property

9.1 Responsibilities regarding patents and intellectual property

An Informative Annex to this Standard (Annex E) provides summary information that has been identified as possibly being relevant to some or all of the Standards in the 18000 series of Standards. Attention is drawn the caveats and limitations given in Clause E1 of this annex.

9.2 Patents referenced in 18000 series Standards

Developers of 18000 series air interface standards are requested to provide the reference numbers of patents that they have directly used to assist the development of their Standard. This shall be a simple list of numbers.

Developers of 18000 series air interface standards are required to provide details and abstracts of the patents so listed to the Editor of the 18000 series of Standards, in order that the detail provided in Annex E to this Standard is up to date at the date of publication, and may be updated through the ISO/IEC update procedure for informative annexes.

Annex A
(informative) **Reference co-ordinates for regional and national regulations**

The following web site addresses provide access to Regional and National Regulations

A.1 North America

The FCC can be contacted via **www.fcc.gov**

A.2 Europe & CEPT countries

A list of all contact for the 43 CEPT administrations issuing radio regulations can be found under **www.ero.dk under 'Contacts' .**

A.3 Japan & Pacific

The regulatory contacts for Japan can be contacted via

http://www.tele.soumu.go.jp

Ministry of Public Management, Home Affairs, Posts and Telecommunications. (the regulator.)

http://www.telec.or.jp

TELEC is an extra-departmental organization that provides a technical standard conformity certification service, which is "GITEKI" in Japanese" and a calibration service for measuring devices under the Radio Low.

http://www.arib.or.jp

(ATIB is a private standardization body. They publish ARIB standards for radio equipment.)

Annex B
(informative)

Pro forma for parameter definition standards (including parameter definition tables)

Note: A Parameter definition Standard (part to ISO 18000-) should be initially created using the current ISO Template (available from website iso.ch). ISO will only accept Committee Drafts that have been prepared using this Template.

Completing the template set up will allocate the SC and Standard number references, titling, together with Standard ISO Text in the initial sections.

It is recommended that for each Parameter definition Standard, the following Text extracts be cut and pasted (one section at a time) to the new Draft.

Foreword

(Text as generated by template, adapted)

(And add)

The ISO 18000 series of Standards comprise :

— *Part 1 : Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 1 - Reference Architectures and Definition of Parameters to be Standardized.*

— *Part 2 : Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 2 - Parameters for Air Interface Communications below 135 kHz*

— *Part 3 : Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 3 - Parameters for Air Interface Communications at 13.56 MHz*

— *Part 4 : Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 4 - Parameters for Air Interface Communications at 2.45 GHz*

— *Part 6 : Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 6 - Parameters for Air Interface Communications at 860-930 MHz*

— *Part 7: Information Technology AIDC Techniques - RFID for Item Management - Air Interface, Part 6 - Parameters for Active Air Interface Communications at 433 MHz*

— This Standard, ISO 18000 Part n: determines nnnnnnn

Introduction

This Standard has been developed by ISO/IEC SC31 WG4, Radio Frequency Identification for Item Management, in order to provide parameter definitions for communications protocols within a common framework for Internationally useable frequencies for Radio Frequency Identification (RFID),

This Part of the ISO/IEC Standard 18000 has been prepared in accordance with the requirements determined in ISO 18000-1 *–Information technology, AIDC techniques, Part 1, Definition of parameters to be standardized.*

The following shall be included in any MODE submission for any Part of ISO 18000 submissions:

1 Scope

The remainder of this Annex to be added (as a single cut and paste block) to each Mode of each part of each submission for a Standard.:

Each Mode shall contain the following text:

The scope of this Standard is to provide parameter definitions for (Frequency) in accordance with the requirements of ISO 18000-1

This Standard provides Parameter definition for each MODE determined in the Requirements and Parameter Sections below.

In This version of the Standard, **N** non interfering MODES.

MODES *****   ******   ****** are interoperable

MODES ****** ***** ****** are not interoperable, but non interfering.

2. Conformance

2.1 Claiming Conformance

In order to claim conformance with this Standard it is necessary to comply to all of the clauses of this Standard except those marked 'optional' and it is also necessary to operate within the local National Radio regulations (which may require further restrictions) and to hold a valid licence from the appropriate owner of intellectual property associated with the MODES defined herein.

2.2 General conformance requirements

General conformance requirements are determined within ISO 18047 Information Technology-AIDC Techniques-RFID device conformance test methods.

*(*delete as applicable*).

2.4 Command Structure and Extensibility

Clauses 7.1 and 7.2, include definition of the structure of command codes between an Interrogator and a Tag and indicate how many positions are available for future extensions.

Command specification clauses provide a full definition of the command and its presentation.

Each Command is labelled as being ‘mandatory’ or ‘optional’.

In accordance with ISO 18000-1, the clauses of this Standard make provision for ‘custom’ and ‘proprietary’ commands.

2.4.1 Mandatory Commands

A Mandatory command shall be supported by all tags that claim to be compliant. Interrogators which claim compliance shall support all mandatory commands.

2.4.2 Optional Commands

Optional commands are commands that are specified within the Standard. Interrogators shall be technically capable of performing all optional commands that are specified in the Standard (although need not be set up to do so). Tags may or may not support optional commands.

If an optional command is used, it shall be implemented in the manner specified in the Standard.

2.4.3 Custom Commands

Custom commands may be enabled by a Standard, but they shall not be specified in that Standard.

A custom command shall not solely duplicate the functionality of any mandatory or optional command defined in the Standard by a different method.

2.4.4 Proprietary Commands

Proprietary commands may be enabled by a Standard, but they shall not be specified in that Standard.

A proprietary command shall not solely duplicate the functionality of any mandatory or optional command defined in the Standard by a different method.

3. Normative references

The principal Normative references for this Standard are detailed in ISO/IEC 18000-1.

International Standards specific to this Part of the 18000 series are as follows:

4. Terms and definitions

The principal Terms and Definitions for this Standard are detailed in ISO/IEC 19762, Information Technology AIDC Techniques-Vocabulary

Terms and Definitions specific to this Part of the 18000 series are as follows:

5. Symbols and abbreviated terms

The principal Symbols and Abbreviated Terms for this Standard are detailed in ISO/IEC 19762, Information Technology AIDC Techniques-Vocabulary

Symbols and Abbreviated Terms specific to this Part of the 18000 series are as follows:

6 Requirements

The context, form and general Requirements for this Standard have been determined in ISO/IEC 18000-1. The form and presentation of this part, which provides Parameter definition definitions for RFID Systems for Item Identification operating at is in accordance with the requirements of ISO/IEC 18000-1.

Within the frequency range 13.56 MHz this Standard defines (n) MODES of operation. Whilst, except where stated, these MODES are not interoperable, except in countries/conditions listed in Annex A of this Standard, they may be expected to operate without causing any significant interference with each other.

Each mode defined in this Standard is described in the form of Parameter Definition Tables.

6.1 Parameters for MODE 1 of this standard

6.1.1 MODE 1: Physical and media access control (MAC) parameters :

6.1.1.1 MODE 1: Interrogator to tag link

Ref.	Parameter Name	Description
M1-Int: 1	Operating Frequency Range	
M1-Int: 1a	Default Operating Frequency	
M1-Int: 1b	Operating Channels (for Spread Spectrum systems)	
M1-Int: 1c	Operating Frequency Accuracy	
M1-Int: 1d	Frequency Hop Rate (for Frequency Hopping [FHSS] systems)	
M1-Int: 1e	Frequency Hop Sequence (for Frequency Hopping [FHSS] systems)	
M1-Int: 2	Occupied Channel Bandwidth	
M1-Int:2a	Minimum Receiver Bandwidth	
M1-Int: 3	Interrogator Transmit Maximum EIRP	
M1-Int: 4	Interrogator Transmit Spurious Emissions	
M1-Int: 4a	Interrogator Transmit Spurious Emissions, In-Band (for Spread Spectrum systems)	
M1-Int: 4b	Interrogator Transmit Spurious Emissions, Out-of-Band	
M1-Int: 5	Interrogator Transmitter Spectrum Mask	
M1-Int:6	Timing	

Ref.	Parameter Name	Description
M1-Int: 6a	Transmit to Receive Turn Around Time	
M1-Int: 6b	Receive to Transmit Turn Around Time	
M1-Int: 6c	Dwell Time or Interrogator Transmit Power On Ramp	
M1-Int: 6d	Decay Time or Interrogator Transmit Power Down Ramp	
M1-Int: 7	Modulation	
M1-Int: 7a	Spreading Sequence (for Direct Sequence [DHSS] systems)	
M1-Int: 7b	Chip Rate (for Spread Spectrum systems)	
M1-Int: 7c	Chip Rate Accuracy (for Spread Spectrum systems)	
M1-Int: 7d	Modulation Index	
M1-Int: 7e	Duty Cycle	
M1-Int: 7M1-Int:	FM Deviation	
M1-Int: 8	Data Coding	
M1-Int: 9	Bit Rate	
M1-Int: 9a	Bit Rate Accuracy	
M1-Int: 10	Interrogator Transmit Modulation Accuracy	
M1-Int: 11	Preamble	
M1-Int:11a	Preamble Length	
M1-Int:11b	Preamble Waveform	
M1-Int: 11c	Bit Sync Sequence	
M1-Int: 11d	Frame Sync Sequence	
M1-Int: 12	Scrambling (for Spread Spectrum systems)	
M1-Int: 13	Bit Transmission Order	
M1-Int: 14	Wake-up process	
M1-Int: 15	Polarization	

6.1.1.2 MODE 1 : Tag to interrogator link

Ref.	Parameter Name	Description
M1-Tag:1	Operating Frequency Range	
M1-Tag:1a	Default Operating Frequency	
M1-Tag:1b	Operating Channels (for Spread Spectrum systems)	
M1-Tag:1c	Operating Frequency Accuracy	
M1-Tag:1d	Frequency Hop Rate (for Frequency Hopping [FHSS] systems)	
M1-Tag:1e	Frequency Hop Sequence (for Frequency Hopping [FHSS] systems)	
M1-Tag:2	Occupied Channel Bandwidth	
M1-Tag:3	Transmit Maximum EIRP	
M1-Tag:4	Transmit Spurious Emissions	
M1-Tag:4a	Transmit Spurious Emissions, In-Band (for Spread Spectrum systems)	
M1-Tag:4b	Transmit Spurious Emissions, Out-of-Band	
M1-Tag:5	Transmit Spectrum Mask	
M1-Tag:6a	Transmit to Receive Turn Around Time	
M1-Tag:6b	Receive to Transmit Turn Around Time	
M1-Tag:6c	Dwell Time or Transmit Power On Ramp	
M1-Tag:6d	Decay Time or Transmit Power Down Ramp	
M1-Tag:7	Modulation	
M1-Tag:7a	Spreading Sequence (for Direct Sequence [DHSS] systems)	
M1-Tag:7b	Chip Rate (for Spread Spectrum systems)	
M1-Tag:7c	Chip Rate Accuracy (for Spread Spectrum systems)	
M1-Tag:7d	On-Off Ratio	
M1-Tag:7e	Sub-carrier Frequency	
M1-Tag:7f	Sub-carrier Frequency Accuracy	
M1-Tag:7g	Sub-Carrier Modulation	
M1-Tag:7h	Duty Cycle	
M1-Tag:7I	FM Deviation	
M1-Tag:8	Data Coding	
M1-Tag:9	Bit Rate	
M1-Tag:9a	Bit Rate Accuracy	
M1-Tag:10	Tag Transmit Modulation Accuracy (for Frequency Hopping [FHSS] systems)	
M1-Tag:11	Preamble	
M1-Tag:11a	Preamble Length	
M1-Tag:11b	Preamble Waveform	
M1-Tag:11c	Bit Sync Sequence	
M1-Tag:11d	Frame Sync Sequence	

Ref.	Parameter Name	Description
M1-Tag:12	Scrambling (for Spread Spectrum systems)	
M1-Tag:13	Bit Transmission Order	
M1-Tag:14	Reserved	
M1-Tag:15	Polarization	
M1-Tag:16	Minimum Tag Receiver Bandwidth	

6.1.2 MODE 1 : Protocol parameters

Ref.	Parameter Name	Description
M1-P:1	Who talks first	
M1-P:2	Tag addressing capability	
M1-P:3	Tag UID	
M1-P:3a	UID Length	
M1-P:3b	UID Format	
M1-P:4	Read size	
M1-P:5	Write Size	
M1-P:6	Read Transaction Time	
M1-P:7	Write Transaction Time	
M1-P:8	Error detection	
M1-P:9	Error correction	
M1-P:10	Memory size	
M1-P:11	Command structure and extensibility	

6.1.3 MODE 1: Collision management parameters

Ref.	Parameter Name	Description
M1-A:1	Type (Probabilistic or Deterministic)	
M1-A:2	Linearity	
M1-A:3	Tag inventory capacity	

6.1.4 Modulation index

The modulation type and index shall be fully described, including timing diagrams.

6.2 Parameters for MODE 2 of this standard

6.2.1 MODE 2: Physical and media access control (MAC) parameters

6.2.1.1 MODE 2: Interrogator to tag link

Ref.	Parameter Name	Description
M2-Int: 1	Operating Frequency Range	
M2-Int: 1a	Default Operating Frequency	
M2-Int: 1b	Operating Channels (for Spread Spectrum systems)	
M2-Int: 1c	Operating Frequency Accuracy	
M2-Int: 1d	Frequency Hop Rate (for Frequency Hopping [FHSS] systems)	
M2-Int: 1e	Frequency Hop Sequence (for Frequency Hopping [FHSS] systems)	
M2-Int: 2	Occupied Channel Bandwidth	
M2-Int:2a	Minimum Receiver Bandwidth	
M2-Int: 3	Interrogator Transmit Maximum EIRP	
M2-Int: 4	Interrogator Transmit Spurious Emissions	
M2-Int: 4a	Interrogator Transmit Spurious Emissions, In-Band (for Spread Spectrum systems)	
M2-Int: 4b	Interrogator Transmit Spurious Emissions, Out-of-Band	
M2-Int: 5	Interrogator Transmitter Spectrum Mask	
M2-Int:6	Timing	
M2-Int: 6a	Transmit to Receive Turn Around Time	
M2-Int: 6b	Receive to Transmit Turn Around Time	
M2-Int: 6c	Dwell Time or Interrogator Transmit Power On Ramp	
M2-Int: 6d	Decay Time or Interrogator Transmit Power Down Ramp	
M2-Int: 7	Modulation	
M2-Int: 7a	Spreading Sequence (for Frequency Hopping [FHSS] systems)	
M2-Int: 7b	Chip Rate (for Spread Spectrum systems)	
M2-Int: 7c	Chip Rate Accuracy (for Spread Spectrum systems)	
M2-Int: 7d	Modulation Index	
M2-Int: 7e	Duty Cycle	
M2-Int: 7M2-Int:	FM Deviation	
M2-Int: 8	Data Coding	

Ref.	Parameter Name	Description
M2-Int: 9	Bit Rate	
M2-Int: 9a	Bit Rate Accuracy	
M2-Int: 10	Interrogator Transmit Modulation Accuracy	
M2-Int: 11	Preamble	
M2-Int:11a	Preamble Length	
M2-Int:11b	Preamble Waveform	
M2-Int: 11c	Bit Sync Sequence	
M2-Int: 11d	Frame Sync Sequence	
M2-Int: 12	Scrambling (for Spread Spectrum systems)	
M2-Int: 13	Bit Transmission Order	
M2-Int: 14	Wake-up process	
M2-Int: 15	Polarization	

6.2.1.2 MODE 2 : Tag to interrogator link

Ref.	Parameter Name	Description
M2-Tag:1	Operating Frequency Range	
M2-Tag:1a	Default Operating Frequency	
M2-Tag:1b	Operating Channels (for Spread Spectrum systems)	
M2-Tag:1c	Operating Frequency Accuracy	
M2-Tag:1d	Frequency Hop Rate (for Frequency Hopping [FHSS] systems)	
M2-Tag:1e	Frequency Hop Sequence (for Frequency Hopping [FHSS] systems)	
M2-Tag:2	Occupied Channel Bandwidth	
M2-Tag:3	Transmit Maximum EIRP	
M2-Tag:4	Transmit Spurious Emissions	
M2-Tag:4a	Transmit Spurious Emissions, In-Band (for Spread Spectrum systems)	
M2-Tag:4b	Transmit Spurious Emissions, Out-of-Band	
M2-Tag:5	Transmit Spectrum Mask	
M2-Tag:6a	Transmit to Receive Turn Around Time	
M2-Tag:6b	Receive to Transmit Turn Around Time	
M2-Tag:6c	Dwell Time or Transmit Power On Ramp	
M2-Tag:6d	Decay Time or Transmit Power Down Ramp	
M2-Tag:7	Modulation	
M2-Tag:7a	Spreading Sequence (for Frequency Hopping [FHSS] systems)	
M2-Tag:7b	Chip Rate (for Spread Spectrum systems)	
M2-Tag:7c	Chip Rate Accuracy (for Spread Spectrum systems)	
M2-Tag:7d	On-Off Ratio	
M2-Tag:7e	Sub-carrier Frequency	
M2-Tag:7f	Sub-carrier Frequency Accuracy	
M2-Tag:7g	Sub-Carrier Modulation	
M2-Tag:7h	Duty Cycle	
M2-Tag:7I	FM Deviation	
M2-Tag:8	Data Coding	
M2-Tag:9	Bit Rate	
M2-Tag:9a	Bit Rate Accuracy	
M2-Tag:10	Tag Transmit Modulation Accuracy (for Frequency Hopping [FHSS] systems)	
M2-Tag:11	Preamble	
M2-Tag:11a	Preamble Length	

Ref.	Parameter Name	Description
M2-Tag:11b	Preamble Waveform	
M2-Tag:11c	Bit Sync Sequence	
M2-Tag:11d	Frame Sync Sequence	
M2-Tag:12	Scrambling (for Spread Spectrum systems)	
M2-Tag:13	Bit Transmission Order	
M2-Tag:14	Reserved	
M2-Tag:15	Polarization	
M2-Tag:16	Minimum Tag Receiver Bandwidth	

6.2.2 MODE 2 : Protocol parameters

Ref.	Parameter Name	Description
M2-P:1	Who talks first	
M2-P:2	Tag addressing capability	
M2-P:3	Tag UID	
M2-P:3a	UID Length	
M2-P:3b	UID Format	
M2-P:4	Read size	
M2-P:5	Write Size	
M2-P:6	Read Transaction Time	
M2-P:7	Write Transaction Time	
M2-P:8	Error detection	
M2-P:9	Error correction	
M2-P:10	Memory size	
M2-P:11	Command structure and extensibility	

6.2.3 MODE 2: Collision management parameters

Ref.	Parameter Name	Description
M2-A:1	Type (Probabilistic or Deterministic)	
M2-A:2	Linearity	
M2-A:3	Tag inventory capacity	

6.2.4 Modulation index

The modulation type and index shall be fully described, including timing diagrams.

Repeated for any additional modes.

7. Table of characteristic differences between the MODES specified in this standard

8. Declaration of all patents and intellectual property rights intrinsic to this standard.

8.1 Responsibilities regarding patents and intellectual property

Mode developers have specifically highlighted patents listed below as being relevant to this Standard, but other Patents may apply. A list of identified Standards and summary descriptions of the Standards listed below are to be found in ISO 18000-1.

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.

8.2 Patents referenced in this Standard

The following companies have declared that they hold Patents which may have an impact on the use of the ISO 18000 series of standards. All companies have declared they will abide by the rules for Patented technology as set down by ISO. No representation is made as to the completeness or validity of this list.

For abstracts of these Patents see ISO 18000-1, Annex E.

Company:

Country	**Patent Reference**

Annex C
(informative)

Architectural views of logistic and distribution systems

C1 Context.

C1.1 Logistics, Supply and Distribution Systems are an indispensable part of modern society. Such systems provide the means of moving material and product to manufacturing systems, moving materials, components, sub assemblies and product through manufacturing systems, and get product and physical items to their end delivery points. They also include delivery services for non manufactured items (such as airline baggage, post and parcel delivery systems). Such systems also manage returnable units, and provide information around the system (a function that we have described "The Information Manager").

C1.2 This Informative Annex describes typical architecture views and contexts in which RFID for item Management is typically to be found. In this Informative Annex, architecture is described from the following perspectives:

a) Conceptual Description

b) Logical Definition

c) Object Identification

d) Object Interaction Structure

- Connectivity and Workflow Architecture (OSI Layers 1 - 6)

- Application Architecture (OSI Layer 7 and above)

C1.3 In the majority of situations the objective of the item identification process is to uniquely identify an item. This is sometimes described as a 'licence plate' technique where a unique identification may be referred to a database for additional information. There may be in addition the monologue transfer of additional data (for example a manifest) or there may be a bi-directional exchange of data, or an interrogator initiated interrogation where all or part of the available data may be accessed. The limits to such access may be to increase transaction efficiency, or the 'interrogator' may only be authorised to access certain parts of the data available. Security authorisation and encryption may form part of such data transfer.

C1.4 In some circumstances the position may be reversed and it may be for a moving vehicle or equipment to identify a static or moving object, such as a location identifier, timestamp, customs clearance authorisation or another moving vehicle or equipment (for example to provide a record of which tractor units a trailer has been married with).

C1.5 In some cases it is necessary to protect the identity of an item, vehicle, equipment or load detail for reasons of privacy or security. In these cases an Item Identification system shall provide an 'unambiguous identification' that does not necessarily identify the true permanent identification of the vehicle or equipment. It may, for example, identify a smart card temporarily located in an on board unit, or a temporary trip related identification

C1.6 It is important to remember, however, that the equipment used may provide the functions of more than one entity, or indeed the entity may be performed by a combination of equipment (such as an interrogator plus an antenna).

C2 Conceptual Description

Figure C-1, shows typical conceptual relationships of Logistics/Supply/Distribution systems at a high level.

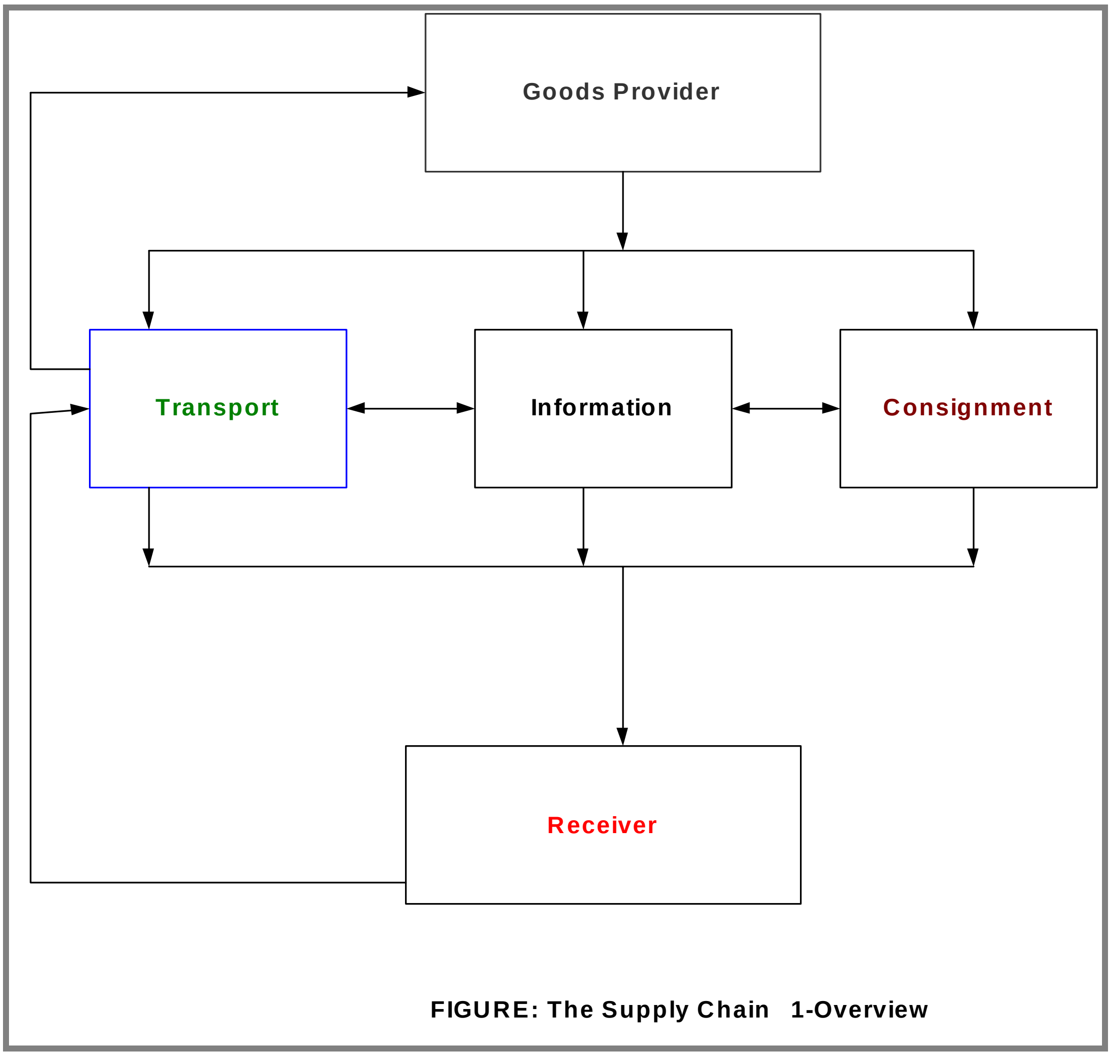

Figure C-1 : The supply chain overview

Figure C-1 shows that Logistics/Supply/Distribution chains involve/interface with most aspects of modern society. The detail (relevant actors, Classes (objects), interfaces and interactions) depend on the perspective from which they are viewed.

The following figures show the logistics/Distribution/Supply Chain from the perspective of the key classes shown in Figure C-1 and for particular logistic distribution systems (such as airline baggage distribution).

Figure C-2 shows the view from the view of the goods provider.

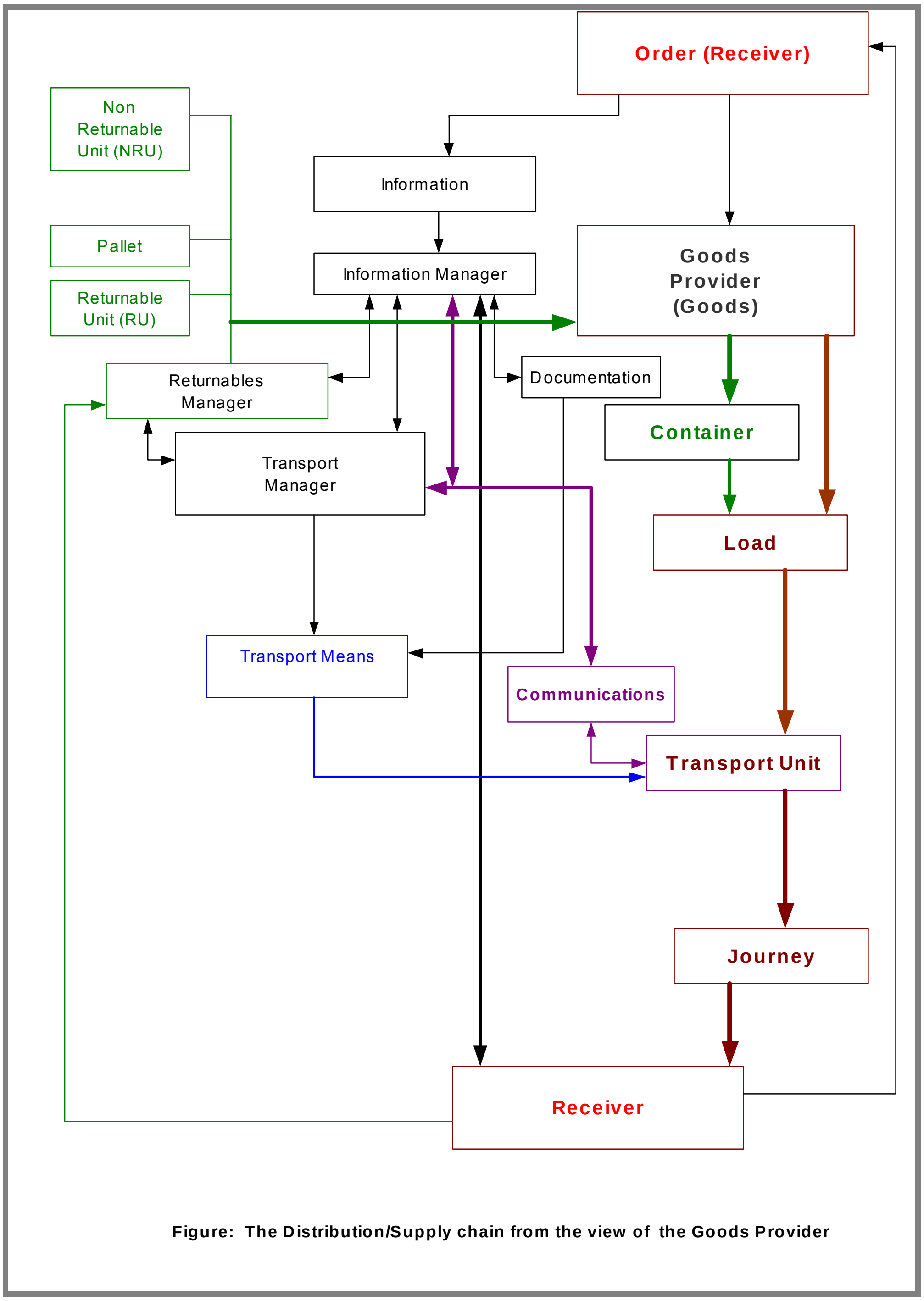

Figure C-2 : The distribution/supply chain from the view of the goods provider.

The goods provider may simply be a distributor or agent, but may also be, or act in concert with, a manufacturer. Manufacturing is a specific view of the logistic/supply chain. It is a view whose complexity is often hidden from much of the supply chain, but examination shows not only external involvement, but a complex internal logistic and supply chain requirement. Figure C-3 shows such a view.

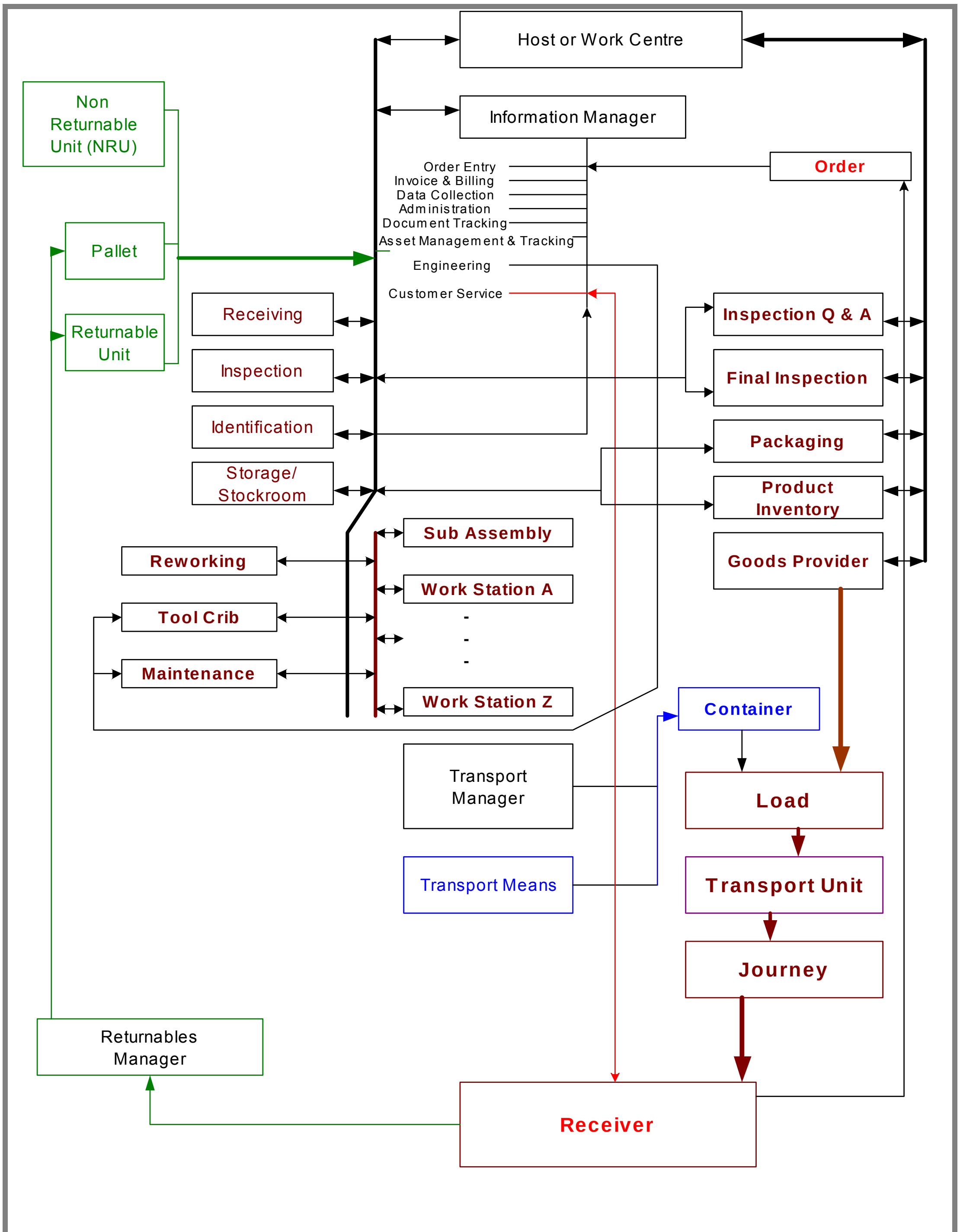

Figure: The Distribution/Supply chain from the view of the Manufacturer

Figure C-3 : The logistics/distribution/supply chain from the view of the manufacturer

Once manufactured, and placed through the hands of the goods provider, the item(s) to be delivered become a consignment. Figure C-4 provides the Logistics/Distribution/Supply chain, from the view of the Consignment.

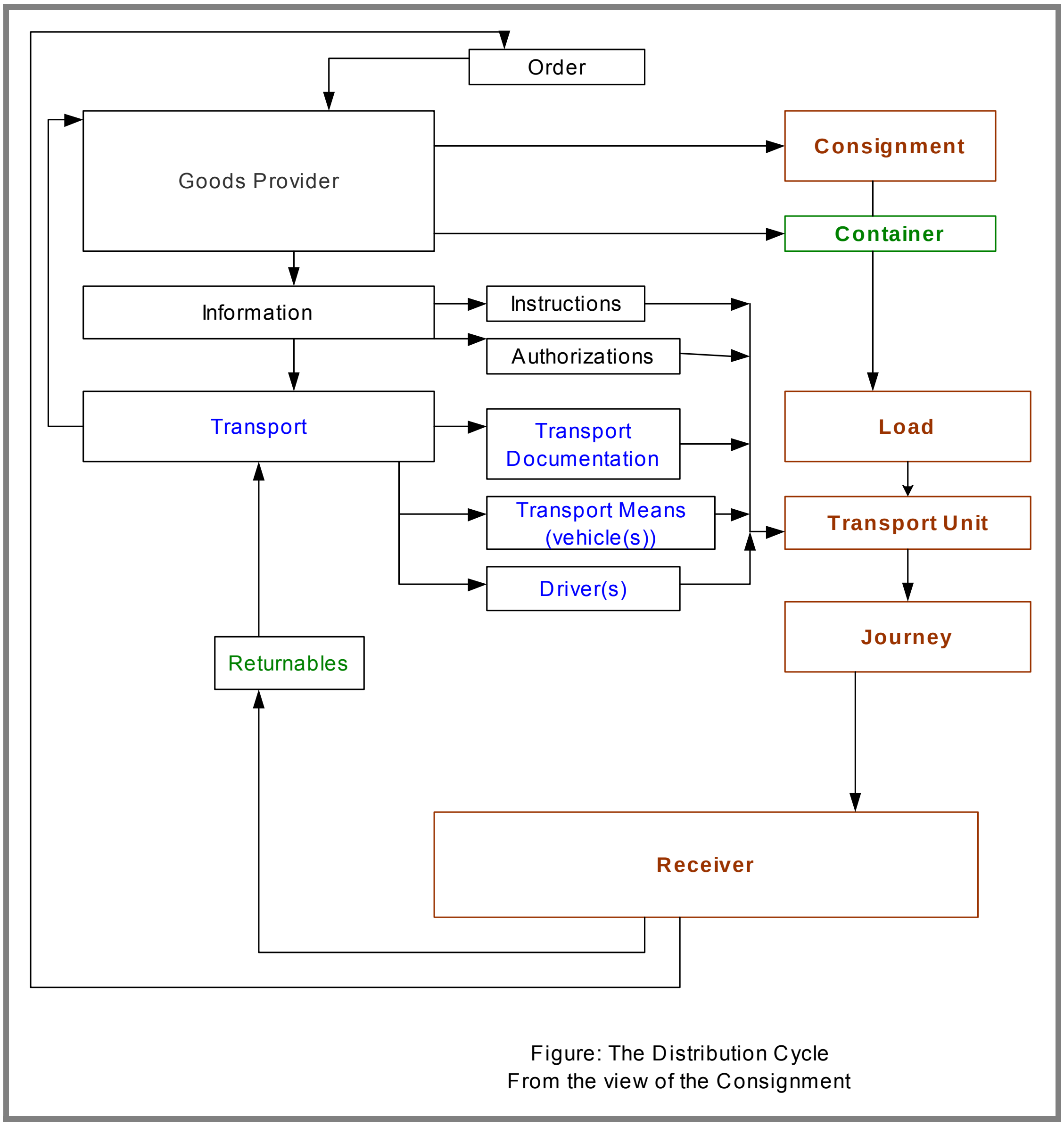

Figure C-4 : The distribution cycle from the view of the consignment

The objective of the Logistic/Distribution/Supply chain is the Receiver. The receiver may be an end user or a manufacturer or intermediary. Figure C-5 provides the chain from this point of view.

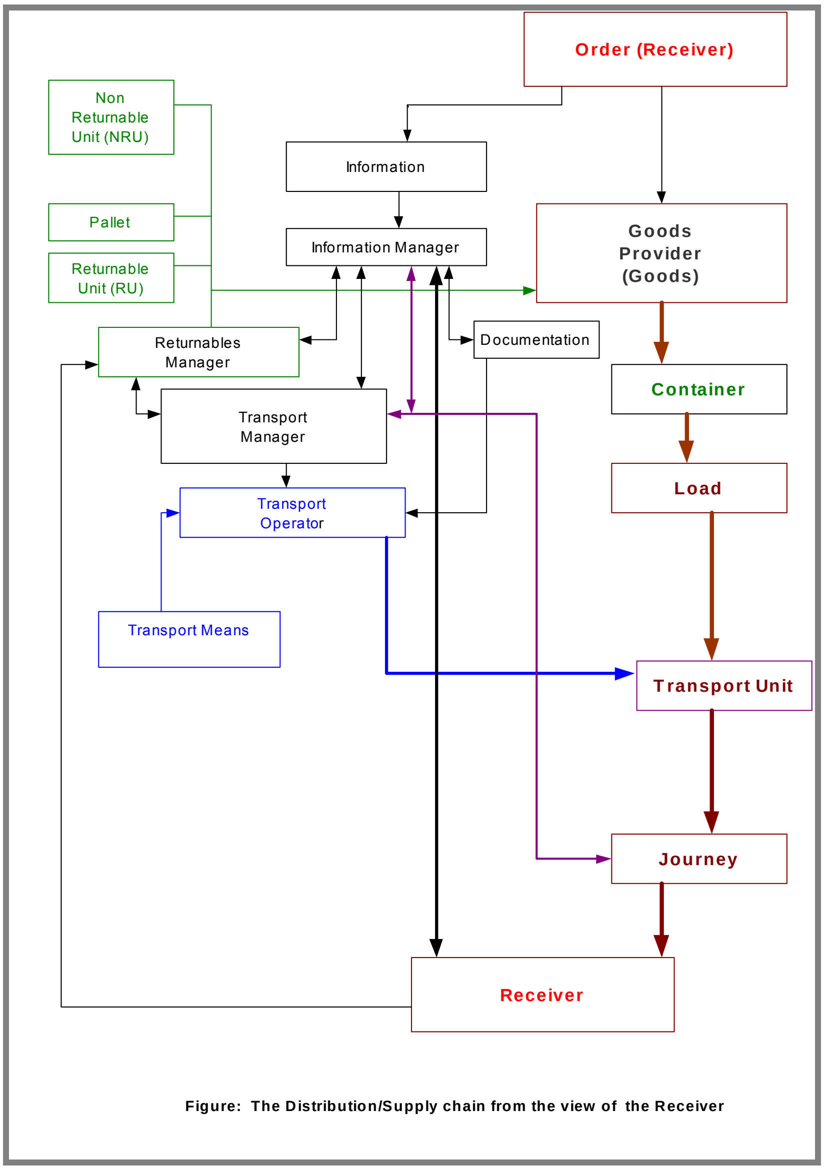

Figure C-5: The logistic/distribution/supply chain from the view of the receiver

In order to get the item from its source to its destination it has to be moved. This involves a transportation function. This may be performed in house, through single subcontract or through a subcontract chain. Who, or how many actors fulfil these transport aspects, the functional classes remain conceptually similar and divisible.

NOTE: There is an interface between "item Identification" and "Transport Unit" identification. Within the context of this series of Standards, the relevant "items" relate to the contents of a trailer "(pallet" items; "small container" items, packets, parcels, and individual items).

This is in line with agreement between ISO/IEC SC31 and ISO TC204.

Identification for larger items (vehicles, trailers, Swap Bodies etc.) are standardized by ISO TC204; TC104; railway and airline equipment are Standardized by other Standardization bodies.

However, regardless of who originates the Standards for various aspects, the View of Transportation also shows Logistic/Distribution/Supply chain requirements which are in the purview of this Series of Standards.

Figure C-6 shows the View of Transportation. A view similar and consistent with C-6 also appears in the Automatic Vehicle and Equipment Standard, Intermodal AVI/AEI Architecture (ISO 17261).

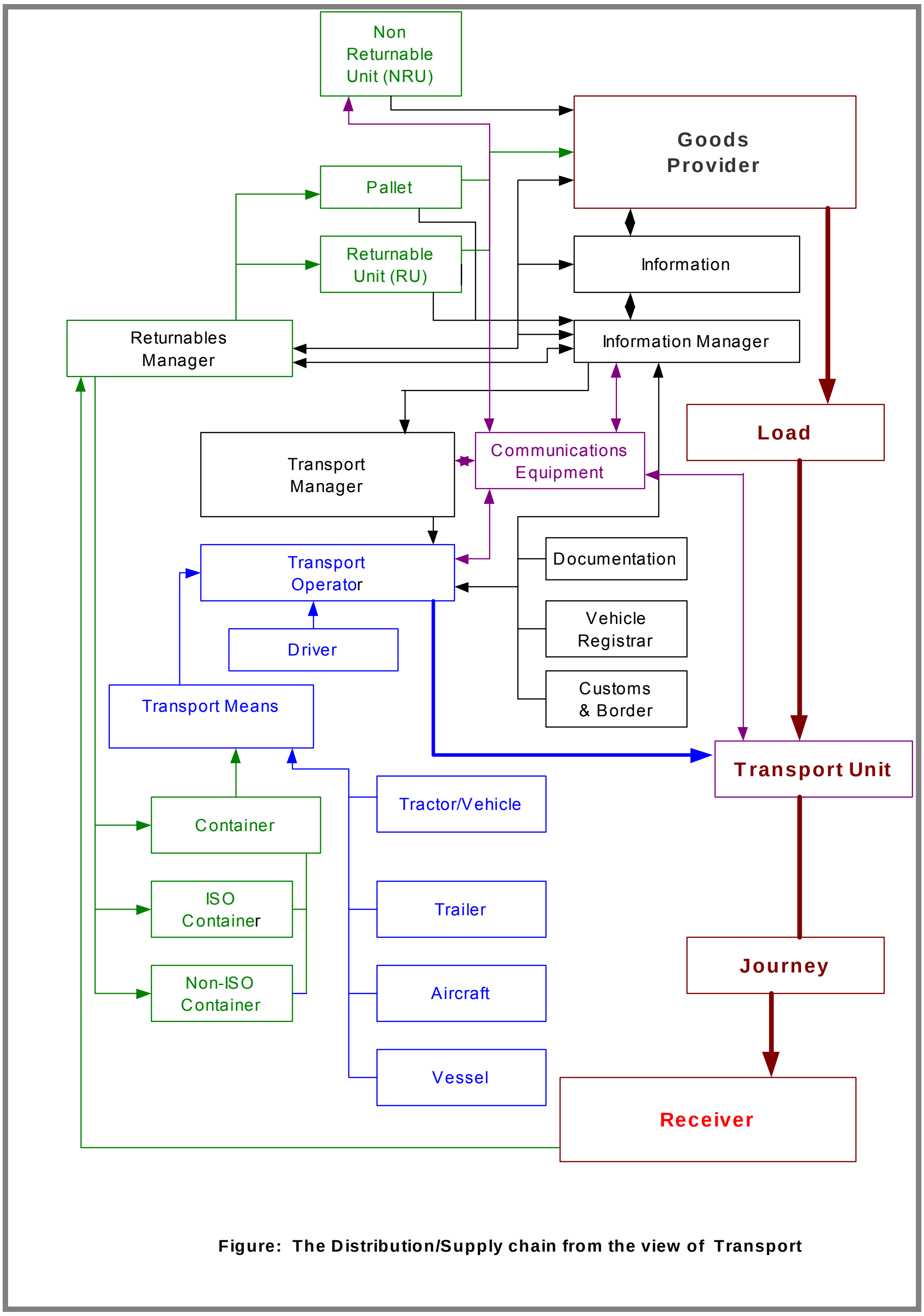

Figure C-6 : The logistics/distribution/supply chain from the view of transport

Whilst the views described in the above figures encompass most situations, they do not embrace all architecture views. Some specialized views can also benefit from further description. One such example is airline baggage handling. Figure C-7 shows such a view.

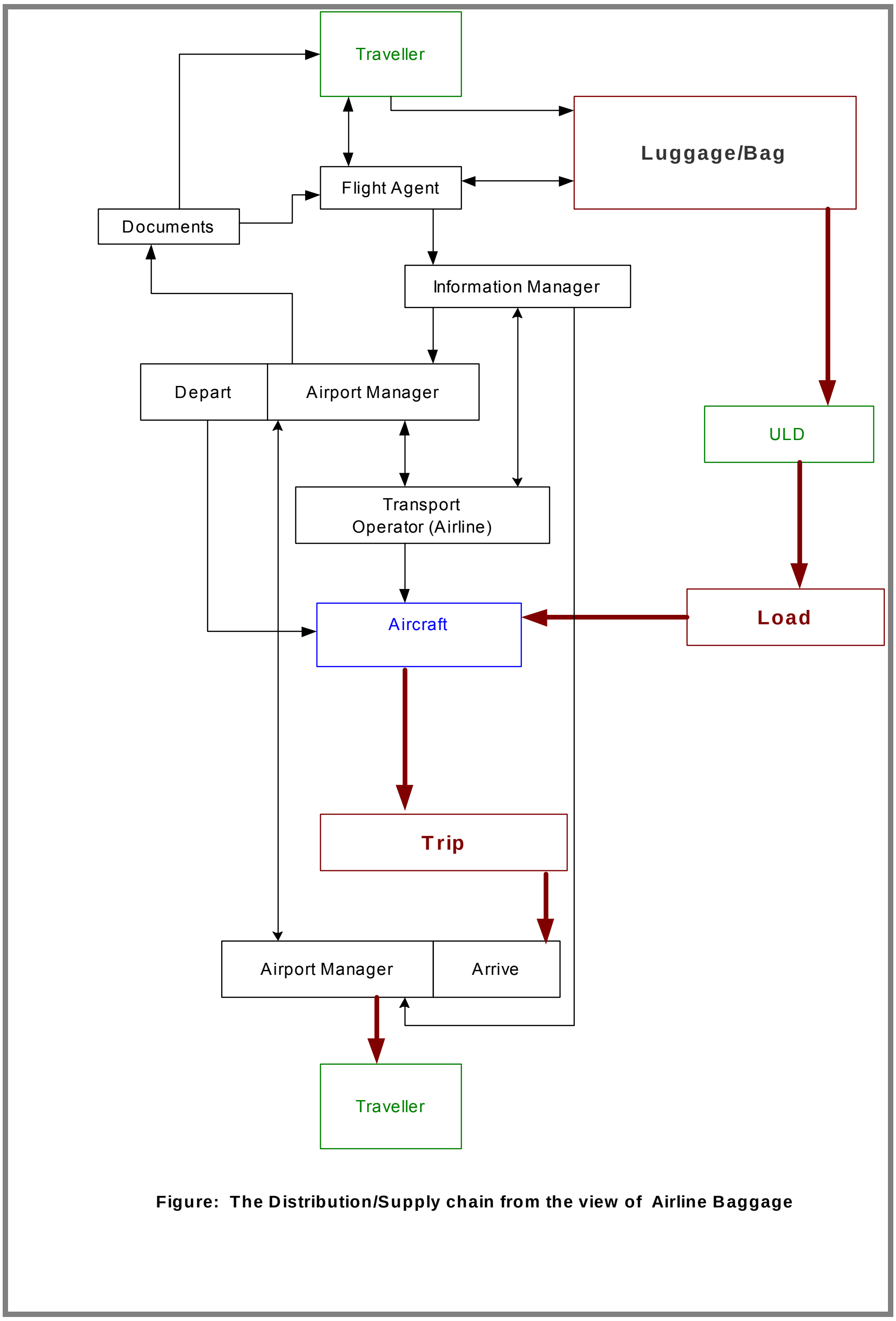

Figure C-7 : The logistics/distribution/supply chain from the view of airline baggage handling

As far as a high level generic model is concerned, this can be seen as a subset of the general model, where The Flight Agent, Airport Manager, and Airline is part of the "Transport Operator" class. Luggage is an instance of the Class "Non Returnable Container" or "item".

The work of ISO/IEC SC31 WG4 relates to "RFID for item management". The work programme concerns the collection and management of information (primarily identification) about "items" in Manufacturing/Logistics/Distribution/Supply chains. As such it is the "information" rather than the physical movement that lies at the heart of the work programme. Key Classes, which appear in every one of the views described above are those of "information" and the "Information Manager" function.

Figure C-8 is therefore crucial to this series of Standards. It provides the view of The "Information Manager".

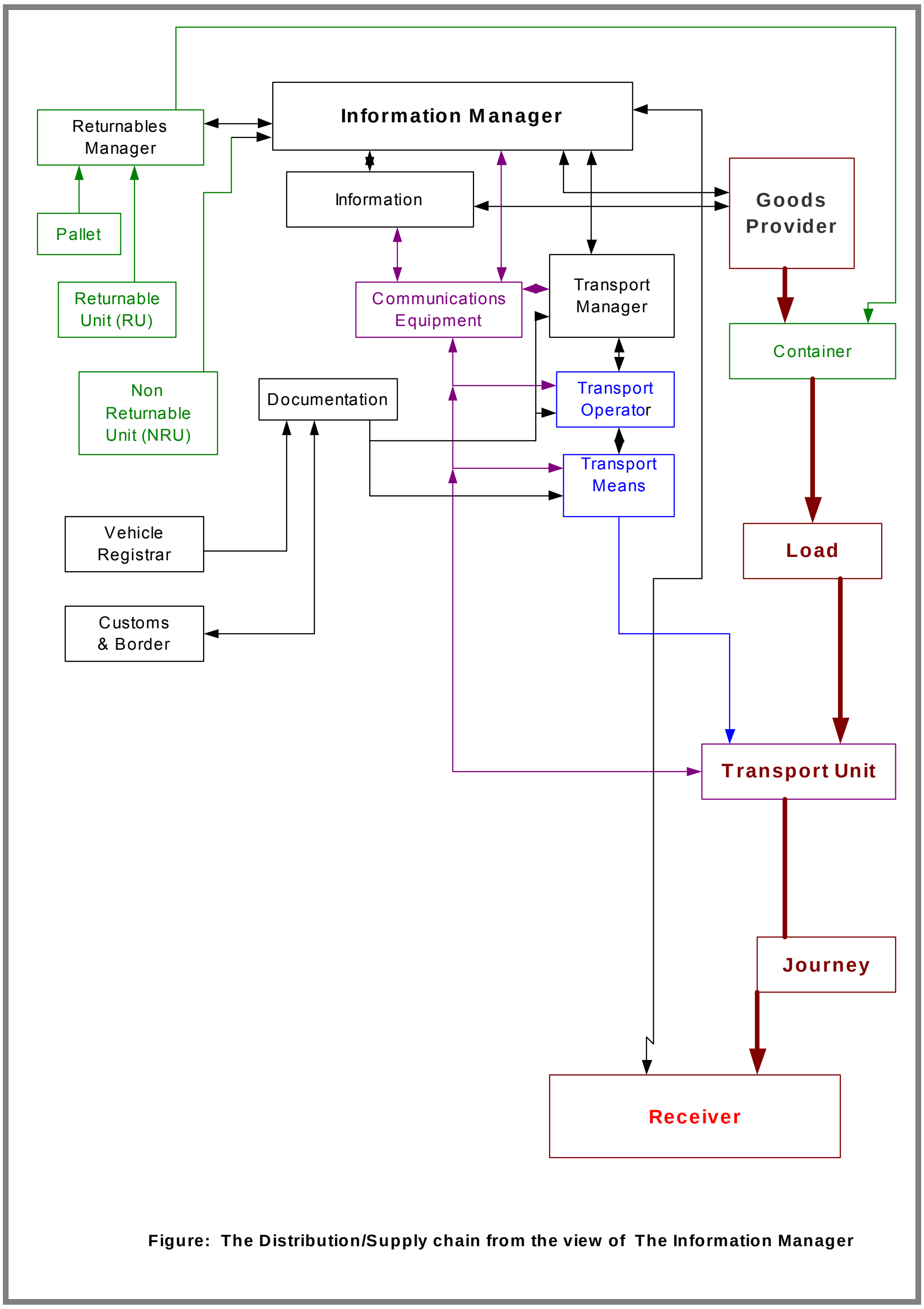

Figure C-8 : The logistics/distribution/supply chain from the view of the information manager

C3 Relationship to the architecture views of the transport sector.

The Standardization Committee of the Intelligent Transport Sector (ISO TC204) has a formal liaison with ISO/IEC SC31. Its WG4 (AVI/AEI) uses the following, similar model, viewed from their perspective, and also share several of the architecture views described above in its Standard ISO 17261 Intelligent Transport Systems, 錯誤! 找不到參照來源。. They also provide an additional conceptual architecture view as shown in Figure C9.

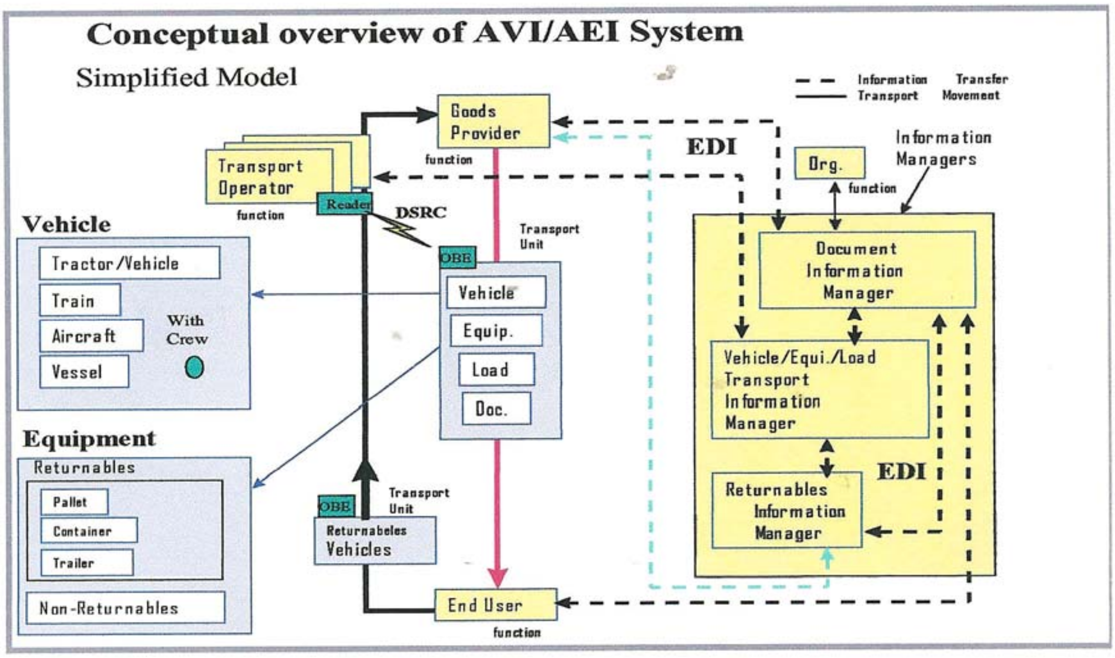

Figure C-9 : ISO TC204 WG12 Conceptual view of AVI/AEI system classes showing key attributes

C.4 Logical definition

C.4.1 The purpose of the **logical definition** is :

a) to provide the General Distribution Logistic Model with a logical product independent conceptual framework that can be used to help identify and select the best in class technical components for inclusion into a coherent overall solution. This selection process will occur both during procurement and afterwards when upgrading or replacing technical products and or services.

b) to provide a road map for seamlessly evolving the System IT infrastructure in line with anticipated regional to global deployment of The System services.

c) to provide potential suppliers of system technology and services with a logical overview of the conceptual Architecture.

The Architecture is not intended to be prescriptive. It provides a descriptive and representative view of the classes and their interactions in the General Distribution Logistic Model environment.

Figure C10 shows the logical functionality of the information interactions in the system.

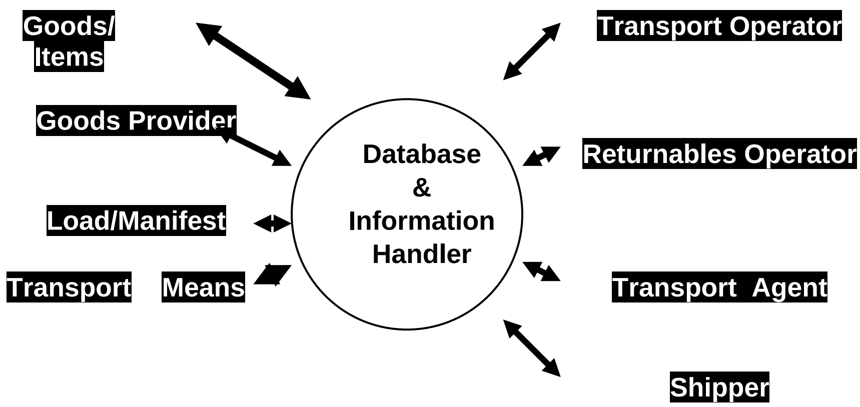

Figure C10. Logical Functionality showing information interactions.

C.5 Functional architecture

The prime item identification function is to provide an unambiguous identification at an appropriate time. For General Distribution Logistic Model the information flow is a simple monologue where, on receipt of an appropriate signal, the Tag returns its identity, but in many cases also additional information. However, whilst the key 'item identification' transaction may be a monologue, the technical solution will often require a bi directional dialogue.

These models are expanded from simple Class Diagrams (such as the examples given above in this Annex to show the key attributes. Figure C11 provides of how this may be elaborated.

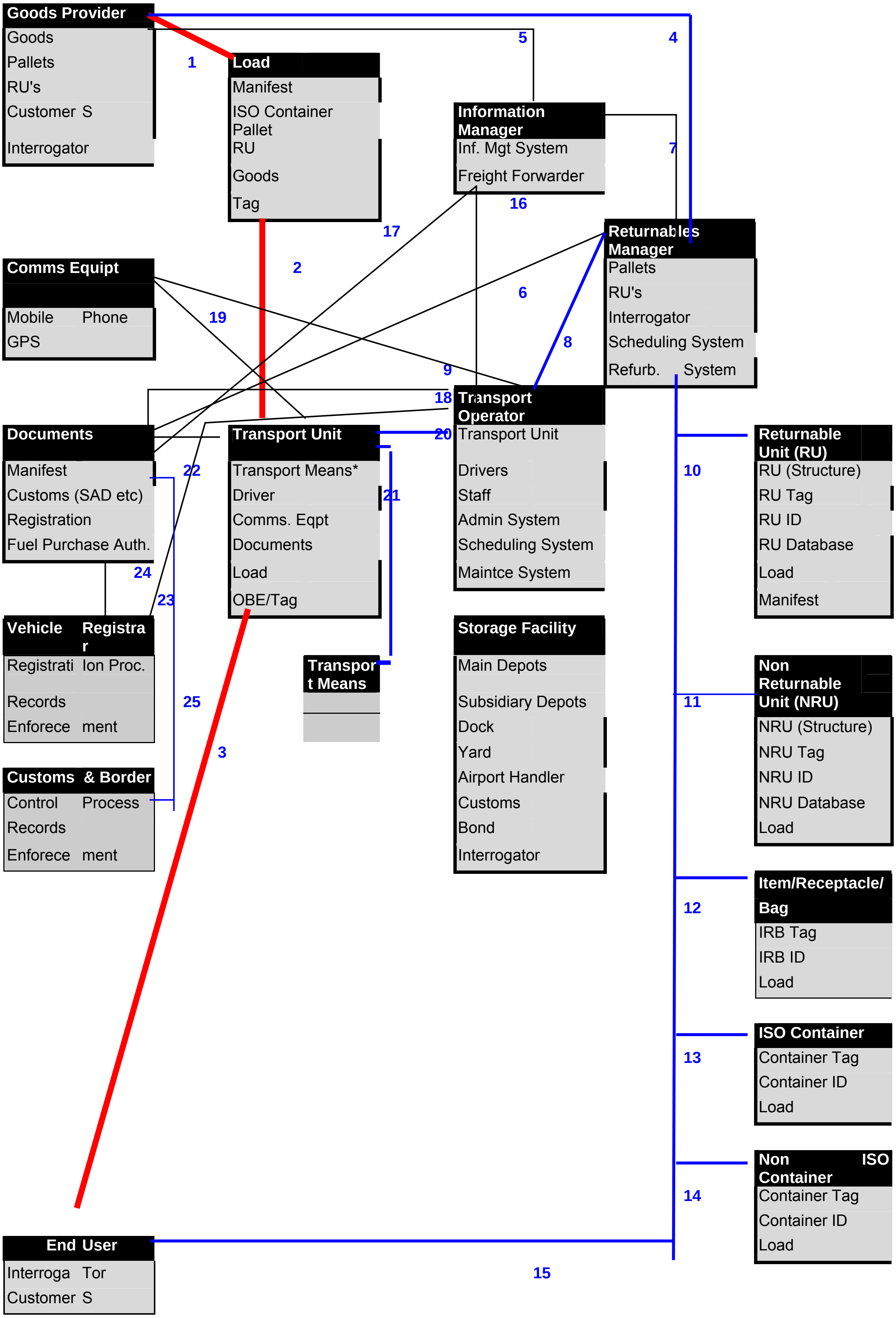

Figure C-11 :Conceptual view of a logistics/distribution/supply model system classes showing key attributes

C6 Object interactions (examples)

Example terse descriptions for typical interaction interfaces are provided in the following sub Clauses. The interactions described are typical rather than complete or entire and are intended as descriptive rather than a prescription.

Whilst a terse description of typical interactions is provided, sequence diagrams are not provided. Additional information interactions may, and will, vary and this Technical Specification provides only the possibility of such additional transactions, therefore does not define the necessity nor sequence of such interactions :

C6.1 Object interaction 1 : goods provider - load

Order- Load
Manifest-Load
Load to transport unit
Passenger Bag to Transport Agent

C6.2 Object interaction 2 : load - transport unit

Transport unit to load location
Load to transport unit.
Contract Negotiation.
Provision of instruction to Transport Provider

C6.3 Object interaction 3 : transport unit – end user

Deliver load to end location
Unload
Deliver load to end user
Deliver bag to Traveller.
Transport unit to base

C6.4 Object interaction 4 : returnables manager – goods provider

Contract
Provide returnable Units to Goods Provider
Receive returnable units for repair/recycling

C6.5 Object interaction 5 : goods provider – information manager

Provide order information to Information Manager
Scheduling
Provide load collection information to information manager
Reporting.

C6.6 Object interaction 6 : returnables manager - documents

Generate supporting documentation in respect of Returnables

C6.7 Object interaction 7 : returnables manager – information manager

Provide information regarding Returnables movements and logistics.

C6.8 Object interaction 8 : returnables manager- transport operator

Organise collection of Returnables
Organise delivery of Returnables

C6.9 Object interaction 9 : transport operator - communications equipment

Instructions to Driver
Equipment position monitoring
Equipment condition monitoring
Requests from Driver
Information from Driver

C6.10 Object interaction 10(a) : returnables manager – pallet

Program Pallet ID to Pallet data carrier
Program additional data to Pallet data carrier
Read Pallet information data carrier
Update Pallet information data carrier
Receive Pallet
Repair Pallet
Store Pallet
Despatch Pallet

C6.11 Object interaction 10(b) : returnables manager – other returnable unit (RU)

Program RU ID to RU data carrier
Program additional data to RU data carrier
Read RU information data carrier
Update RU information data carrier
Receive RU
Repair RU
Store RU
Despatch RU

C6.12 Object interaction 10(c) : returnables manager – item/receptacle/bag (IRB)

Program item/receptacle/bag ID to RU data carrier
Program additional data to IRB data carrier
Read IRB information data carrier
Update IRB information data carrier
Receive IRB
Repair IRB
Store IRB
Despatch IRN

C6.13 Object interaction 11 : returnables manager - non returnable unit (NRU)

Program NRU ID to NRU data carrier
Program additional data to NRU data carrier
Read NRU information data carrier

C6.14 Object interaction 13 : returnables manager – ISO containers

13(a) 20' & 40' Boxes
13(b) Swap Bodies
13(c) Curtainliners
13(d) Tanks

Program ISO Container (Class) Id To ISO Container (Class) Data Carrier
Program Additional Data To ISO Container (Class) Data Carrier
Read ISO Container (Class) Information Data Carrier
Update ISO Container (Class) Information Data Carrier
Receive ISO Container (Class)
Repair ISO Container (Class)
Store ISO Container (Class)
Despatch ISO Container (Class)

C6.15 Object interaction 14 : returnables manager – non ISO containers

Program Container Id to Container Data Carrier
Program Additional Data to Container Data Carrier
Read Container Information Data Carrier
Update Container Information Data Carrier
Receive Container
Repair Container
Store Container
Despatch Container

C6.16 Object interaction 15 : end user - returnables manager

Contract
Instruct Returnables Manager to Collect
Collect Pallets and RU's

C6.17 Object interaction 16 : information manager - transport operator

Despatch Instructions
Monitor Progress

C6.18 Object interaction 17 : information manager – documents

Update support documentation
Maintain Document Library
Maintain Data Registry
Maintain Data Dictionary

C6.19 Object interaction 18 : transport operator - documents

Transport Means documentation
Customs documentation
Driver/Pilot Documentation
Equipment documentation
Load Documentation

C6.20 Object interaction 19 : transport unit - communications equipment

Instructions to Driver/Pilot
Equipment position monitoring
Equipment condition monitoring
Requests from Driver/Pilot
Information from Driver/Pilot

C6.21 Object interaction 20 : transport operator – transport unit

Transport Unit – Transport Means Association Information
Driver/Pilot Assignment
Driver/Pilot Association Information
Driver/Pilot Monitoring Information
Load Assignment
Load Association Information
Maintenance Information
Condition Monitoring

C6.22 Object interaction 21 : transport operator- transport means

Carrier Association Information
Contract
Schedule
Route Plan
Load Assignment
Load Association Information
Vehicle/Trailer Maintenance Information
Condition Monitoring
Point of Departure
Point of Transfer
Point of Arrival
+ a/b/c interactions as required.

C6.22.1 Object interaction 21a : transport operator – transport means - train

Engine / Train name Association Information
Train / Railcar Association information

C6.22.2 Object interaction 21b : transport unit – sea/water

Vessel Association information

C6.22.3 Object interaction 21c : transport unit - aircraft

Flight Association information

C6.22.4 Object interaction 22: documents – transport unit

Documents to Transport Unit
Document from Transport unit
Documents inspected within Transport unit

C6.23 Object interaction 23: transport operator – vehicle regulator

Update Vehicle Registration Documents
Vehicle Taxation Documents
Vehicle Inspection and test Documents.

C6.24 Object interaction 24: vehicle registrar – documents

Issue Vehicle Registration Documents
Update Vehicle Registration Documents

C6.25 Custom/Border – documents

Issue SAD and other Cargo Documents
Inspect SAD and other Cargo Documents

Annex D
(informative)

Unique Identifier

D.1 Applicability

Where a unique identifier is used it is recommended that the following form be used. In the case of some 18000 Standards, or Modes of those Standards, the use of this Unique Identifier form may be mandatory (Defined in the each Standard where mandatory).

D.2 Unique identifier

The tag serial number shall either be in accordance to clause D.2.1 or clause D.2.2 .

The UID format "E0xxx" is preferred.

Differentiation is achieved by the leading bits in byte 0, which are 111 for unique identifiers as defined in Clause D 2.1 and 000 for unique identifier as defined in Clause D.2.2 .

D.2.1 Unique identifier

MSB							LSB
Byte 0 M L	**Byte 1** M L	**Byte 2** M L	**Byte 3** M L	**Byte 4** M L	**Byte 5** M L	**Byte 6** M L	**Byte 7** M L
'E0' 8 bits	IC Mfg code acc. ISO/IEC 7816-6/AM1	Chip Manufacturer Assigned 48 bits					

D.2.1.1 'E0' (byte 0)

E0 is the header for unique identifier followed by the manufacturer code according ISO/IEC 7816-6/AM1.

D.2.1.2 IC Mfg code according ISO/IEC 7816-6/AM1 (byte 1)

ISO/IEC 7816-6/AM1 defines an 8 bit code for chip manufacturers.

D.2.1.3 Chip manufacturer assigned (bytes 2 – 7)

This is a 48-bit field that is defined and managed by the chip manufacturer. Different chip manufacturers will have different manufacturer codes (see below), thus eliminating the potential for duplicated collision arbitration data (Tag UID's). The numbering system employed by the chip manufacturer shall ensure that all tags produced will have a unique and unambiguous number (used by the collision arbitration algorithm). This unique number is to be "locked" prior to use. Maximum value for this field is 2^{48} -1.

Responsibility for ensuring uniqueness and for locking this unique number prior to use shall rest with the chip manufacturer.

The Tag Serial Number shall be programmed and locked at the factory with a unique number for each tag.

D.2.1.4 Check sum (bits 0, 1)

It represents the truncated sum of the bits set to 1 for 62 bits preceding the check sum in the Tag Serial Number field. Valid values are 0, 1, 2, & 3.

D.2.1.5 Fab code (bits 2 – 5)

This four bit hexadecimal code is available to provide further segregation within a registered Manufacturer Code to accommodate multiple chip fabricators. It is the responsibility of the registered manufacturer to administer this code (if used) in conjunction with the Serial Number (bits 14 – 63) field to ensure that all tags produced by the manufacturer will have a unique and unambiguous number (used by the collision arbitration algorithm).

D.2.1.6 Manufacturer code (bits 6 – 13)

This is an 8-bit hexadecimal field that has been included to meet anticipated ANSI/ISO standard requirements. This 8-bit hexadecimal field is required to segregate multiple producers of chips compliant with this air interface standard. All manufacturers will have a separate and unique number allowing them to produce chips with collision arbitration numbers that do not interfere through duplication.

Registration and management of this code shall be in accordance with the specified mechanism defined by ISO/IEC JTC 1/SC 31.

D.2.1.7 Chip manufacturer assigned (bits 14 – 63)

This is a 50-bit field that is defined and managed by the chip manufacturer. Different chip manufacturers will have different manufacturer codes (see below), thus eliminating the potential for duplicated collision arbitration data (Tag UID's). The numbering system employed by the chip manufacturer must ensure that all tags produced will have a unique and unambiguous number (used by the collision arbitration algorithm). This unique number will be "locked" prior to use. Maximum value for this field is 2^{50} -1.

Annex E
(informative)

Intellectual property : Patents

E.1 Responsibilities regarding patents and intellectual property

Attention is drawn to the statement in the Foreword to this Standard

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

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 20 was prepared by Joint Technical Committee ISO/IEC JTC, Subcommittee SC 31, *Information technology - AIDC techniques*.

This Informative Annex provides summary information that has been identified as possibly being relevant to some or all of the Standards in the 18000 series of Standards. The list in this Informative Annex does not purport to be complete, and represents only Patents that have been identified by developers of the 18000 series of Standards during the development of those Standards as possibly being relevant to one or more of the Air Interfaces defined in the ISO 18000 series of Standards. Further, because a patent is listed here, or referenced in one of the subsequent Parts of the 18000 series of Standards, it does not imply any level of status, priority, preference or acceptance of the relevance of Patents listed, and the summaries are provided for information only. Interested parties are advised to seek professional advice in respect of any patents that appear relevant. Neither ISO nor the developers of the 18000 Standards accept any responsibility for the accuracy of these provided descriptions.

E.2 Contact web addresses for Patent Offices

Further information can be obtained from the patent holder and from the applicable patent office web site:

At the time of publication the following web addresses provided useful links to the patent information:

Table E.1 – Selected intellectual property resources

Country	URL
Australia	http://www.ipaustralia.gov.au/
Canada	http://patents1.ic.gc.ca/srch_num-e.html
China	http://www.patent.com.cn/english/
Europe	http://ep.espacenet.com/

Japan	http://www.ipdl.jpo.go.jp/homepg_e.ipdl
Singapore	http://www.surfip.gov.sg/sip/site/sip_home.htm
South Africa	http://www.cipro.gov.za/
United Kingdom	http://www.patent.gov.uk/
United States	http://www.uspto.gov/patft/index.html
World Intellectual Property Organization - Intellectual Property Digital Library	http://ipdl.wipo.int/

E.3 Patents declared to SC 31/WG 4/SG 3

The following companies who have participated in the development of the ISO/IEC 18000 series of Standards have declared that they hold Patents which may have an impact on the use of the ISO 18000 series of standards. All companies have declared they will abide by the rules for patented technology as established by ISO. No representation is made as to the completeness or validity of this list.

Table E.2 – Declared patents

ISO/IEC 18000 Part	Assignee	Patent Number
Part 4, Mode 2	Siemens	DE 10137247.7
		PCT/DE02/02769
Part 3, Mode 1	TagSys	EP 0578701B1
		AU 664544
		AU PCT AU/00/01493
		WO 01/41043
		AU PCT AU98/00017
		WO 98/32092
		US 5523749
		AU PCT AU01/01676
		WO02/054365
		FR FR00/01704
		WO 01/01326
Part 6, Type A	TagSys	EP 0578701B1
		AU 664544
		AU PCT AU/00/01493
		WO 01/41043
		AU PCT AU98/00017
		WO 98/32092
		US 5523749
		AU PCT AU01/01676
		WO02/054365

ISO/IEC 18000 Part	Assignee	Patent Number
		FR FR00/01704
		WO 01/01326
Part 4	Intermec	US 5942987
		US 5521601
		US 5995019
		US 5030807
		US 5828693
		US 5850181
		US 4786907
		US 5550547
		US 5673037
		US 5777561
		US 5828318
Part 6	Intermec	US 5942987
		US 5521601
		US 5995019
		US 5030807
		US 5828693
		US 5850181
		US 4786907
		US 5550547
		US 5673037
		US 5777561
		US 5828318
Part 3	Philips (PHO 98.531)	EP 1038257B
		CN 1277695
		JP 00-561579
		US 09/357270
		WO 00/05673
	Philips (PHO 98.519)	EP 0998792B
		JP 00-551498
		US 09/315708
		WO 99/62196
	Philips (PHO 98.530)	EP 1034644B
		JP 00-560700
		US 6442215

ISO/IEC 18000 Part	Assignee	Patent Number
		CN 1273730A
		WO 00/04686
	Philips (PHO 94.520)	EP 0669591B
		AT-PS 401127
Part 6	Philips (PHO 98.529)	EP 1034503B
		JP 00-560535
		US 09/352317
		WO 00/04485
	Philips (PHAT010034)	JP 03-502778
		US 2002/0186789A1
		WO 02/099741 A1
Part 4	Philips (PHAT010034)	JP 03-502778
		US 2002/0186789A1
		WO 02/099741 A1
Part 2	Philips (PHO 94.520)	EP 0669591B
		AT-PS 401127
	Philips (PHO 99.503)	CN 1293789-A
		EP 1064616A
		JP 00-596516
		US 09/487151
		WO 00/45328-A1
	Philips (PHO 90.508)	EP 0473569B
		JP A91-211035
		US 5345231B
		AT-PS 395224
	Philips (PHAT010012)	US 2002-0131453-A1
		WO 02/073511
Part 2	ATMEL	US 5286955
		EP 0502518B1
Part 3 Mode 2	Magellan	
	Identification Apparatus and Methods	US 5302954
		WO 8905549
		EP 0390822
		DE 3854478D

ISO/IEC 18000 Part	Assignee	Patent Number
		SG 37971
	Communication Device and Methods	US 5485154
	Transmitter and Method for Transmitting Data	US 09/582341
		US 09/611658
		WO 9934526
		EP 1048126
		JP 2002500465T
		AU 1654099
	Radio Frequency Identification Transponder	US 10/204159
		WO 0165712
		EP 1266458
		JP 2001-654480
		AU 3711301
Part 3 Mode 1	EM	US 6470045 B1
	(pending)	EP 97115772
		CN 148806 (Taiwan)
		SG 69362
	(pending)	HK 99103807.9
Part 2	Texas Instruments	EP 845751
		US 5793324
		US 5929801
		US 5053774
Part 3 Mode 1	Texas Instruments	EP 845751
		US 5793324
		US 5929801
		US 5053774
Part 6 Type A	BiStar – Electronic Identification System	ZA 9810199
		US 6480143 B1
		EP 1001366
		JP 200230978
		CN 1255689
Part 2 3 4 6 7	Intercode	
	Process and device for registering and checking items	US 5426423
		EP 90909459.1

ISO/IEC 18000 Part	Assignee	Patent Number
		CA 2058 947
	Method for remotely interrogating tags and station and tag implementing said method	US 6177858B1
		EP 96402556.3
		CA 2191787
	Phase control method for electronic tags and station and tag implementing said method	US 5923251
		EP 96402554.8
		CA 21911788
	Power and Modulation circuit for remotely portable electronic tag	US 5808550
		EP 96402555.5
		CA 2191794
Part 2 3 4 6 7	Matrics	US 6002344

E.4 Patent abstracts

The following companies who have participated in the development of the ISO/IEC 18000 series of Standards have declared that they hold Patents which may have an impact on the use of the ISO 18000 series of standards. All companies have declared they will abide by the rules for patented technology as set down by ISO. No representation is made as to the completeness or validity of this list.

DE10137247.7

2001-07-30

Title: Method for transmitting data between a read/write device and a data memory, use of said method in an identification system and a read/write device and mobile data memory for an identification system of this type.

Abstract

PCT/DE02/02769 (29 July 2002), WO 03/015006 A2 (20 February 2003). The invention relates to a method for transmitting data between a read/write device (SLG) and a mobile data memory (D, HD) in an identification system for capturing object-related data. Said method comprises the following steps: division of the data transmission between the read/write device and the data memories into several time slots (SLOT), subframes (SUBFRAME) and frames (FRAME); receipt and evaluation of an identification time slot (S-CH) of the respective data memory in at least one evaluation time slot (S0a); identification of the data memory as a mobile high-speed data memory (HD), if the identification time slot is a high speed identification time slot ($S_{31,0}$, $S_{0,31}$) and evaluation of the corresponding data memory identification block (MB2), at least from the following time slot. The advantage of the invention is that an extremely rapid capture of high-speed data memories (HD) can be achieved.

Assignee: Siemens

- - - -

EP0578701 / US5523749

1996-06-04

Title: Identification system for simultaneously interrogated labels

Abstract

PCT No. PCT/AU92/00143 Sec. 371 Date Sep. 28, 1993 Sec. 102(e) Date Sep. 28, 1993 PCT Filed Apr. 3, 1992 PCT Pub. No. WO92/17866 PCT Pub. Date Oct. 15, 1992. An identification system having an electronic label for processing articles such as baggage or carrier cargo. The system uses the principle of electromagnetic communication in which an interrogator containing a transmitter generates an electromagnetic field through which the electronic label containing a label receiving antenna may pass. The electronic label is attached to the article being processed and includes means for sensing the electromagnetic field and means for generating intermittently repeated label reply signals. The system includes a receiver for detecting and decoding the label reply signal. The electronic label replies intermittently as long as it is within the electromagnetic field, and the field is maintained for a period of time which is greater than the time interval between the intermittently repeated label replies. The electronic label also includes means for determining the interval between the intermittently repeated label reply signals without reference to timing signals external to the label. The interval between label reply signals varies from label to label and is greater than the time required for a label reply.

Assignee: TagSys

- - -

WO 01/41043

2001-06-07

Title: Electronic Label Reading System

Abstract

PCT/AU00/01493. An electronic label reading system is disclosed having an interrogator including a transmitter for generating an interrogation signal and a receiver for detecting and decoding a reply signal. The system also has an interrogation field creation means including a transmitter antenna connected to the transmitter for generating from the interrogation signal an interrogation electromagnetic field through which objects possessing code responding labels may pass. The code responding labels include label receiving antennas for receiving from the interrogation field a label interrogation signal, means for generating label reply signals, and means for generating from the label reply signals, reply electromagnetic fields. The system also has a receiver antenna connected to the receiver for receiving the reply signals from the label reply fields. The system is arranged so that the interrogation field and label reply fields provide a communication channel from the labels to the interrogator, and the interrogator includes means for signaling to the labels condition information indicative of the condition of the communication channel.

Assignee: TagSys

- - -

WO 02/054365

2001-12-28

Title: A System and Method for Interrogating Electronic Labels

Abstract

PCT/ AU01/01676. The invention provides a system and method for interrogating one or more electronic labels attached to objects, the system including an interrogation device capable of radiating an electromagnetic interrogation signal which contains information in the form of a plurality of symbols, each symbol being represented by a respective time interval between consecutive dips in amplitude of the interrogation signal. The one or more of the electronic labels are capable of detecting and decoding the interrogation signal to recover the symbols, and in response to recovering the symbols generate a reply signal. The reply signal is able to be detected and decoded by the interrogation device. It is envisaged that the invention will find particular use in identifying, sorting, controlling and/or auditing objects having information bearing electronically coded labels.

Assignee: TagSys

- - -

WO 01/01326

2000-06-21

Title: Method for Identifying Electronic Labels by Adaptive Rounds

Abstract

FR FR00/01704. The invention concerns a method for identifying electronic labels affixed on products using a querying device, characterised in that it comprises the following steps which consist in: a) indicating to the electronic labels the number Ns of consecutive emitting windows of a first cycle or round (rectangle 62); b) counting, during the first cycle of Ns windows, the messages received from the electronic labels to determine the number ni of identifications, the number nv of windows or blank spaces and the number nc of collisions (rectangle 64); c) stopping the process if nc = 0 (rectangle 68); or proceeding to step d) if nc ≠ 0; d) calculating a number Ns1 of emitting windows for the next cycle on the basis of the values of Ns, ni, nv and nc (rectangle 70); going back to step a) with Ns = computed Ns1 (rectangle 62).

Assignee: Gemplus (TagSys)

- - -

AU664544

1995-11-23

Title: Article Sorting System

Abstract

Identification and telemetry system esp. for baggage and cargo sorting – has interrogation tunnel through which labeled objects pass to create interrogation field for interacting with electronic coded labels.

Assignee: Integrated Silicon Design (TagSys)

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WO 98/32092

1998-07-23

Title: Multiple tag reading systems”

Abstract

Australian Provisional Patent Application Number PN 4647, 17 Jan 97, now AU737367 PCT AU98/00017. A system for processing articles in a warehousing or merchandising operation wherein information bearing electronically coded labels are attached to the articles to be processed. The system uses the principle of electromagnetic communication in which an interrogator (4) containing a transmitter generates an electromagnetic signal which is transmitted via an interrogator antenna system (2, 3) to electronic labels (5) containing label receiving antennas. The electronic labels (5) are attached to articles as they are processed. Each label antenna receives a proportion of the transmitted energy and operates a reply generation circuit connected either to the label receiving antenna or a separate label reply antenna with the result that an information bearing electromagnetic reply signal is radiated by the label. The interrogator (4) includes an arrangement for detecting the strength of the reply signal which is radiated by the label and for generating a signal which is indicative of the strength of the reply signal.

Assignee: Integrated Silicon Design (TagSys)

- - -

US5942987

1999-08-24

Title: Radio frequency identification system with write broadcast capability

Abstract

A Write Broadcast system and method uses a base station to write sent data associated with no particular destination tag or tags, by radio frequency signal, to all or some selected number (sub group) of tags in a base station field simultaneously. By unselecting the tags that have been successfully written to, and requesting a response from the remaining tags in the field (or sub group), the system determines, by receiving a response to the request, that there are tags in the field (sub group) that were unsuccessfully written to. Another Write Broadcast signal is sent to these tags. The system is useful for quickly (simultaneously) "stamping" information on the tag memory of a large number of tags in the field of the base station.

Assignee: Intermec

- - -

US5521601

1996-05-28

Title: Power-efficient technique for multiple tag discrimination

Abstract

This invention provides a tag identification system and method for identifying tags in the range of a reader station where the tags are divided into smaller groups, where the tags are identified one group at a time so as to save power by powering off the tags that are not in the group currently being identified. Each tag puts itself in a group by performing calculations from parameters stored in itself and from parameters received from the reader station. In another variation of this invention, only tags which configure themselves to be activated at a final frequency are identified. The set of tags which configure themselves to be activated at the final frequency changes with each identification round until all tags in the range of the reader have been identified.

Assignee: International Business Machines Corporation (Intermec)

- - -

US5995019

1999-11-30

Title: Method for communicating with RF transponders

Abstract

A method of selecting groups of radio frequency RF transponders (tags) for communication between a base station and the tags. The tags are selected into groups according to a physical attribute of the signal sent by the tags to the base station, or according to the physical response of the tags to a physical attribute of the signal sent from the base station to the tags. Communication with the tags is thereby simplified, and the time taken to communicate with the first tag is markedly reduced.

Assignee: Intermec

- - -

US5030807

1991-07-09

Title: System for reading and writing data from and into remote tags

Abstract

The subject invention relates to a system for identifying, for writing data into and reading data out of electronic tags which may be attached to moving and moveable objects. An interrogator sends an RF signal to a remote tag, the signal including data intended to be received and stored in the tag. The tag backscatter-modulates the received signal with data temporarily and permanently stored in the tag, including data indicating the identity of the object to which the tag is attached. The interrogator has the capability of (1) recognizing the identity of the tagged object from the returned backscatter-modulated signal and (2) transmitting data to the tag only if it has data to be transmitted to that particular tagged object. This permits data to be selectively transmitted to a tag and received and stored by that tag only after the tag has been identified as a correct one to receive that data. The tag, in addition, may have the capability of increasing its sensitivity to the receipt of transmitted data after receiving a signal from the interrogator of sufficient strength to be capable of transmitting data to that tag.

Assignee: Amtech Corporation (Intermec)

- - -

US5828693

1998-10-27

Title: Spread spectrum frequency hopping reader system

Abstract

An apparatus for sourcing an interrogation signal for use in a object identification system including a frequency hopping source for generation of an interrogation signal which is coupled to a homo dyne radio for transmission by a bi-directional antenna to a tag. Upon receipt, the tag provides a return signal that is backscatter modulated to include tag identification or other data which is processed by the sourcing system. The frequency hopping source includes a voltage controller oscillator which is driven by a pseudo random code generator for selecting one of a plurality of hopping frequencies at which the interrogation signal is to be generated based on the available bandwidth.

Assignee: Amtech Corporation (Intermec)

- - -

US5850181

1998-12-15

Title: Method of transporting radio frequency power to energize radio frequency identification transponders

Abstract

An apparatus and a method of transporting energy from a base station to energize a remote RF transponder having an energy store is described, comprising transporting power in pulses of frequencies chosen from a randomly ordered list of frequencies, wherein the time between pulses when little power is transmitted is less than the time taken for the remote transponder to deplete the energy store.

Assignee: International Business Machines Corporation (Intermec)

- - -

US4786907

1998-11-22

Title: Transponder useful in a system for identifying objects

Abstract

A reader transmits interrogating rf signals to a transponder including an antenna having a particular impedance. The signals received by the antenna are converted to a direct voltage which is introduced to a first terminal of a switch such as an emitter of a semi-conductor device having conductive and non-conductive states of operation. A second terminal of the switch, such as the base of the semi-conductor device, receives a voltage variable between first and second magnitudes in accordance with a pattern of binary 1's and 0's in a data source such as a read-only memory (ROM). This pattern of binary 1's and 0's is individual to an object identified by the transponder. The variable voltage on the base of the semi-conductor device causes the emitter-collector current of the semi-conductor device to vary between first and second amplitudes. When this current has the first amplitude, the impedance of the semi-conductor device and the ROM substantially matches the antenna impedance. When this current has the second amplitude, the impedance of the semi-conductor device and the ROM is substantially greater than the antenna impedance. Capacitance may be connected to the collector of the semi-conductor device and the ROM to store energy in accordance with the current flow through the semi-conductor device. This stored energy provides for an energizing of the semi-conductor device and the ROM. A diode may be connected between the emitter and collector of the semi-conductor device to increase the second amplitude of the current through the semi-conductor device.

Assignee: Amtech Corporation (Intermec)

- - -

US5550547

1996-08-27

Title: Multiple item radio frequency tag identification protocol

Abstract

The present invention uses a novel adaptation of a tree splitting algorithm applied to Radio Frequency (RF) tagging technology to identify many tags in the RF field of a base station. The invention uses the tree splitting algorithm to identify a single tag in a field of a plurality of radio frequency tags. Once the single tag is identified, the identified tag is placed in a Data.sub.-- Exchange state where the base station can access data from the tag memory by using information that identifies the tag.

Assignee: International Business Machines Corporation (Intermec)

- - -

US5673037

1997-09-30

Title: System and method for radio frequency tag group select

Abstract

A system and method is disclosed for selecting certain subgroups of radio frequency (RF) tags for querying, communicating, and/or identifying by a base station. The base station sends commands to a group tags within a RF field of the base station. The tags use control logic to determine whether or not they meet certain criteria sent out by the commands. This may cause the tags to change state which either prevents or allows a given tag to participate in an identification process. In this way, a given subgroup(s) of tags meeting certain criteria can be selected for querying, communicating, and/or identifying.

Assignee: International Business Machines Corporation (Intermec)

- - -

US5777561

1998-07-07

Title: Method of grouping RF transponders

Abstract

A method of selecting groups of radio frequency RF transponders (tags) for communication between a base station and the tags. The tags are selected into groups according to a physical attribute of the signal sent by the tags to the base station, or according to the physical response of the tags to a physical attribute of the signal sent from the base station to the tags. Communication with the tags is thereby simplified, and the time taken to communicate with the first tag is markedly reduced.

Assignee: International Business Machines Corporation (Intermec)

- - -

US5828318

1998-10-27

Title: System and method for selecting a subset of autonomous and independent slave entities

Abstract

A master entity is capable of broadcasting commands to a plurality of three-state-selection machine slaves. Transitions from one state to another are effected on instruction from commands in a sequence of commands broadcast from the master. Slaves move to another state when they satisfy a primitive condition specified in the command. By moving slaves among the three sets, a desired subset of slaves can be isolated in one of the sets. This desired subset of slaves then can be moved to one of the states that is unaffected by commands that cause the selection of other desirable subsets of slaves.

Assignee: International Business Machines Corporation (Intermec)

- - -

WO0005673 / EP1038257B / US09/357270 / JP00-561579 / CN1277695

Title: System for the transmission of data from a data carrier to a station by means of at least one other auxiliary carrier signal

2000-09-27

Abstract

Data transmission from a data carrier (D) to a station (1) normally takes place by load modulation of a non–modulated carrier signal (CS) by means of an auxiliary carrier signal (SCS1), test means provided in the station then test the correct data transmission and, upon detection of disturbed data transmission, a change over is made to an other transmission mode in which data transmission takes place from the data carrier (D) to the station (1) by means of load modulation of the non–modulated carrier signal (CS) by means of at least one other auxiliary carrier signal (SCS2).

Assignee: Philips Electronics

- - -

WO99/62196 / EP0998792B / JP00-551498 / US09/315708

1999-05-14

Title: Write/read device for communication with transponders, having first coding means and second coding means

Abstract

A write/read device (1) for the contactless communication with at least one transponder has first coding means (4) for coding a data block (DB) in accordance with a first coding method, which first coding means (4) can generate at the most a given number of N coding signals (KI) per data block (DB) in accordance with this first coding method, and has second coding means (9) for coding a data block (DB) in accordance with a second coding method, which second coding means (9) can generate at the most a given number of M coding signals (KI) per data block (DB) in accordance with this second coding method, and has selection means (10) for the selection between the coding signals (KI) supplied by the first coding means (4) and the coding signals (KI) supplied by the second coding means (9).

Assignee: Philips Electronics

- - -

WO00/04686 / EP1034644B / US6442215 / JP00-560700 / CN1273730A

1999-07-02

Title: Data carrier with at least two demodulators for receiving ask signals of differing modulation index

Abstract

A data carrier is adapted to receive a carrier signal (CSM1, CSM2, CSM3), which has been modulated with one of a fixed set of modulation indices (for exemple 100 %, 50 % and 10 %). The data carrier is provided with demodulators (15, 19, 20) sensitive to each of the modulation indices. Means are provided to ensure that only one demodulated signal is passed on to signal processing means (18).

Assignee: Philips Electronics

- - -

EP0669591 / AT-PS 401127

1995-08-30

Title: System for contactless data transmission

Abstract

The system operates between at least one transmission and reception station and several transponders. The station has an HF oscillator (3) for generating an HF signal for transferring information to the transponders which have devices for transferring information to the station, esp. a transmission stage for load modulation of the signal from the station. The station has a demodulator (9) for the signals from the transponders. The inner or scalar product of the signal fo for a null and the signal f1 for transferring a logical 1 from the transponder is equal to 0, i.e. INT0-T f0(t) . f1(t) . h(t) dt = 0, where h(t) is a selected weighting function and T is the period to transfer one bit. The station contains two correlators (7,8) with inputs connected to the demodulator and the signal generators.

Assignee: Mikron (Philips Electronics)

- - -

WO00/04485 / EP1034503B / US09/352317 / JP00-560535

1999-07-07

Title: Transponder system with acknowledgements associated with respective transponders

Abstract:

During a communication operation in a transponder system, consisting of a write/read station (1) and at least one transponder (2), a selection data block (SDB) is transmitted from the station (1) to at least one transponder (2) and, in response to the received selection data block (SDB), at least one transponder (2) transmits an identification data block (IDB) to the station (1), after which the station (1) transmits, in response to the identification data block (IDB), an acknowledge data block (QDB) to a transponder (2), the bit configuration of the acknowledge data block (QDB) being formed while using only a part (PM1) of the identification data block (IDB) associated with a transponder (2).

Assignee: Philips Electronics

- - -

WO02/099741 / US2002/0186789A1 / JP03-502778

2002-06-04

Title: Data carrier comprising memory means for storing information significant for intermediate operating states

Abstract

A data carrier (2) or an integrated circuit (41) for a data carrier (2) comprises a memory (54) which is designed to store intermediate operating state information (ZS, CI16, CI20, BRS) significant for an intermediate operating state of the data carrier (2) or the integrated circuit (41) and comprises a memory control device (51), which after the occurrence of information significant for intermediate operating states ensures that this intermediate operating state information is stored in the memory (54) and comprises a control device (51), which - after the detection of the non-existence of the supply voltage (V) required for faultless operation during execution of a communication sequence interrupted by this non-existence and the subsequent detection of the re-existence of the supply voltage (V) - ensure that the data carrier (2) or the integrated circuit (41) is controlled in an intermediate operating state for which intermediate operating state information (ZS, CI16, CI20, BRS) stored in the memory (54) is significant.

Assignee: Philips Electronics

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WO00/45328 / EP1064616A / US09/487151 / JP00-596516 / CN 1293789-A

2000-01-13

Title: Data carrier provided with at least two decoding stages

Abstract

In a data carrier (1) which includes receiving means (5) for receiving a modulated carrier signal (MTS) which contains a data signal (DS1) encoded in conformity with an encoding method (MA, PW, MI, RTZ, FSK, PSK), demodulation means (9) for demodulating the received modulated carrier signal (MTS) and for outputting the encoded data signal (DS1) contained therein, decoding means (10) for decoding the encoded data signal (DS1) and for outputting data (D1, D2), and data processing means (11) for processing the data (D1, D2) output by the decoding means (10), the decoding means (10) are provided with at least a first decoding stage (12) and a second decoding stage (13), the first decoding stage (12) being arranged to decode a data signal (DS1) encoded in conformity with a first method e.g. RTZ whereas the second decoding stage (13) is arranged to decode a data signal (DS1) encoded in conformity with a second method e.g. MI.

Assignee: Philips Electronics

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EP0473569B / US5345231 / JPA91-2110335 / AT-PS-395224

1994-09-06

Title: Contactless inductive data-transmission system

Abstract

A contactless inductive data transmission system provides bidirectional signal transfer between a sending-and-receiving station and one or more batteryless transponders. A high-frequency signal from the sending-and-receiving station is pulse width modulated for data transmission to a transponder and provides a system clock, which is extracted in both the sending-and-receiving station and in the transponder for synchronization, and provides the electrical power for operation of the transponder. The pulse width modulated signal is demodulated in the transponder for triggering a response wherein a modulating signal is applied by load modulation to the pulse width modulated high-frequency signal to form an information-carrying load modulated high-frequency signal, which is demodulated in the sending-and-receiving station.

Assignee: Mikron (Philips Electronics)

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WO02/073511 / US2002-0131453-A1

2002-09-19

Title: Method of communicating between a communication station and at least one data carrier

Abstract

In a method of communicating between a communication station (1) and at least one data carrier (2 (DC)) comprising an information data block (IDB) and useful data (UD = N(UDB), an inventorization procedure with successive procedure runs is carried out at least one part of a block region (NKP-IDB) of the identification data block (IDB) not yet known in the communication station (1) and, in addition, specific useful data (n(UDB) are transmitted from each data carrier (2 (DC)) to the communication station (1) in the implementation of the inventorization procedure, such that after termination of the inventorization procedure at least one part of the identification data block (IDB) of each data carrier (2 (DC)) and the associated specific useful data (n(UDB) are known in the communication station (1).

Assignee: Philips Electronics

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EP0502518B1 / US5286955

1994-02-15

Title: Method for wireless transmission of data to a data carrier

Abstract

A method is described of wireless transmission of data onto a data carrier, in particular onto a chip card or IC card, by said data carrier being placed in a high-frequency field. To carry out amplitude keying, the field is switched on and off, with the information being here the number of periods transmitted between two transmission intervals. The semiconductor circuit accommodated in the data carrier receives its clock from the received high-frequency field or from an oscillator allocated to the semiconductor circuit, with this clock being off during a transmission gap.

Assignee: ATMEL

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US5302954

1994-04-12

Title: Identification apparatus and methods

Abstract

An identification system comprising a transponder having receiver means adapted to extract powering energy from a surrounding electromagnet field, transponder transmitter means adapted to transmit at least one unique signal from the transponder, frequency generating means for generating a plurality of pre-determined frequencies, each frequency adapted to carry the signal from the transmitter means to an interrogator receiver means adapted to receive said signals to achieve identification of said transponder, said transponder transmitting signals successively or repetitively using at each successive or repetitive transmission a newly selected frequency or set of newly selected frequencies.

Assignee: Magellan Corporation (Aust.) Pty. Ltd.

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WO8905549 / EP0390822 / DE3854478D / SG37971

1989-06-15

Title: Identification apparatus and methods

Abstract

A transponder comprising: transponder receiver means adapted to extract powering energy from a surrounding electromagnetic field, transponder transmitter means adapted to transmit at least one unique signal from the transponder, frequency generating means for generating a plurality of predetermined frequencies, each frequency adapted to carry the signal from the transmitter means to an interrogator receiver means adapted to receive said signals to achieve identification of said transponder. An

identification system comprising: a transponder having means to extract powering energy from a surrounding electromagnetic field, and a transmitter means adapted to transmit one or more unique signals, and receiver means adapted to receive said signals and identify said transponder.

Assignee: Magellan Corporation (Aust.) Pty. Ltd.

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US5485154

1996-01-16

Title: Communication device and method(s)

Abstract

The present invention relates to the areas of communication and/or identification of remote devices (active or passive). The invention has application where there is a need to identify or communicate with more than one remote device. The remote device may be embodied as a transmitter arrangement, transducer, transponder or responder. In particular, the present invention calls for each remote device to include a transmitter means in which, at each transmission, a carrier frequency or medium is newly selected.

Assignee: Magellan Corporation (Aust.) Pty. Ltd.

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WO99/34526 / EP1048126 / US09/582341 / US09/611658 / JP2002500465T / AU1654099

1999-07-08

Title: A transmitter and a method for transmitting data

Abstract

An excitation reference source (Fc) is split through a 90 degree splitter. One output from the splitter is fed to the LO port of a mixer. Data is fed to the mixer's IF port and causes PRK modulation of the LO port's signal. The output of the mixer at the RF port is a PRK modulated quadrature signal. This is attenuated and added back onto the reference by a zero degree combiner ready for transmission to the transponder.

Assignee: Magellan Corporation (Aust.) Pty. Ltd.

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WO01/65712 / EP1266458 / US10/204159 / JP2001-654480 / AU3711301

2001-02-28

Title: Radio frequency identification transponder

Abstract

A radio frequency identification transponder including a power supply and a dynamic memory array which stores data. When power from the power supply ceases the data in the dynamic memory array is validly maintained for a predetermined period of time. The dynamic memory array is responsive to an interrogating signal for selectively updating the data. Further claimed is a radio frequency identification transponder wherein a signal processor extracts an identifier from the interrogation signal and is responsive to the identifier and the stored data to determine whether some or all of the identifier is stored in the dynamic memory array. Further claimed is a system wherein a transmitter provides a plurality of

temporally spaced interrogating signals which are received by a receiver which incorporates a signal processor that is able to determine the order in which transponders were first in receipt of the interrogating signal. Further claimed is a baggage handling system wherein a transmitter provides a plurality of temporally spaced interrogating signals into an interrogating space through which a conveyor sequentially progresses baggage, a receiver receives transponder response signals which include baggage identity data, a signal processor then extracts the identity data and determines the order in which the baggage has progressed through the interrogating space.

Assignee: Magellan Corporation (Aust.) Pty. Ltd.

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US6470045 / EP97115772 / CN148806 / SG69362 / HK99103807.9

2002-10-22

Title: Communication protocol between a transceiver unit and transponders or transceivers associated with said unit

Abstract

The communication protocol between at least one transceiver unit (communication unit) and transponders or transceivers (transponders) associated with said unit is characterised in that at least one initial command is sent by said unit to generate interaction with said transponders entering its field of action, said initial command having at least partially a coding with a specific time structure which is different from the basic time structure used for encoding said coded data. The specific time structure has greater coding time periods than the coding time periods of the basic time structure. At least one coding period of the specific time structure has a constant characteristic electric value over a time interval greater than the duration of said constant characteristic electric value able to appear in any bit sequence having the basic time structure.

Assignee: EM Microelectronic Marin

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EP0845751

1998-06-03

Title: A transponder system

Abstract

A transponder system comprises an interrogation device (12) and a transponder (14), which after reception of interrogation data transmitted by the interrogation device (12) transmits answer data, when it has recognized the interrogation data as interrogation data assigned to it. The interrogation device (12) transmits the interrogation data in the form of a pulse duration modulated carrier in the ISM frequency range. The transponder (14) transmits the answer data in the form of an FSK signal modulated with the received carrier back to the interrogation device (12). The production of the FSK frequencies takes place by frequency division of the carrier received by the transponder (14). The range of the FSK frequencies is so set that no carrier of a known transmitter occurs within this range. The two FSK frequencies are so set in the range that in the base band they are not interfered with by known transmission frequencies and that they can be derived by whole-number division ratios from the carrier frequency. The baud rate of data transmission from the interrogation device (12) to the transponder (14) and from the transponder (14) to the interrogation device (12) is so set that it may be derived by a whole-number division ratio from the carrier frequency

Assignee: Texas Instruments

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US5793324

1998-08-11

Title: Transponder signal collision avoidance system

Abstract

Transponder signal collision avoidance system includes a reader and wireless HDX or FDX type transponders (A, B) are disclosed, interrogated by the reader (R) by alternately powering and then reading through cycles corresponding to a number of possible transponders in the interrogation field. The cycles, which include reader power pulses, signify addresses of respective possible transponders, whether in or out of the field. The transponders for this purpose count reader power pulses by end-of-burst detection, increasing a stored count value with each reader power pulse. The transponder responds to the reader by transmission if and only if a stored count value in a read cycle matches a respective transponder address, preventing the transponders from transmitting telegrams interfering with each other. As a method of reader-transponder operation, the collision avoidance scheme thus cycles the reader interrogating through cycles having power pulses according to possible transponders in the field, not only calling the addresses of each of respective possible transponders but also shortening or lengthening read and power steps dependent upon responses received from the transponders.

Assignee: Texas Instruments

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US5929801

1999-07-27

Title: Method for repeating interrogations until failing to receive unintelligible responses to identify plurality of transponders by an interrogator

Abstract

A novel addressing scheme for an RF-ID system or LAN network is presented in which an interrogator(reader) addresses a set of transponders, each transponder in this set having a common addressing scheme, and the addressed transponders respond only upon the matching of their own address with the received addressing scheme. The addressing scheme comprises a fixed size sub-address and a variable size mask. For example, assuming that the transponder address is 32 bits, the implementation of the addressing scheme can choose 4 bits for the size of the sub-address and 0, 4, 8, 12, 16, 20, 24, 28 bits for the size of the mask. By varying the addressing scheme according to the algorithm in FIG. 4, the reader will in time interrogate all the transponders individually, thus receiving their unique address and achieving the requested exhaustive inventory.

Assignee: Texas Instruments

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US5053774 / EP87111110.0

1991-10-01

Title: Transponder arrangement

Abstract

A transponder arrangement is described comprising an interrogation unit (10) which sends an RF interrogation pulse to at least one responder unit (12). The responder unit (12) then transmits back data stored therein in the form of a modulated RF carrier to the interrogation unit (10). In the responder unit (12) is an energy accumulator (136) which stores the energy contained in the RF interrogation pulse. The responder unit (12) further contains means (142, 148) which in dependence upon the termination of the reception of the RF interrogation pulse and the presence of a predetermined energy amount in the energy accumulator (126) initiate the excitation of an RF carrier wave generator (130, 132, 134) operating with the frequency contained in the RF interrogation pulse. Further means (158, 192) are provided which from the output signal of the RF carrier wave generator (130, 132, 134) generate a control signal which is utilized to maintain the RF carrier wave and to modulate the RF carrier to be sent back with the stored data.

Assignee: Texas Instruments

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US6480143 / EP1001366 / JP200230978 / CN1255689 / ZA9810199

2002-11-12

Title: Electronic identification system

Abstract

An electronic identification system 100 comprises an interrogator 10 and a plurality of transponders 12, 14 and 16. The interrogator comprises a transmitter 11 for transmitting an interrogation signal to the transponders; a receiver 13 for receiving response signals from the transponders; and a controller 19 for processing response signals received, to identify the transponders by their respective response signals. Each transponder comprises a signature generator 35, 32 for generating a unique signature characteristic of the transponder and intermittently transmits, in responses to the interrogation signal, a response signal including the signature. The interrogator further comprises an acknowledgement signal generator 21 for generating upon reception of a response signal from one of the transponders, an acknowledgement signal to be transmitted by the transmitter 11. The acknowledgement signal comprises the signature, thereby to acknowledge reception of the response signal.

Assignee: Supersensor (BiStar)

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US5426423 / EP90909459.1 / CA2058 947

1995-06-20

Title: Process and device for registering and checking items

Abstract

In particular for reducing the waiting time at the checkouts of self-service supermarkets, articles are registered by providing each article with a microcircuit (24) having a loop for picking up high frequency energy and for responding to an interrogation by transmitting a modulated message at high frequency representing an article-identifying signature. An article (20) is taken into account by exciting its microcircuit by applying an energy-supplying and interrogation high frequency signal thereto to cause it to transmit the modulated signal of the signature, the modulated signal is picked up by memory means causing the signatures to correspond to the prices of articles, the price of the interrogated article is stored in a memory, and it is displayed, and the price of the article is added to that of any articles that may previously have been taken into account.

Assignee: Intercode

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US6177858 / EP96402556.3 / CA2191787

2001-01-23

Title: Method for remotely interrogating tags, and station and tag implementing said method

Abstract

A method is provided for remotely identifying electronic or radio frequency tags, typically those used to mark articles, from a station, each of the tags having its own code constituted by digits, in which identification of a tag comprises the steps of issuing interrogation signals from the station for different digit positions and employing procedures to accelerate tag identification once a first tag has been found. A suitable station and tag are also provided.

Assignee: Intercode

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US5923251 / EP96402554.8 / CA21911788

1999-07-13

Title: Phase control method for electronic tags and station and tag implementing said method

Abstract

An electronic tag and a method for remote interrogation of electronic tags from a station are provided in which, in reply to polling signals sent from a station, tags send responses which may interfere, the method comprising a step in which the tags are brought into phase before sending their responses.

Assignee: Intercode

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US5808550 / EP96402555.5 / CA2191794

1998-09-15

Title: Power and modulation circuit for a remotely-pollable electronic tag

Abstract

A power and modulation circuit, notably for a passive remotely-pollable electronic tag is provided, the circuit having a coil for picking up an inductive field and modulating it, circuitry being provided whereby circuits of the tag can be continuously powered while the inductive field is being modulated.

Assignee: Intercode

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US6002344

1999-12-14

Title: System and method for electronic inventory

Abstract

A system and method for conducting an inventory of tags, wherein each tag is assigned a Tag ID and a manufacturer number. Each tag can be attached to an item to take inventory of those items. A tag reader transmits a wake-up signal followed by at least one clock signal. Each tag increments a first tag count in response to the clock signals, and transmits the Tag ID assigned to the tag when the first tag count corresponds to the Tag ID assigned to the tag. The tag reader records the transmitted Tag IDs. When more than one tag transmits simultaneously, the tag stores the Tag ID in order to resolve the contention when the first read cycle is complete. In the second read cycle, the tag reader transmits the contended Tag ID followed by at least one clock signal. Each tag that contended for the transmitted Tag ID increments a second tag count in response to the clock signals, and transmits the manufacturer number assigned to the tag when the second tag count corresponds to the manufacturer number assigned to the tag. The tag reader records the transmitted Tag IDs, completing the inventory of the tags.

Assignee: Matrics