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ISO 24535

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Intelligent transport systems — Automatic vehicle identification — Basic electronic registration identification (Basic ERI)

Systèmes intelligents de transport — Identification automatique des véhicules — Identification d'enregistrement électronique de base (ERI de base)

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member 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 shall not be held responsible for identifying any or all such patent rights.

ISO 24535 was prepared by Technical Committee ISO/TC 204, *Intelligent transport systems*.

Introduction

Electronic registration identification (ERI) is used, or can be used, for a number of purposes and with a range of levels of security. This International Standard provides for a basic ERI functionality for the exchange of data between an in-vehicle component containing the ERI data and a reader or writer inside or outside the vehicle. Other International Standards in this family of ERI standards, ISO/TS 24534-4 and ISO/TS 24534-5, are being developed to service a range of ERI requirements. The relationship between the various parts of ISO 25434 and ISO 24535 are shown in Figure 1.

This International Standard defines a “basic ERI” system with security adequate for information that is currently available manually (such as license plate and/or VIN data). This International Standard does not purport to provide the high levels of security, authentication and confidentiality required for some administrative requirements (those requiring high-security fully featured systems are advised to follow ISO/TS 24534-4 or ISO/TS 24534-5).

In its most fundamental form, “basic ERI” simply provides unique vehicle identification. However the “basic ERI” concept allows for the transmission of additional application-relevant data.

Different envisaged applications require some or all of these aspects. Simple registration identification requires a basic communication stack together with moderate levels of security. If there are national security issues or there is personal confidential information stored, the levels of security and encryption need to be more comprehensive.

However, while many applications require an ISO/TS 24534-4 or ISO/TS 24534-5 “fully featured” operational environment, a rapidly emerging, and urgent, need has also been identified within road traffic administrations to provide a simple unique electronic identification of registered vehicles. Such applications may frequently be those where visible information is currently supplied in the form of, for example, the vehicle registration numberplate, VIN number, or a vignette to publicly display registration and compliance with vehicle testing, payment of excise duties, but is not necessarily restricted to those applications. Such applications may not require the levels of security associated with the more demanding requirements envisaged within security, regulatory, enforcement, or anonymous environments.

“Basic ERI” is defined in this International Standard as an electronic system that uniquely identifies a registered vehicle. It incorporates an electronic device that allows the unique, remote and reliable communication of one or more identifying parameters of a vehicle. It typically comprises an in-vehicle data storage element and a vehicle-to-infrastructure data communication element.

“Basic ERI” is a simple means of uniquely identifying road vehicles using a system that can be implemented and deployed at minimum cost. The widespread application of “basic ERI” offers significant benefits over existing manual techniques for vehicle identification. “Basic ERI” addresses the need of authorities and other users for simple electronic identification of roaming vehicles. The identification data always includes a unique vehicle identifier and can also include other data typically found in the vehicle's registration certificate and other data related to specific applications.

“Basic ERI” is an application in its own right, allowing the electronic identification of vehicles. But more importantly, it acts as an enabler, making many other applications more effective through the provision of vehicle identification information. It will contribute to the improvement of road safety and traffic management, reduce crime, and enhance the operational efficiency of public authorities.

Electronic registration identification can also be used in support of vehicle end-of-life mandatory provisions, such as Directive 2000/53/EC of the European Parliament on end-of-life vehicles (ELV directive).

Whilst the requirements for “basic ERI” can be less demanding than those for ISO/TS 24534-4 or ISO/TS 24534-5 “fully featured” ERI, it is important that the basic data concepts utilised are common with those defined in ISO/TS 24534-3. (ISO/TS 24534-4 and ISO/TS 24534-5 are also capable of instantiation in different degrees of capability, and the reader is advised to study all three International Standards to find that most suitable to their needs).

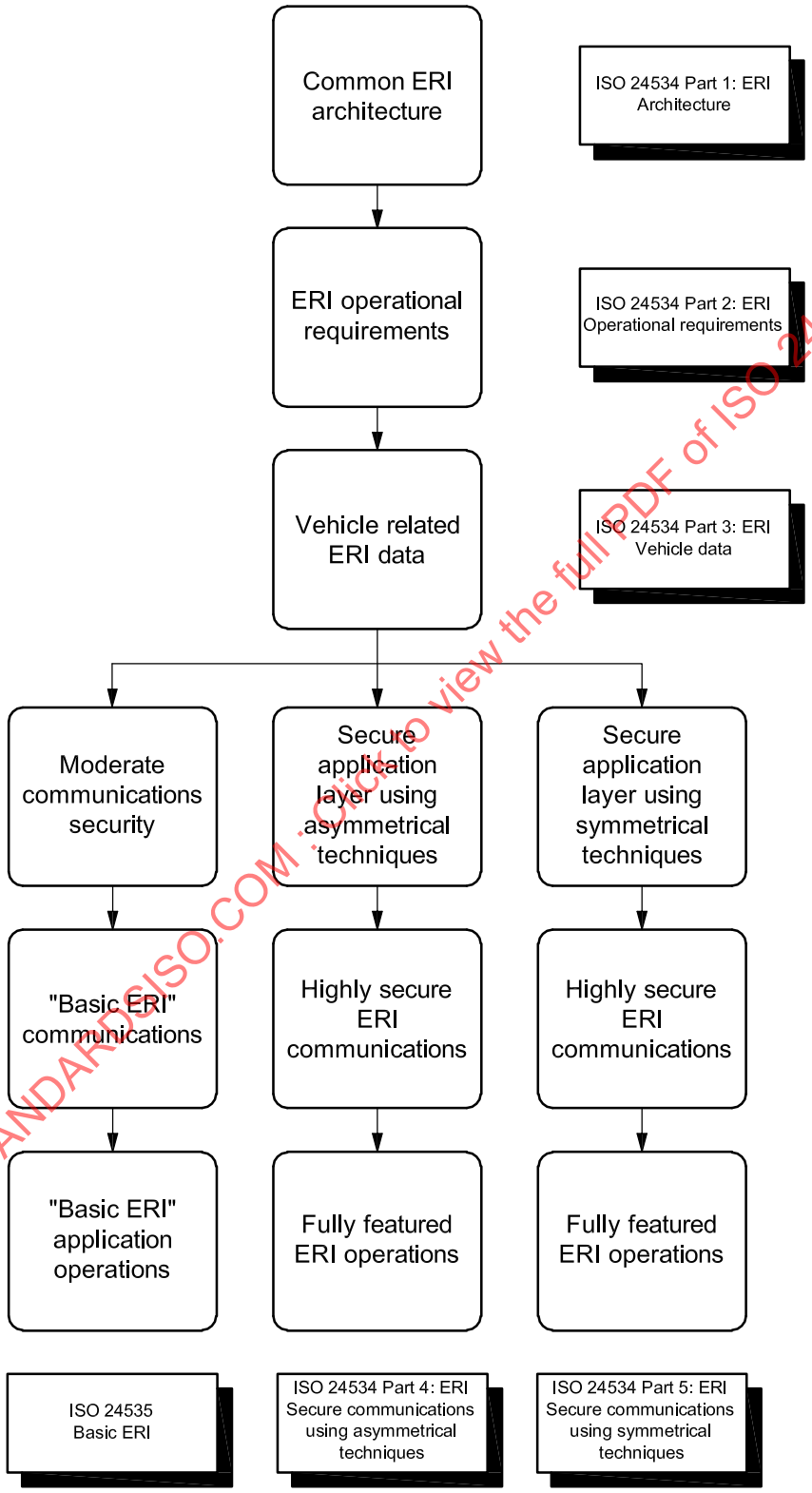

Figure 1 — Functional stack accommodating both “fully featured” and “basic ERI”

Intelligent transport systems — Automatic vehicle identification — Basic electronic registration identification (Basic ERI)

1 Scope

This International Standard supports simple systems for “basic electronic registration identification” (“basic ERI”) for use in intelligent road transport applications.

This International Standard “basic ERI” defines the

— specification of a unique vehicle identifier (using an International Standard, or non-standard, data concept),

— “basic ERI” functional capabilities, selectable for different “basic ERI” applications,

— minimum data interoperability requirements between basic electronic registration tags (ERTs) and electronic registration readers (ERRs).

This International Standard allows, but does not require, vehicle-related data storage in addition to the unique vehicle identifier.

This International Standard is consistent with the ERI architecture defined in ISO/TS 24534-1 and data concepts defined in ISO/TS 24534-3, but is not necessarily interoperable with the more capable and “fully featured” ERI communication systems to be defined in ISO/TS 24534-4 or ISO/TS 24534-5.

This International Standard defines a “basic ERI” system with security adequate for information that is currently available manually (such as license plate and/or VIN data) but it does not purport to provide the high levels of security required for some administrative requirements. Those requiring high security are advised to follow the relevant parts of ISO/TS 24534.

Although not part of this International Standard, the employed technologies supporting this International Standard may enable additional non-standard security measures to be added for specific applications.

NOTE The “basic ERI” system implies the use of a basic ERT. Interrogators may or may not support both ISO/TS 24534-4 or ISO/TS 24534-5 and this International Standard, this being a commercial and not a standardization decision.

It is not the purpose of this International Standard to define “basic ERI” applications.

This International Standard requires the use of an air interface communication that complies with an international, regional, or national standard whose protocols are publicly defined and available in that standard, but this International Standard does not define such an air interface, nor specify which standard air interface is used for any particular implementation.

This International Standard limits its scope to

— the requirement that a standard air interface with publicly available protocols is used,

— the use of data concepts consistent with ISO/TS 24534-3,

— the ability to additionally use private data concepts.

2 Conformance

In order to claim compliance with this International Standard, successful compliance testing shall be certified by an Accredited Independent Testing Body (AIB) approved by the nation state.

Where ERT performance is specified in terms of existing International Standards that contain verification procedures, then those procedures shall be used for verification.

3 Normative references

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

ISO 14815:2005, *Road transport and traffic telematics — Automatic vehicle and equipment identification — System specifications*

ISO 14816:2005, *Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure*

ISO/TS 24534-1, *Automatic vehicle and equipment identification — Electronic Registration Identification (ERI) for vehicles — Part 1: Architecture*

ISO/TS 24534-2, *Automatic vehicle and equipment identification — Electronic Registration Identification (ERI) for vehicles — Part 2: Operational requirements*

ISO/TS 24534-3, *Automatic vehicle and equipment identification — Electronic Registration Identification (ERI) for vehicles — Part 3: Vehicle data*

ISO/TS 24534-4, *Automatic vehicle and equipment identification — Electronic Registration Identification (ERI) for vehicles — Part 4: Secure communications using asymmetrical techniques*

ISO/TS 24534-5, *Automatic vehicle and equipment identification — Electronic Registration Identification (ERI) for vehicles — Part 5: Secure communications using symmetrical techniques*

ISO/IEC 8825-2, *Information technology — ASN.1 encoding rules — Part 2: Specification of Packed Encoding Rules (PER)*

IEC 60215, *Safety requirements for radio transmitting equipment*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measurement techniques — Electrostatic discharge immunity test*

EN 300 220-1, *Electromagnetic compatibility and radio spectrum matters (ERM) — Short range devices (SRD) — Technical characteristics and test methods for radio equipment to be used in the 25 MHz to 1 000 MHz frequency range with power levels ranging up to 500 mW — Part 1: Parameters intended for regulatory 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 — Part 3: Harmonized EN covering essential requirements under article 3.2 of the R&TTE directive*

EN 301 489-1, *Radio equipment and services — EMC — Part 1: Common technical requirements*

EN 301 489-3, *Radio equipment and services — EMC — Part 3: Specific conditions for short range devices (SRD) operating on frequencies between 9 kHz and 40 GHz*

ARIB T75, *Dedicated short-range communication system*, Association of Radio Industries and Businesses (ARIB), Japan

FCC Part 15, *Unlicensed RF devices*, USA Federal Communications Commission

4 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

4.1
authentication
assurance by interactive electronic means of device authenticity between communication partners

4.2
basic ERI system
system providing unique identification of a vehicle by wireless communications between an electronic registration tag carried on a vehicle and an electronic registration reader that can fulfil the requirements defined in this International Standard

4.3
basic ERR
electronic registration reader or interrogator that can fulfil the requirements defined in this International Standard

4.4
basic ERT
electronic registration tag that can fulfil the requirements defined in this International Standard

4.5
electronic registration identification
ERI
unique identification of a vehicle by wireless communications between an electronic registration tag carried on a vehicle and an electronic registration reader

4.6
electronic registration reader
ERR
device used to read data by wireless communications from the electronic registration tag

4.7
electronic registration tag
ERT
on-board ERI device that contains the ERI data, including the relevant implemented security provisions and one or more interfaces to access that data

4.8
fully featured ERI system
system providing unique identification of a vehicle by wireless communications between an electronic registration tag carried on a vehicle and an electronic registration reader, and supporting features for a number of purposes and with a minimal to high level of security

4.9
Interrogator
device that can instigate and conduct a read-or-write transaction with a tag via the chosen air interface

4.10
reader
device that can instigate and conduct a read transaction with a tag via the chosen air interface, but that does not have the capability of changing data held in the memory of the tag

cf. **interrogator** (4.9)

4.11
registration authority
⟨ERI data⟩ organization responsible for writing the (additional) ERI data and security data into an ERT according to local legislation

4.12
registration procedure
procedure for registration as defined in ISO/TS 24534-3

4.13
service level
service features provided to support the ERI transaction

NOTE Different levels of service are provided within this International Standard.

5 Abbreviated terms

AIB	Accredited Independent (testing) Body
CEN	Comité European de Normalisation
CHAP	Challenge Handshake Authentication Protocol
ELV	End Life Vehicle (European Directive)
ERI	Electronic Registration Identification
ERR	Electronic Registration Reader
ERT	Electronic Registration Tag
ETSI	European Telecommunications Standards Institute
FCC	Federal Communications Commission (USA)
PKI	Public Key Infrastructure
RFID	Radio Frequency IDentification
SSH	Secure Shell (protocol)
VIN	Vehicle Identification Number

6 System concept

Studies have addressed the potential benefits that can arise following the widespread deployment of ERI systems. These potential benefits may include detection of non-compliance, confirmation of testing of safety and roadworthiness of vehicles and operating regulations, etc., and improved consumer protection and enforcement.

ISO/TS 24534 (all parts) and ISO 24535 provide a complementary family of documents to enable such benefits to be achieved. The principles and specifications defined in ISO/TS 24534-1 and ISO/TS 24534-3 to ISO/TS 24534-5 are common to this International Standard.

The system concept for ERI is defined in ISO/TS 24534-1, which describes a transaction between an interrogator/reader and an ERT device located on a vehicle, using a standardized air interface to obtain or write ERI data. The system concept for this International Standard provides for “basic ERI” transactions that do not require some of the more complex provisions of ISO/TS 24534-4 or ISO/TS 24534-5.

7 Requirements

7.1 Environmental conditions

The “basic ERT” shall comply with the environmental conditions for class H1 and H2 equipment as specified in 5.10.2 of ISO 14815:2005.

In order to claim compliance with this International Standard, any “basic ERI” device shall be operable within all of the climatic conditions defined in the air interface International Standard(s) and any associated conformance and performance International Standards. Equipment that cannot meet the full climatic condition requirements of the declared class of such International Standards shall not be considered compliant.

The “basic ERT” shall operate reliably in an environment with electromagnetic field disturbance within the limits specified in IEC 61000-4-2 and in EN 301 489.

7.2 Safety requirements

The “basic ERT” shall not obstruct the view of the driver.

The “basic ERT” shall not distract the attention of the driver.

Identification of a vehicle shall not require any human intervention in the vehicle.

The “basic ERT” shall not constitute a danger for human beings inside or outside of the vehicle.

The “basic ERT” shall not constitute a danger for the proper operation of any other systems inside or outside the vehicle.

The electromagnetic fields produced by any onboard ERI equipment shall be within the limits specified in IEC 60215 and/or EN 301 489

7.3 Installation

The “basic ERT” shall be affixed to the front windscreen of the vehicle or embedded within the license plate of the vehicle.

7.3.1 License plate installation

A “basic ERT” equipped license plate shall be installed within the confines of the location determined by local regulations of the vehicle registration authority.

7.3.2 Windscreen installation

The “basic ERT” shall be located in the vehicle’s forward windscreen, with the edge nearest the windscreen boundary located no closer than 2 cm to any metallic materials at the periphery. If a conductive material is applied to or embedded in portions of the windscreen, the basic ERT shall be located in a region where the conductive material is absent.

7.4 Operational parameters

The operational and functional requirements for the ERR/ERT transaction are principally defined in the relevant air interface International Standard with which they comply. The operational parameters defined in this International Standard are additional operational parameter requirements required for the “basic ERI” application.

7.4.1 Basic ERT operating life

A “basic ERT” shall be capable of operating without maintenance for a minimum of

— Class 1: 10 years,

— Class 2: 5 years,

when operating at temperatures below 70 °C.

NOTE It is recognized that in situations where the operating temperatures frequently exceed 70 °C, this will result in shorter life of the basic ERT.

7.4.2 Basic ERT read/write capabilities

A “basic ERT” having read/write capabilities shall, with exception of the unique vehicle identifier or any permanently locked data, be capable of successfully changing data in the memory a minimum of 100 000 times.

7.4.3 Basic ERR read requirements — Distance

A “basic ERR” shall be capable of reading the unique vehicle identifier from a “basic ERT” passing within a range of 4 m from the “basic ERI” reader antenna.

7.4.4 Basic ERR read requirements — Speed

A “basic ERR” shall be capable of reading the unique vehicle identifier from a “basic ERT” passing at speeds up to 160 $km \cdot h^{-1}$.

7.4.5 Authentication

Transactions between interrogators/readers and tags shall comply with the authentication requirements of any air interface International Standard that they are using.

Where tag data is being read, the reader/interrogator shall additionally be capable of one of the classes of entity authentication defined in this subclause.

While there is *no requirement* for tags to use mutual authentication, if mutual authentication is used, then there is a requirement to use a recognized authentication protocol and the authentication method shall be declared and defined in any system specification in such a way that it can be used by multiple vendors.

There are several methods used in mutual authentication. They have different levels of security and require different levels of functionality/complexity. Authentication shall conform to one of the following, representing different levels of security:

— Class 1: no mutual authentication;

— Class 2: Challenge Handshake Authentication Protocol (CHAP);

For CHAP, the authentication agent (interrogator) sends the client (tag) a random value that is used only once and an ID value. Both the sender and client share a predefined secret. The client tag concatenates the random value, the ID and the secret and calculates a one-way hash function, meaning that it takes a message and converts it into a fixed string of digits. The hash value is sent to the authenticator, which in turn builds that same string on its side, calculates the hash sum itself and compares the result with the value received from the peer. If the values match, the peer is authenticated.

— Class 3: Public Key Infrastructure (PKI) such as Secure Shell protocol (SSH);

For a Public Key Infrastructure (PKI) such as Secure Shell protocol (SSH), a “keystore” holds key entries, each of which is an entity's (tag) identity and its private key used to identify oneself to a server (interrogator) as a trusted client, and a “truststore” holds trusted certificate entries, each of which is an entity's (tag) identity and its public key, which are used to identify trusted servers (interrogators). To assure mutual authentication, the client (tag) generates a certificate, and stores a version of the certificate containing his identity and *private* key in his keystore. The client (tag) also generates a version containing his identity and *public* key, which the server (interrogator) must store in its truststore. There are other more sophisticated PKI methods of mutual authentication.

7.4.6 Tamper-evident feature

A “basic ERT” shall display visual evidence where the “basic ERT” has been physically tampered with and may be compromised.

NOTE This subclause specifies a requirement for a tamper-evident feature (visual evidence of any tampering). Provisions for electronic notification of an attempt to tamper (optional) are given in Clause 8.

7.4.7 Destruct on removal

A “basic ERT” shall be rendered permanently inoperable upon removal from its installed position.

7.5 System requirements

Different applications may have different requirements for “basic ERI”. ISO/TS 24534-3 provides definitions for a comprehensive range of ERI data. The scope of this International Standard is limited to providing identification of a registered vehicle using a Standard air interface (“basic ERI”). Any additional vehicle data shall be in accordance with the provisions of ISO/TS 24534-3. Other additional data may be carried but is not standardized in this International Standard.

7.5.1 Service level variants

Three service level variants are identified:

a) ID only — Read only

This is the simplest version of “basic ERI”. The unique vehicle identifier is written only once and no other information can be added to the “basic ERT”. A “basic ERI” reader can then only read the unique vehicle identifier from the vehicle’s “basic ERT”.

A checksum as defined in 7.5.2 shall be used.

Once written, the unique vehicle identifier shall be permanently locked/rendered incapable of further change. A “basic ERI” reader or interrogator shall be able to read this ID, but never be able to change it.

b) Read only with optional additional ERI data

In addition to a read-only identity, the “basic ERT” may also contain optional additional “basic ERI” data. However, all data can only be written once in the lifetime of a “basic ERT”. A checksum as defined in 7.5.2 or other validation value may additionally be carried.

c) Read/write

The “basic ERT” contains the unique vehicle identifier (which is locked in the memory and cannot be modified) plus optional additional application related data. This optional additional data can be updated, if required, via the air interface, in accordance with the writing operations defined in the standardized air interface protocols that it is using. A checksum as defined in 7.5.2 or other validation value may additionally be carried.

7.5.2 Checksum

A checksum shall be used. This shall be the checksum specified in the relevant air interface International Standard or, in the event that the air interface International Standard does not require/does not specify the use of a checksum, a modulus 11 checksum, calculated as below, shall be used.

Multiply all nine assigned digits by weighted values. The weighted values are 1 for the first digit from the left, 2 for the second digit, 3 for third digit, etc. For example:

$$1*0 + 2*1 + 3*3 + 4*1 + 5*9 + 6*0 + 7*1 + 8*9 + 9*0 = 139$$

$$139 \equiv 7 \pmod{11}$$

7.6 Data requirements

The only data element required for compliance with this International Standard is a unique vehicle identifier as defined in ISO/TS 24534-3. Additional vehicle data is defined in ISO/TS 24534-3. However, if the “basic ERT” device supports additional data, then such other additional data is permitted but the form of such data is not prescribed by this International Standard. All data shall be encoded using ASN.1 PER encoding rules in accordance with ISO/IEC 8825-2.

7.7 Vehicle identifier

7.7.1 General

Where available, the VIN is the preferred vehicle identifier and shall be represented as defined in ISO 24534-3.

The choice of which alternative to use is outside the scope of this International Standard. It may, for example, depend on local legislation.

7.7.2 Vehicle ID type VIN

The value shall be the value of the VIN as defined in ISO 24534-3.

7.7.3 Non-VIN vehicle ID type

If a fully compatible VIN is not available, the VIN alternative shall be as defined in ISO 24534-3.

7.7.4 Registration procedures

Registration procedures shall be in accordance with the procedures defined in ISO 14816.

7.8 Technology

7.8.1 General

To achieve interoperability, it is necessary for all components of a “basic ERI” system to utilize compatible technology. However it is recognized that several demonstrated technologies can achieve the requirements of ERI applications.