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Road transport and traffic telematics — Automatic vehicle and equipment identification — System specifications

Télématique de la circulation et du transport routier — Identification automatique des véhicules et équipements — Spécification des systèmes

Reference number
ISO 14815:2005(E)

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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 14815 was prepared by the European Committee for Standardization (CEN) Technical Committee CEN/TC 278, *Road transport and traffic telematics*, in collaboration with Technical Committee ISO/TC 204, *Intelligent transport systems*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition cancels and replaces ISO/TS 14815:2000, which has been technically revised.

Introduction

System specification

This International Standard is designed to enable users and suppliers of AVI/AEI systems to specify system specification that will enable a nominal interoperability based on a DSRC link.

The terms “AVI” and “AEI” are used both to describe “independently functioning AVI/AEI systems” and as “the function of identification within other RTTT/TICS systems”. This International Standard supports both such uses where no other application or sector standard applies.

Whilst it may be desirable to determine a single set of requirements for operation in all environments and under all operating conditions, this could impose unacceptable costs.

This International Standard therefore provides standard “classes” for different aspects of system specification, such that a system specifier may select the appropriate performance parameters to meet a particular requirement. Supporting informative annexes also provide a number of general use “categories” which may be used to specify the environmental and operating parameters to support interoperable applications.

The architecture descriptions provided in this International Standard are in compliance with the guidelines provided by CEN/TC 278 WG13 ISO/TC 204 WG1.

For the data structure elements, Abstract Syntax Notation One (ASN.1) Packed Encoding Rules (PER) (ISO 8825-2) are used. This usage provides maximum interoperability and conformance to existing standards.

For detailed information on the use of ASN.1 PER for AVI/AEI applications, reference is made to ISO 14816.

This International Standard provides classification procedures and details test requirements needed to support system definition. These requirements are, wherever possible, determined by reference to existing standards and established practices.

Test requirements

Test requirements are determined for AVI/AEI system components. The requirements to meet this International Standard encompass general performance measurement, operational, and environmental aspects.

How to use this International Standard

It is also an objective to provide users with different applications and in different environmental circumstances a useful tool that is flexible enough to serve the various different needs. The categorization and classification system in this International Standard provides for this.

A brief guide showing how to use this International Standard is provided at the end of Annex A.

Road transport and traffic telematics — Automatic vehicle and equipment identification — System specifications

1 Scope

This International Standard defines a generic AVI/AEI System specification for nominal AVI/AEI to provide an *enabling* International Standard, which, whilst allowing the system specifier to determine the performance levels and operating conditions, provides a framework for nominal interoperability.

Within the road context of the Transport and Traffic Telematics Sector, AVI and AEI systems have the specific objective of achieving a unique or unambiguous positive identification of a vehicle or item of equipment, and to make that identification automatically.

Whilst AVI may also be seen as an essential component of some applications, the particular needs of such systems are outside the scope of this International Standard. As far as is possible, care is still taken to provide a useful tool for such applications.

This International Standard only refers to AVI/AEI in the road environment. Multimodal and intermodal exchanges of AVI/AEI are outside the scope of this International Standard.

Where AVI/AEI applications are part of a larger system, and where no standardized application-specific test requirements exist, these test requirements apply.

Anonymity and privacy issues are discussed in ISO 14816, and are not handled in this International Standard.

This International Standard is designed for system specification that will enable a nominal interoperability based on a DSRC link. AVI/AEI systems that are relying on other link types are outside the scope of this International Standard for those parameters where the link type influences parameters.

The scope of this International Standard is confined to generic AVI/AEI system specification for systems that have the following “core” components:

— A means of communication between the vehicle/equipment and the reading station (e.g. a DSRC link);

— operation within a reference architecture which enables compatible systems to read and interpret the identification (See ISO TR 14814);

— compliance to commonly understood data structures that enable meaningful interpretation of the data exchanged in the identification sequence (See ISO 14816);

— the provision of operating and environmental parameters (or classes of operating parameters) within which such systems must successfully function without impairing interoperability. This is to ensure that the system specifier can state his requirements clearly to Implementation Designers and Integrators, and measure the performance of such systems (covered in this International Standard).

2 Normative references

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

ISO 7637-1:1990, *Road vehicles — Electrical disturbance by conduction and coupling — Part 1: Passenger cars and light commercial vehicles with nominal 12 V supply voltage — Electrical transient conduction along supply lines only*

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

ISO/TR 14814[1)], *Road transport and traffic telematics — Automatic vehicle and equipment identification — Reference architecture and terminology*

ISO 14816[1)], *Road transport and traffic telematics — Automatic vehicle and equipment identification — Numbering and data structure*

ENV 12795, *Road Transport and Traffic Telematics (RTTT) — Dedicated Short-Range Communication (DSRC) — DSRC Data Link Layer: Medium Access and Logical Link Control*

IEC 68-1:1987, *Basic Environmental Testing Procedures — Part 1: General and Guidance*

IEC 68-4:1987, *Environmental testing — Part 4: Information for specification writers — Test summaries*

IEC 215:1987, *Safety requirements for radio transmitting equipment* (EN 60215)

IEC 721-3-4:1988, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Stationary use at non-weather protected locations*

IEC 721-3-5:1988, *Classification of environmental conditions — Part 3: Classification of groups of environmental parameters and their severities — Ground vehicle installations*

IEC 801-2:1984, *Electromagnetic compatibility for industrial-process measurement and control equipment*

IEC 1000-4-6, *Electromagnetic compatibility (EMC) — Part 4: Testing and measuring techniques — Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*

CEPT/ERC T/R 22/04:1991, *Harmonisation of Frequency Bands for Road Transport Information Systems*

3 Compliance

In order to claim compliance with this International Standard, a supplier shall provide, for each physically separated component, detail of the classification of its product for all relevant (environmental and operational) parameters determined within this International Standard.

4 Terms and definitions

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

4.1
AVI/AEI system
AVI/AEI application in an RTTT system, either as a stand-alone system or as part of an RTTT application

1) To be published.

4.2
bi-directional monologue
"read only" functionality with a start signal from the FE side

4.3
category
groupings of common class requirements to support interoperability between AVI/AEI systems of common purpose (e.g. a "ruggedized" category versus a "standard" category)

4.4
class
differentiation between system components with different "grades" of requirements for parameters (e.g. class 1 for "extreme" operational and environmental requirements)

4.5
environmental parameters
describe different environmental component properties/specifications

4.6
extreme
refers to class 1 requirements for the "ruggedized" system category "A"

4.7
Fixed Equipment (FE)
equipment required to interrogate, receive and interpret the data in the On-Board Equipment (OBE) in order to present the identification

4.8
lifetime
period of time during which an item of equipment exists and functions according to the relevant requirements of this International Standard

4.9
maintainability
ability to keep in a condition of good repair or efficiency

4.10
Mean Time to Failure
average time that a system functions before first failure

4.11
Mean Time between Failures
mean cycle (one failure and one repair) time of a maintained system

4.12
Nominal Interoperability
"Application Area Interoperability" in a region spanning two or more areas with cross-border operation between operator domains, districts or nations, the capability for a nominal AVI/AEI system FE to operate with a nominal AVI/AEI system OBE

4.13
normal
class 2 requirements for the "standard" system category "B"

4.14
On-Board Equipment (OBE)
equipment fitted to the vehicle or item to be identified and containing the unique or unambiguous positive identification

4.15
operational parameters
different operational component properties/specifications

4.16
physical architecture
physical configuration and physical interconnection of equipment to achieve its function (not the equipment itself)

4.17
selected
class 1-6 requirements for the system categories “3 - 6”

4.18
shadowing
condition where the close proximity of a vehicle/equipment interposed between FE and OBE obscures the signals, thus preventing a successful AVI/AEI transaction

NOTE The shadowing caused by normal traffic behaviour is taken into account and overcome to provide a successful transaction. Abnormal shadowing may be caused by large or unusually shaped vehicles/equipment or by vehicles travelling too closely together.

4.19
(AVI/AEI) transaction
completed cycle of communication (across the air interface at reference point delta) wherein a message identifying a vehicle or item of equipment is successfully received and understood by the receiver during one passage through the read zone

NOTE The number of attempts, retries and repeats is not relevant, it is only that one fully completed identification process communication cycle is successfully completed to the extent that no communications error could be detected.

5 Abbreviations

The following abbreviations are used in this International Standard:

AEI	**A**utomatic **E**quipment **I**dentification
AIB	**A**ccredited, **I**ndependent, Testing **B**ody
ASN.1	**A**bstract **S**yntax **N**otation One
AVI	**A**utomatic **V**ehicle **I**dentification
CEPT	**C**omité **E**uropéenne de **P**ostes et **T**elecommunication (Fr.) European Committee for Post and Telecommunication
DSRC	**D**edicated **S**hort **R**ange **C**ommunication
DUT	**D**evice **U**nder **T**est
FE	**F**ixed **E**quipment
MTBF	**M**ean **T**ime **B**etween **F**ailures
OBE	**O**n-**B**oard **E**quipment
OSI	**O**pen **S**ystems **I**nterconnection
RTTT	**R**oad **T**ransport and **T**raffic **T**elematics (CEN/TC 278)
TICS	**T**ransport **I**nformation and **C**ontrol **S**ystems (ISO/TC 204)

The following abbreviations are used to designate the IEC 721 — Environmental classes:

B Biological

C Chemical substances

F Contaminating fluids

K Climatic

M Mechanical

S Mechanical substances

Z Special climatic conditions

6 Requirements

6.1 Generic system specification for AVI/AEI systems

This clause summarizes the generic system specification for AVI/AEI systems in terms of functions supported, data exchanges, categorization and classification. The requirements defined in this clause:

— provide operation within the reference architecture defined in ISO/TR 14814,

— allocate application data in accordance with ENV ISO 14816, and

— enable nominal interoperability.

To obtain interoperability, it is a requirement that nominal AVI/AEI system FE shall have the capability to operate with nominal AVI/AEI system OBE, albeit of different capability using an air interface as referenced in 6.5.

However, the environmental and operating conditions within which such equipment has to function may be different according to geographical location, traffic operating conditions, etc. This International Standard provides environmental/operational classes grouped into categories to enable the marketplace to decide the most appropriate FE for individual fixed locations. This is with the knowledge that, within the operating/environmental constraints selected, any properly configured standard compliant AVI/AEI system OBE shall have the capability to be identified by all standard compliant AVI/AEI system FE.

To obtain nominal AVI/AEI system interoperability, it is a requirement that OBEs shall have the capability to operate with nominal AVI/AEI system FE.

However, the environmental and operating conditions within which on-board equipment has to function may be different according to geographical location, vehicle or equipment type, OBE location, etc. This International Standard provides options and environmental/operational classes to enable the marketplace to select the most appropriate OBE equipment, with the knowledge that, within the operating/environmental constraints selected, any properly configured standard compliant AVI/AEI system FE shall have the capability to identify all standard compliant AVI/AEI OBEs passing within its compass.

These generic system specifications provide a migration path to later generations of equipment and to equipment of greater capability.

In order to enable an AVI/AEI system to operate across wide areas, it is necessary for the system to use the standardized interfaces architecture and data structures normalized in this family of AVI/AEI European Standards. As particular system specifications will vary, well-declared and flexible structures are used. It is important, for example, that AVI/AEI system FE facilities can effectively operate different variants of OBE. The system specification defined in this International Standard supports the numbering schemes and data structuring defined in ISO 14816.

6.2 System specification: architecture

It is the ***Vision*** of the AVI/AEI system specification International Standard to:

"provide a method (trans-national and interoperable) of automatically identifying a vehicle or item of equipment using a standard DSRC link."

Other subsequent standards may determine requirements for AVI/AEI systems working at other air interfaces.

It is the ***Mission*** of the AVI/AEI system specification International Standard to:

"Define the functionality, environmental and operating parameters (system specification for AVI/AEI) such that they may achieve the objectives of the Vision Statement in an Open Systems Environment, enabling interoperability, whilst retaining the ability for different equipment to coexist."

According to the operational situation, AVI/AEI systems may be viewed either as a service to support an application (such as the vehicle identification component in a public transport system or freight management system), or as an application in itself (for example, the identification of a "probe" vehicle in a traffic management situation or in an enforcement situation). As such, the AVI/AEI system function may be achieved using purpose-specific dedicated equipment (such as an AVI/AEI system transponder), or may be achieved using equipment installed for the application that it supports, or indeed, using existing equipment installed for another application (such as a freight logistics system utilizing AVI techniques). Such multi-application support and interoperability will be particularly common in respect of the OBE, although it will also be required in respect of the FE.

6.2.1 Conceptual architecture

See ISO/TR 14814.

6.2.2 Logical architecture

See ISO/TR 14814.

6.2.3 Functional architecture

See ISO/TR 14814.

6.2.4 Control architecture

See ISO/TR 14814.

6.2.5 Identification principles

This International Standard adheres to the Open Systems Interconnection (OSI) philosophy, i.e. the definition is concerned with the exchange of information between systems and not the internal functioning of each individual system component.

In order to cooperate, entities in any OSI layer, other than the lowest layer, communicate by means of the set of services provided by the next lower OSI layer.

This International Standard references the series of International Standards developed by CEN/TC 278/WG9.

The work of ISO/TC 204, especially WG1/SG3, is taken into account as far as possible, as are other existing relevant definitions of data elements [such as the "Data elements to be used in surface transport applications of machine readable cards" (CEN/TC 224/WG11)].

Where the RTTT/TICS system service has to support devices in an interoperable environment, it is essential that the devices be capable of “upwards migration”, either to accommodate different types of devices in the emerging specifications, or as new generations of systems are developed.

6.2.6 Information architecture

See ISO/TR 14814 and ISO 14816.

6.2.7 Physical (application) architecture

This clause describes the physical configuration and physical interconnection of equipment to achieve its function (not the equipment itself).

The physical architecture shall be as defined in 4.5 of ISO/TR 14814.

The following clauses provide a summary of the application architecture.

In the majority of situations, the objective of the AVI/AEI system function is to uniquely identify vehicles or equipment. 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, or another moving vehicle or equipment).

In some cases, it is necessary to protect the identity of a vehicle or equipment for reasons of privacy or security. In these cases, the AVI/AEI system shall provide an alias or temporary unambiguous identification that does not necessarily provide the permanent identification of the vehicle or equipment. (It may, for example, identify a smart card temporarily located in an on-board unit.) Such identifications are supported within this International Standard.

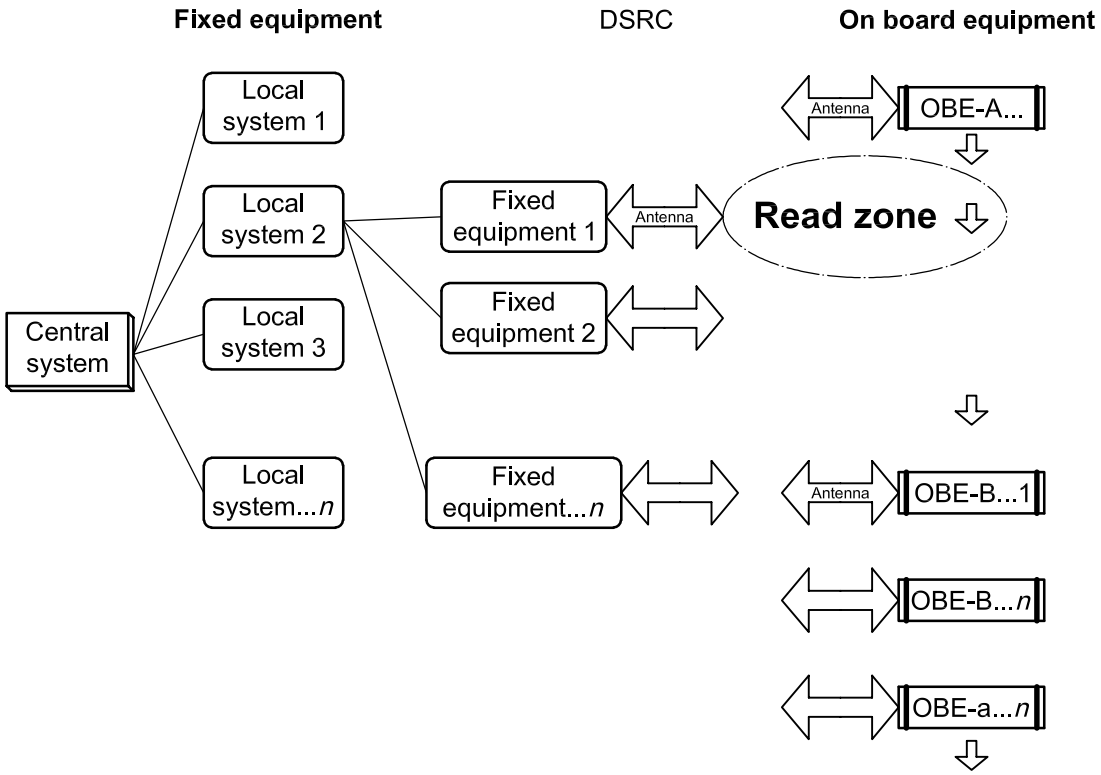

Figure 1 — Example of physical architecture model

The example in Figure 1 shows one central FE system with a number of local FE systems. Each local system may have one or multiple FE connections. The example also shows OBE of two different types, without indication of the exact number of each.

The AVI/AEI system may be a stand-alone function using dedicated equipment, or may be an application service within a more complex service (such as fee collection, route guidance, fleet management, etc.) achieved using the equipment provided for that service. The FE used may provide the functions of more than one service, or indeed the function may be performed by a combination of equipment (such as an interrogator plus an antenna).

The general application configuration shall be comprised of FE and OBE (OBE), making use of the DSRC to communicate.

The FE shall utilize an antenna targeted on the identification zone. The FE shall normally, but not necessarily, be connected to either a local and/or a central computer system.

The OBE shall utilize an antenna located such that it will pass through the identification zone.

As the OBE passes through the Identification Zone, communication shall be effected using a DSRC link (see 5.5). All AVI/AEI system application-specific data shall be comprised of one or more numbering scheme(s) determined in ISO 14816, or a “private” class data construct supported within that International Standard.

The AVI/AEI system identification component specified within this International Standard may be described as a “bi-directional monologue” — bi-directional in that there shall be a communication phase where contact is established with the OBE and the OBE responds, a monologue in that the AVE/AEI identification is a data structure (or group of data structures) sent from the OBE to the FE.

Additional bi-directional data exchanges are permissible (and indeed are essential to support many application services) but are outside the domain of this International Standard. Other standards for the sector shall prescribe the form of these data exchanges.

An AVI/AEI system identification, or AVI/AEI system component of a more complex RTTT/TICS identification, shall only be regarded as a standard-compliant identification if it complies with the system specification determined in this International Standard. In order to ensure interoperability within the sector, no form of AVI/AEI system, other than that determined in this International Standard (and in the related International Standards ISO/TR 14814 and ISO 14816), may claim to be compliant with CEN TC 278 RTTT standards for AVI/AEI systems or ISO/TC 204 TICS International Standards for AVI/AEI systems.

6.2.8 Deployment (implementation) design

The deployment architecture for AVI/AEI systems is not considered appropriate for standardization.

6.3 Specific system specification for stand-alone AVI/AEI systems

This clause defines the specific data exchange operation to achieve the AVI/AEI transaction.

The AVI/AEI transaction is an essentially simple bi-directional monologue transaction in which the FE requests the data from the OBE and the OBE provides its data.

The data shall comprise one or more standardized data constructs as defined in ISO 14816.

The transaction shall conform to any relevant CEN or ISO system specification standard for AVI/AEI. The clause below defines the description method used in describing the specific system specification for an AVI/AEI transaction.

6.3.1 GET function

The principal function to support access to the AVI/AEI data structures (defined in ISO 14816) is:

GET

NOTE This is the only standardized function required to perform AVI/AEI.

GET is an AVI/AEI system function used to initiate a read operation of AVI/AEI system information, i.e. AVI/AEI system application data.

Usage: **GET** (⟨ASN.1DataStructureIdentifier⟩, Data)

6.3.2 Further (optional) functions

Some AVI/AEI systems may additionally provide further functions. The following functions are not mandatory, but if present shall conform to the following general form and to the definition as specified in any CEN/ISO AVI/AEI standard. This function requires a full bi-directional link.

6.3.2.1 SET

SET is an AVI/AEI system function used to put data into the memory of on-board equipment (OBE).

Usage: **SET**(⟨ASN.1 DataStructureIdentifier⟩.[DataElementIdentifier], data to be written,[⟨location⟩]).

6.4 Specific system specification for the AVI/AEI system function incorporated into other systems

The AVI/AEI system may be used as an identification element within another application (e.g. fleet management, parking management, etc.).

Where an application requires simply an AVI/AEI system identification transaction, it shall use the method defined in 6.3. above. In cases where there is an application-defined transaction using a standardized DSRC interface, this International Standard does not apply.

6.5 Air interface aspects

This International Standard assumes the provision of adequate DSRC interface European Standards provided by ETSI (EN 300 674) and CEN (EN 12253, 12795, 12834). The provisions and determinations specified within this International Standard assume a DSRC link at 5,795-5,805 GHz as recommended by CEPT/ERC 22/04 or other frequencies as may be specified in such ETSI and CEN Standards.

NOTE 1 Whilst many of the system specifications determined in this International Standard may be applicable regardless of the frequency, it will be necessary to reconsider each of the provisions of this International Standard in situations where new frequency ranges are to be used. Where appropriate, new standards may need to be developed for specific frequency ranges.

NOTE 2 For ISO parallel voting, the relevant ITU reference will replace or be added to this clause as soon as available.

6.6 Operating parameters

6.6.1 AVI/AEI system operating parameters

In order to claim compliance, a declaration for all tables and table combinations shall be made. Omission of declaration of any one table or any table combination in this section shall constitute non-conformance to the International Standard.

Where speed is claimed, the maximum number of transponders in zone shall be declared; where life of transponders is claimed, the number of reads per period shall be declared.

6.6.1.1 Reliability, availability, lifetime and maintainability

The operational requirements for reliability, availability, lifetime and maintainability on the AVI/AEI system level are formulated qualitatively, not quantitatively.

6.6.1.1.1 Reliability

This clause relates to the reliability requirements between reference points alpha and delta determined in ISO/TR 14814.

In order to be considered reliable, a compliant AVI/AEI system shall deliver a declared maximum of undetected erroneous identification results under nominal operational conditions at reference point beta.

6.6.1.1.2 Maintainability

The FE shall be designed to facilitate maintenance.

The OBE (excluding exchangeable batteries or external power source) shall not require maintenance.

6.6.1.1.3 Minimum number of identifications per year for the OBE

Table 1 — Identification per year for OBE

Class	Identifications per year
A1	20 000
A2	10 000
A3	4 000
A4	2 000

Where an internal battery is used in the OBE, Class A is to be considered in conjunction with Class B below. In order to claim compliance with a particular “Class A” classification, the OBE shall also meet the claimed OBE lifetime classification.

6.6.1.1.4 Lifetime of OBE

The minimum lifetime of the OBE shall be as determined in Table 2.

Table 2 — Minimum lifetime of OBE

Class	OBE lifetime
B1	15 years
B2	10 years
B3	5 years
B4	3 years
B5	2 years
B6	1 year
B7	6 months
B8	3 months
B9	1 month

In the case of using an exchangeable battery in the OBEs, the lifetime of the battery shall be as determined in Table 3.

Table 3 — OBE battery lifetime

Class	Battery lifetime*
BB1	15 years
BB2	10 years
BB3	5 years
BB4	3 years
BB5	2 years
BB6	1 year
BB7	6 months
BB8	3 months
BB9	1 month

*Based on 500 transactions per month.

6.6.1.1.5 Distance between FE and OBE antennas

Table 4 — Distance between FE and OBE antennas

Class	Reading distance test points
C1	20 m
C2	10 m
C3	6 m
C4	3 m
C5	1 m
C6	0,5 m

To achieve Class C1, it shall read at all test point, Class C2, all test points up to 10 m, etc.

Where ETSI Standard I-ETS 300 674 applies, distance shall be measured according to power levels as defined by ETSI Standard I-ETS 300 674. The power class, where applicable, shall be documented (e.g. Class C1/1, Class C1/2, etc). Applicable ETSI power classes shall not be exceeded.

6.6.1.2 OBE Installation

The technology adopted for an AVI/AEI system shall not preclude OBEs that can be installed by the user without any aid from any expert.

Installation is to be effected according to an approved, documented procedure provided by the manufacturer.

When being fitted to a vehicle, the equipment and the whole installation must comply with the provisions relating to maximum tolerances laid down by the manufacturer's specifications.

The equipment shall be immune to damage caused by the normal handling, connection and disconnection that are necessary for installation and maintenance activities.

This shall not preclude OBEs which are specifically designed to cease functioning upon removal or tampering.

6.6.1.3 Electromagnetic disturbance

The AVI/AEI system shall be able to perform identifications in an environment with electromagnetic disturbance in accordance with IEC 801 and EN 50081. For the radio link, part I, ETS 300 674 applies.

6.6.1.4 Emissions

The electric or magnetic fields produced by the AVI/AEI system shall not exceed the levels as specified in IEC 215 (EN 60215). This clause applies to both FE and OBE. For the radio link, part I, ETS 300 674 applies.

EXAMPLE IEC 215 (EN 60215) requires that the transmitted electric and magnetic fields shall not exceed 200 V/m or 0,5 A/m, respectively over the frequency range 30 MHz to 30 GHz. This approximately corresponds to a radiation power density of 100 W/m^2 (10 mW/cm^2) and applies to distance greater than 5 cm from accessible surfaces of the equipment.

NOTE For the ISO parallel voting, the relevant ITU reference will replace or be added to this clause as soon as available.

6.6.2 AVI/AEI system-specific operating parameters

Due to the variations in size and loading configurations of items of equipment that may be encountered in an RTTT/TICS environment, references to distance detailed in this clause refer to distances between the OBE antennas.

The system must be able to operate within the limits as specified in the following tables.

Table 5 — Maximum number of OBE antennas per cubic metre

Class	OBEs per m^3
D1	0,1
D2	1
D3	10
D4	25
D5	50
D6	100 and above

NOTE Depending on the technical solution, there may be a requirement to specify the maximum number of OBEs in the read zone as a factor of passing speed.

Table 6 — Minimum distance between OBE antennas

Class	Clearance between OBEs
E1	1 cm
E2	5 cm
E3	10 cm
E4	25 cm and above

NOTE This will normally reference distance between monolithic OBEs when mounted according to manufacturer's specification.

Table 7 — Passing speed

Class	Speed test point	
	Km/h	m/s
F1	240	66
F2	160	44
F3	120	33
F4	72	20
F5	18	5
F6	9	2.5
F7	3.6	1

To achieve Class F1, it shall read at all test point, Class F2, all test points from 1 m/s up to 66 m/s, etc.

NOTE F5 to F7 are applicable classes for use in low-speed AEI environments such as inventory management, etc., but are also used as stop-and-go traffic test points.

6.7 Data structure requirements

The overall requirements for AVI/AEI system data are determined within ISO 14816.

6.8 Privacy

Privacy is not a mandatory requirement for a nominal AVI system (or system service), as its principal objective is to positively identify vehicles/equipment. See ISO 14816 for further details.

6.9 Information security

Security data at the message level and the security information objects (such as cryptographic checksums) can optionally be provided by adequate measures, but do not form part of this International Standard. See ISO 14816 for further details.

6.10 Environmental parameters

This clause is applicable for all parameters of operation, transport and storage

The following abbreviations are used to designate the environmental classes defined in IEC 721:

B Biological
C Chemical substances
F Contaminating fluids
K Climatic
M Mechanical
S Mechanical substances
Z Special climatic conditions

6.10.1 FE environmental parameters

FE environmental parameters are classified in accordance with IEC 721-3-4.

Table 8 — Environmental conditions for the FE

Class	Reference	Category
G1	IEC 721-3-4	4K4/4Z2/4Z5/4Z8/4B1/4C2/4S3/4M4
G2	IEC 721-3-4	4K3/4Z7/4B1/4C2/4S3/4M4
G3	IEC 721-3-4	4K2/4Z7/4B1/4C2/4S3/4M4
G4	IEC 721-3-4	4K1/4Z7/4B1/4C2/4S3/4M4

6.10.2 OBE environmental parameters

OBE environmental parameters are classified in accordance with IEC 721-3-5.

Table 9 — Environmental conditions for the OBE

Class	Reference	Category
H1	IEC 721-3-5	5K4/5B1/5C1/5S1/5F1/5M3
H2	IEC 721-3-5	5K3/5B1/5C1/5S1/5F1/5M2
H3	IEC 721-3-5	5K2/5B1/5C1/5S1/5F1/5M2

6.11 Safety

As this International Standard does not deal with any single defined application, and as the implementation architecture is not part of the International Standard, it is not possible to include strict quantitative requirements on safety. However, it is expected that manufacturers take into account safety aspects in product design. Annex D details some aspects that should be considered as a minimum by manufacturers.

7 Test requirements

7.1 Objectives

It is the objective of this International Standard to provide specific reference criteria for test requirements and reference tests for equipment claiming conformance with this family of International Standards for AVI/AEI systems.

Wherever possible, the test requirements determined in this International Standard are formulated and referenced to existing standards. This International Standard provides references to such standards by classes.

All normative testing required in order to claim compliance with this International Standard shall be certified by an AIB, approved by the nation state.

7.2 Operational parameters to be tested

7.2.1 General test requirements

7.2.1.1 Reliability

See 6.6.1.1.1.

7.2.1.1.1 Error Rates

The manufacturer shall satisfy the AIB (e.g. by means of calculation) that the system components have been designed such that any relevant accuracy (maximum tolerated error rate) requirements determined in this International Standard for a particular classification are met. (The form of such calculation is not predetermined).

7.2.1.1.2 Failure Rates

The manufacturer shall satisfy the AIB (e.g. by means of calculation) that the system components have been designed such that any relevant MTBF requirement determined or advised in this International Standard for a particular classification is met. (The form of such calculation is not predetermined).

7.2.1.2 Availability

The form of availability check is not predetermined.

7.2.1.3 Lifetime

7.2.1.3.1 FE Lifetime

The manufacturer shall satisfy the AIB (e.g. by means of accelerated life cycle tests and/or calculation) that the FE is expected to meet its claimed expected lifetime.

7.2.1.3.2 OBE Lifetime

The manufacturer shall satisfy the AIB (e.g. by means of accelerated life cycle tests and/or calculation) that the OBE is expected to meet its claimed lifetime. (see 6.6.1.1.4).

7.2.1.4 Maintainability

See 6.6.1.1.2.

The OBE (excluding replaceable battery or external power source) shall not require maintenance throughout its claimed lifetime.

NOTE Maintainability requirements for Fixed Equipment is considered to be a commercial agreement between the buyer and seller, and is not covered by this International Standard.

7.2.1.5 Number of transactions/identifications per year (OBE):

The AIB shall ascertain to its satisfaction that the OBE has, at minimum, achieved the number of transactions/identifications per year in accordance with the classification (as specified in this International Standard) claimed by the manufacturer.

Where the OBE has a non-replaceable battery, such certification shall be based upon usage of an internal/non-replaceable battery for the expected minimum lifetime of the OBE as specified in Table 3.

Where the OBE has a replaceable battery, the AIB shall ascertain to its satisfaction that the OBE shall meet the minimum number of transactions/identifications between battery changes to meet the requirements of the classification (as specified in this International Standard) claimed by the manufacturer.

7.2.1.6 Distance between FE and OBE antennas

The AIB shall certify compliance with respect to operation of the system at each of the test points of the reading range, according to the classification (as specified in this International Standard) claimed by the manufacturer.

7.2.1.7 Distance between OBEs

The AIB shall certify compliance with respect to operation of the system distance at each of the test points between OBEs (or, where separated, OBE antennas) according to the classification (as specified in this International Standard) claimed by the manufacturer. (See Table 6.)

7.2.1.8 Passing speeds

The AIB shall certify compliance with respect to operation of the system at vehicle speeds according to the classification (as specified in this International Standard) claimed by the manufacturer. (See Table 7.)

Annex A
(normative)

Categories of AVI/AEI systems

A.1 Classes and categories

Whilst it may be desirable to determine a single set of requirements for operation in all environments and under all operating conditions, this could impose unacceptable costs.

Equipment shall be defined according to its classes as determined in this International Standard.

However, determination into classes does not by itself enable interoperability. In order to achieve interoperability, different operators need to use similar classes or groups of classes to provide their minimum requirements. This International Standard therefore provides a range of categories for common uses. These categories are advisory rather than mandatory, and are determined in order to make the adoption and interoperable use of the International Standard both practicable and easy.

These categories comprise sets of classes that specify the environmental and operating parameters. The categories are as follows:

1) **Nominal interoperable "ruggedized"**
Capable of operation in extreme (as defined in classes) RTTT environment/operating conditions that may be expected; operable within a wide range of temperatures; waterproof; high specification in respect of vibration, thermal shock, chemical resistance.

2) **Nominal interoperable "standard"**
Capable of operating within normal (as defined in classes) RTTT environments/operating conditions that may be expected in the RTTT sector. OBE mounted inside the vehicle (with the possible exception of antenna and connections from OBE to antenna).

3) **Nominal interoperable "within selected environmental classes"**
Capable of operating within all normal (as defined in classes) RTTT operating conditions, and conforming to selected classes with respect to the environments in which the equipment may be expected to function.

4) **Nominal interoperable "within selected operational classes"**
Capable of operating within all normal (as defined in classes) environments that may be expected, and conforming to selected classes with respect to one or more operational aspects (e.g. operational parameters such as maximum speed).

5) **Nominal interoperable "within selected environmental and operational classes"**
Capable of operating within selected environmental and operational classes.

6) **Not nominal interoperable "within selected environmental and operational classes"**
Selected classes, not capable of operating as defined in the RTTT set of standards.

Categories 1 and 2 represent the most stringent, least flexible situations. They each have a fixed specification of classes. They are designed for widespread use.

Categories 3, 4 and 5 support a range of classes to enable interoperability within limited and definable ranges of environmental classes, operational classes, or a combination of the two.

Category 6 is a category providing for classification of systems not suitable for full nominal interoperability but within common “selected environmental and operational classes”.

NOTE The terms: “Extreme”, “Normal”, “Selected” with respect to environmental conditions refer to the classes defined in this International Standard.

Table A.1 defines the operational and environmental categories.

Table A.1 — System categories

	Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
Environmental	Extreme	Normal	Selected	Normal	Selected	Selected
Operational	Extreme	Normal	Normal	Selected	Selected	Selected

Each of the system categories is assigned a set of parameters as shown in Tables A.2, A.3 and A.4 below:

— Fixed Equipment, or

— On-Board Equipment.

Table A.2 — Fixed equipment, operational and environmental conditions

		Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
Reading distance	(C)	1	2	2	1-5	1-5	1-5
Speed	(F)	1	2	2	1-6	1-6	1-6
Environmental	(G)	1	2	1-4	2	1-4	1-4

Table A.3 — On-board equipment (AVI), operational and environmental conditions

		Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
IDs per Year	(A)	1	2	2	1-4	1-4	1-4
Lifetime	(B)	1	2	2	1-5	1-5	1-5
Reading distance	(C)	1	2	2	1-5	1-5	1-5
Speed	(F)	1	2	2	1-6	1-6	1-6
Environmental	(H)	1	2	1-3	2	1-3	1-3

Table A.4 — On-board equipment (AEI), operational and environmental conditions

		Category 1	Category 2	Category 3	Category 4	Category 5	Category 6
IDs per Year	(A)	1	2	2	1-4	1-4	1-4
Lifetime	(B)	1	2	2	1-5	1-5	1-5
Reading distance	(C)	1	2	2	1-5	1-5	1-5
Speed	(F)	1	2	2	1-6	1-6	1-6
Environmental	(H)	1	2	1-3	2	1-3	1-3

A.2 Examples on use of classes for system specification

The three examples below indicate how users/operators may specify AVI/AEI system specification using this International Standard and the categories.

A.2.1 Example 1: Requiring a nominal AVI system, category 2

Identifying the system specification

In this example, an AVI/AEI operator selects an AVI/AEI system that shall provide:

— enable nominal interoperability,

— a high level of performance for operational requirements,

— operation in most foreseeable environmental conditions,

— but not ruggedized equipment.

In respect of the operational requirements, he may, for example require:

speed: 150 km/h, reading distance 8 metres, OBE lifetime 10 years, 10 000 reads per year per OBE.

This implies the following classes:

Description		**Class**
Reads/year	10 000	A2
OBE lifetime	10 years	B2
Reading distance	8 metres	C2
Vehicle speed	150 km/h	F2

In respect of the environmental parameters, he may, for example require:

Operation in –35°- +70° C, no influence of road salt, sand, dust, oils, etc. (OBE behind windscreen), normal vibration and shock resistance.

This implies the following class:

I2	IEC 721-3-5	**5K3/5B1/5C1/5S1/5F1/5M2**

In this example, in the system specification the operator may refer to this International Standard as follows:

ISO 14815 OBE: Classes: A2/BIP2/C2/D2/I2

In many cases, many groups of users will have similar requirements (for example, freight operators within ENV countries), and in these circumstances, to maximize interoperability, it will be simpler and more consistent to refer to one of the categories in this annex.

Using the categories in the system specification, the operator would refer to this International Standard as follows:

ISO 14815 OBE: Category 2

A.2.2 Example 2: Requiring a nominal AVI/AEI system, category 5

Identifying the system specification

In this example, an AVI/AEI operator selects an AVI/AEI system that shall provide:

— nominal interoperability,

— a limited level of performance for access control (e.g. a parking operation),

— not ruggedized equipment.

In respect of the operational requirements, he may, for example require:

speed: 20 km/h, reading distance 3 metres, OBE lifetime 3 years, 2 000 reads per year per OBE.

This implies the following classes:

Description		**Class**
Reads/year	2 000	A4
OBE Lifetime	3 years	B3
Reading distance	3 metres	C4
Vehicle Speed	20 km/h	F4

In respect of the environmental parameters, he may, for example require:

Operation in –25°- +70° C, no influence of road salt, sand, dust, oils etc. (OBE behind windscreen).

This implies the following class:

I3	IEC 721-3-5	**5K2/5B1/5C1/5S1/5F1/5M2**

In this example, in the system specification the operator may refer to this International Standard as follows

prENV ISO 14815 OBE: Classes: A4/B4/C4/D6/I3

In many cases, many groups of users will have similar requirements (for example, freight operators within tropical countries), and in these circumstances, to maximize interoperability, it will be simpler and more consistent to refer to one of the categories in this annex.

Using the categories in the system specification, the operator would refer to this International Standard as follows:

ISO 14815 OBE: Category 5

A.2.3 Example 3: Requiring a ruggedized antenna, category 3

Identifying the system specification

In this example, a user may require a category 1 antenna together with a category 2 OBE. This implies that the antenna is to be mounted externally and therefore ruggedized, whereas the OBE is mounted inside the vehicle and therefore subject to a different set of environmental parameters:

— enable nominal interoperability,

— a high level of performance for operational requirements,

— operation in most foreseeable environmental,

— ruggedized equipment (extreme environmental).

In respect of the antenna alone, the operational requirements are not applicable, he may, for example require:

speed: 150 km/h, reading distance 8 metres, OBE lifetime 10 years, 10 000 reads per year per OBE.

This implies the following classes:

Description		**Class**
Reads/year	10 000	A2
OBE lifetime	10 years	B2
Reading distance	8 metres	C2
Vehicle Speed	150 km/h	D2

In respect of the environmental parameters, he may, for example require:

Operation in − 45°- +85° C, impervious to ingress of road salt, sand, dust, oils etc. (OBE mounted on exterior of vehicle), vibration and shock resistant, may be subjected to flying stones.

This implies the following class:

I1	IEC 721-3-5	**5K4/5B1/5C1/5S1/5F1/5M3**

In this example, in the system specification the operator may refer to this International Standard as follows:

ISO 14815 OBE: Classes: A2/B2/C2/D2/I1

Using the categories, in the system specification, the operator would refer to this International Standard as follows:

ENV12314-3 OBE: Category 3

Annex B
(normative)

Environmental parameters to be tested

B.1 General aspects

The purpose of environmental classification is to ascertain the environmental conditions within which the equipment is able to operate (including storage) and survive. Environmental test requirements shall therefore ascertain that the equipment is fully operable within parameters of the environmental conditions specified within a particular classification (specified within this International Standard) claimed by the manufacturer.

A further requirement of environmental tests is to ensure compliance with environmental safety regulations.

Where possible, all such tests are by reference to established International Standards.

Before performing environmental tests, the AIB shall determine if the OBE or FE are to be considered as "Heat dissipating specimens" or not. This is defined according to IEC 68-1, chapter 4.3 "Heat-dissipating specimen".

NOTE Typically, the OBE may be expected to be non-heat dissipating, while the FE will be heat dissipating.

B.2 Environmental tests

The following tests shall normally be performed as a sequence of tests, in this sequence and using the same samples, except where otherwise noted. After all tests, mechanical checks are performed.

In this International Standard, most test parameters are specified; however, as the development of other relevant standards is still in process, some are dependent on other standards under development at the time of issue of this International Standard, and some parameters remain only partly specified. Further additions and revisions to this International Standard are therefore to be expected.

The basis for testing determined in this International Standard is the already well-defined and accepted IEC 68-2 series, Parts 1 and 4.

B.2.1 Solar radiation

Test Sa, procedure A, as described in IEC 68-2-5 (see also IEC 68-2-9).

Pre-conditioning: Stabilize temperature

Pre-checks: Mechanical inspection

Condition of DUT: Operational

Irradiance: As specified in the requirements

Temperature in test enclosure: +40°C

Duration: IEC 68-2-9, test b, 3 cycles

Measurements: "Simplified performance test" at the end of the last irradiation period.

Measure temperature rise inside of DUT. If it is necessary to damage the DUT to do this, then this measurement must be performed on separate sample(s). However, the sample(s) to be used for the following tests should also go through this test first.

B.2.2 Low temperature tolerance

Test Ab for non-heat dissipating specimen and test Ad for heat-dissipating specimen. These are described in IEC 68-2-1.

Condition of DUT: Operational

Temperature: Same as low air temperature as specified

Duration: 96 h

Measurements: "Simplified performance test" at the end of the exposure (conditioning).

B.2.3 Dry Heat

Test Bb for non-heat dissipating specimen and test Bd for heat dissipating specimen. To be carried out as described in IEC 68-2-2.

Condition of DUT: Operational

Temperature: High air temperature as specified, plus the temperature rise found in test Sa (see B.2.1)

Duration: 96 h

Measurements: "Simplified performance test" at the end of the exposure (conditioning).

B.2.4 Rapid change of temperature air/air

Test Na; to be carried out as described in IEC 68-2-14 (see also IEC 68-2-33).

Condition of DUT: Operational

Temperatures: As given in requirements

Number of cycles: 5

Change-over time: 30 s (automatic transfer)

Exposure time: 30 m

Measurements: "Simplified performance test" performed immediately after the last exposure. This measurement may be performed in standard atmospheric conditions (see IEC 68-1 chapter 5.3).

B.2.5 Gradual change of temperature air/air

Test Nb; to be carried out as described in IEC 68-2-14 (see also IEC 68-2-33).

Condition of DUT: Operational

Temperatures: As specified in requirements

Number of cycles: 2

Rate of change of temperature: As specified in requirements

Exposure time: 30 m

Measurements: "Simplified performance test" performed at the start of the test, and every 5 minutes during the test period.

B.2.6 Rapid change of temperature air/water (not applicable where OBE is mounted inside)

Test Nc; to be carried out as described in IEC 68-2-14, except that air is used at the higher temperature.

Condition of DUT:	Operational
Temperatures:	As given in requirements
Number of cycles:	10
Change-over time:	2 s
Exposure time:	5 m
Measurements:	"Simplified performance test" performed immediately after the last exposure. This measurement may be performed in standard atmospheric conditions (see IEC 68-1 chapter 5.3).
Liquid:	Water
Exceptions from std. test:	Air is used instead of liquid at the higher temperature. The exposure time at the higher temperature must then be increased higher than at the lower temp.

B.2.7 Impact and non-stationary vibration, shock

IEC tests Ea (68-2-27), Eb (68-2-29), Ec (68-2-32), Ed (68-2-32) and Ee (68-2-55) are considered. These shall then be linked to the requirement specifications.

Performance measurements will not be made during conditioning in this case, but immediately afterwards.

B.2.8 Stationary vibration, sinusoidal

Test Fc; to be carried out according to, and as described in, IEC 68-2-6.

Condition of DUT:	Operational
Displacement /acceleration amplitude:	10 mm
Frequency range:	10 Hz - 150 Hz, (or as specified in requirements)
Procedure:	Endurance by sweeping with vibration response investigation to find critical frequencies. Then endurance at the critical frequencies is found.
Duration of sweeping:	2 h/axis
Duration at critical frequencies:	10 m
Measurements:	"Simplified performance test" performed at the lower, logarithmic middle and upper sweep frequencies and at each of the critical frequencies tested (at the end of the exposure to each frequency). "Simplified performance test" should also be performed after the complete test.

It should be investigated if the random test below could be extended to give the same information as this test, so that this test could be skipped when the random test is performed.

B.2.9 Stationary vibration, random

Test Fd; to be carried out according to, and as described in, IEC 68-2-34, 68-2-35, 68-2-36 and 68-2-37.

Reproducibility: Medium

Condition of DUT: Operational

Frequency range: 20 Hz - 2 000 Hz

A.S.D. levels: 0,005 g^2/Hz

Duration of conditioning: 3 h (equally divided between the specified directions)

Measurements: "Simplified performance test" at the end of the exposure in each direction, and after the complete test.

B.2.10 Low air pressure

Test M; to be carried out according to, and as described in, IEC 68-2-13.

Condition of DUT: Operational

Air pressure: As specified in requirements

Duration of conditioning: 4 h

Rate of air pressure change: No restrictions

Measurements: Simplified performance test to be performed at the end of the conditioning period, and after the test.

B.2.11 Damp heat cycle

Test Z/AD; to be carried out as described in IEC 68-2-38. It might be necessary to accelerate the temperature changes of this test to comply with the aims of the required climatic class specified. This must be further investigated.

Condition of DUT: Operational

Temperatures: As specified in requirements

Measurements: "Simplified performance test" to be performed after pre-conditioning (assisted drying), at the end of the last cold period, at the end of the last warm period and after the complete test.

B.2.12 Damp heat steady state

Test Ca; to be carried out as described in, IEC 68-2-3 (see also IEC 68-2-28). This test is performed on (a) different sample(s) than the other tests, if possible.

Condition of DUT: Operational

Exposure time: 21 days (4 days to be considered)

Exceptions: Temperature and humidity are as specified in requirements.

Measurements: "Simplified performance test" to be performed at the end of the exposure time, and after the complete test.

B.2.13 Absolute humidity

In accordance with IEC 68-2-38. Electrical and mechanical checks to be made before and after the test.

B.2.14 Low relative humidity

In accordance with IEC 68-2-38. Electrical and mechanical checks to be made before and after the test.

B.2.15 Dust and sand

Tests to be carried out as described in IEC 68-2.

B.2.16 Ingress of water

Test R; to be carried out as described in IEC 68-2-18.

B.2.17 EMC/EMI testing

Tests to be carried out as described in:

— Radio Interference: IEC 1000-4-6,

— Conducted Transients: ISO 7637: Part 1 (12V), level III, ISO 7637: Part 1 (24V), level III,

— Voltage Transients: ISO 7637:1991 Part 1,

— Electrostatic Discharge: IEC 801-2, at 16 kV,

— Radiated Emissions and Immunity: EC Commission document 111/4127/91.

Annex C
(normative)

Compliance/certification

C.1 Claiming Compliance

a) In order to claim compliance with this International Standard, the equipment for which compliance to this International Standard is claimed shall meet the requirements determined in the appropriate clause(s) of this International Standard. Certificates of Compliance shall clearly reference the relevant classification attained.

b) Statements claiming compliance with this International Standard shall not be made unless the equipment has been tested by an AIB and a valid “Certificate of Compliance” to this International Standard (The Certificate) issued by the AIB in respect of the specific classification has been claimed.

c) In assessing conformance, the AIB, in addition to assuring compliance with the quantitative aspects of the International Standard, shall also consider the adherence to the general principles and objectives of the International Standard as described in Clause 5.

d) Particularly, where the RTTT system service has to support devices in an interoperable environment, it is essential that the devices are capable of “upwards migration”, either to accommodate different types of devices in the emerging specifications, or as new generations of systems are developed.

e) In respect of equipment claiming compliance to this International Standard, purchasers are advised to ensure that the equipment has been tested by a nationally accredited AIB, and that there is a valid Certificate of Compliance in respect of the specific classification and class claimed.

f) Issuers of Certificates of Compliance to this International Standard (“The Certificate”) shall ensure that “The Certificate” clearly states:

— the name and address of the AIB,

— the name and address of the manufacturer of the equipment tested,

— the equipment's types/models,

— any manufacturer's identification numbers carried on the equipment tested,

— the date of satisfactory completion of testing and issue of The Certificate,

— the technical specification parameters pertaining to classification(s) ascertained

— the consequent “Classification for AVI/AEI Systems” (as determined in this International Standard) attained, and

— the signature of a person duly authorized by the AIB to issue such Certificates of Compliance.

C.2 Aspects requiring test certification

Any Certificate of Compliance with this International Standard issued by an AIB for any equipment shall ensure compliance in respect of the parameters determined in C.2.1, or shall state that a particular parameter is not applicable to the particular equipment tested.

Clause C.3 provides (non-normative) quantitative parameters as guidelines for values to be tested to ensure compliance.

The following parameters are considered:

C.2.1 General

a) Reliability (see 7.2.1.1, C.3.1 and C.3.2),

b) Availability (see 7.2.1.2 and C.3.3),

c) Equipment lifetime (see 7.2.1.3 and C.3.4),

d) Maintainability (see 7.2.1.4),

e) Number of transactions/identifications per year (OBE) (see 7.2.1.5),

f) Distance between FE and OBE Antennas (see 7.2.1.6),

g) Distance between OBE's (see 7.2.1.7).

C.2.2 AVI specific

Vehicle speed limits (see 7.2.1.8).

C.2.3 AEI specific

Passing speed (OBE relative to reading equipment) (see 7.2.1.8).

C.3 Requirements to be tested (form of non-normative test)

C.3.1 The failure rate of the FE

The failure rate of the FE shall be as classified in Table C.1.

Table C.1 — MTBF of FE

Class	MTBF (h)
CA1	2×10^5
CA2	10^5
CA3	0.5×10^5

C.3.2 The failure rate of the OBE

The failure rate of the OBE shall be as classified in Table C.2.

Table C.2 — MTBF of OBE

Class	MTBF (h)
CB1	2×10^5
CB2	10^5
CB3	0.5×10^5

C.3.3 Availability

C.3.3.1 Availability of the FE

The availability of the FE shall not be below 99,5 %, averaged over any 365 day period. (Failures include any hardware or software breakdowns, i.e. anything that results in loss of functionality.)

C.3.3.2 Availability of the OBE

The OBE shall have an availability of at least 99,3 % (including non-replaceable batteries).

C.3.4 Lifetime of the FE

The FE shall have a minimum lifetime of 5 years. Equipment shall be classified as follows:

Table C.3 — Lifetime of the FE

Class	Fixed Equipment lifetime
CC1	15 years
CC2	10 years
CC3	5 years

Annex D
(normative)

Safety

D.1 General consideration of safety aspects

As this International Standard does not deal with any single defined AVI/AEI application, and as the implementation architecture is not part of the International Standard, it is not possible to include strict quantitative requirements on safety. However, it is expected that manufacturers take account of safety aspects into product design.

The manufacturer shall satisfy the AIB on the intended use of the system component with respect to its application(s) and its conditions to enable the AIB to assess the safety aspects that need to be considered.

For those aspects that cannot be measured, the manufacturer shall satisfy the AIB (e.g. by means of calculation) that the system components have been designed such that any relevant safety requirement for its intended application is met.

It is recommended that the manufacturer account for at least the minimum following safety aspects:

a) Mechanical:

   1) temperature/ventilation,

   2) mounting (on windscreen, not to obscure vision),

   3) no sharp edges.

b) Electrical:

   1) fused,

   2) no high voltage.

c) Visual indication:

   1) readability,

   2) non-distracting (e.g. during driving),

   3) unambiguous.

d) Controls:

   1) not necessary during driving,

   2) easy to use,

   3) unambiguous.

Annex E
(normative)

Marking of AVI/AEI equipment

E.1 On-Board Equipment (OBE)

A descriptive plaque shall be affixed to the outside of the OBE (and must remain visible following installation) and must show the following markings:

— name and address of the manufacturer of the OBE,

— numeric serial number of the OBE (based on ENV ISO 14816 CS2),

— approval mark for the equipment type.

E.2 Fixed Equipment (FE)

A descriptive plaque must be affixed to the outside of the FE (and must remain visible following installation) and must show the following markings:

— name and address of the manufacturer of the FE,

— numeric serial number of the FE (based on ENV ISO 14816 CS2),

— approval mark for the equipment type.

ICS 03.220.20; 35.240.60

Price based on 31 pages