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Intelligent transport systems — Automatic vehicle and equipment identification — Interfaces

Systèmes intelligents de transport — Identification automatique des véhicules et de leurs équipements — Interfaces

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

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Foreword

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 17264 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).

Introduction

This International Standard provides requirements for interoperable ITS transactions in an “Automatic Vehicle Identification” (AVI), “Automatic Equipment Identification” (AEI) or “Electronic Registration Identification” (ERI) context. An AVI/AEI transaction is based on defined sets of AVI/AEI functions and data attributes as specified in this International Standard.

NOTE The principal definitions of AVI, AEI, ERI are to be found in ISO 14814, ISO 14815, ISO 14816, ISO 17261, ISO/TS 17262, ISO 17263, ISO/TS 24534 (all parts) and ISO 24535.

This International Standard specifies an application interface for AVI/AEI systems, based on standardized air interface protocols enabling interoperability between different AVI/AEI service providers.

In order to achieve full interoperability, AVI/AEI service providers will additionally have to agree on issues such as:

— protocol implementation conformance statements from manufacturers, detailing which optional features in the AVI/AEI transaction and air interface protocol are actually being implemented and used;

— any contractual agreements needed between AVI/AEI service providers in order to regulate the handling of different AVI/AEI transactions.

NOTE The definitions and examples provided in this International Standard may also be used in an ERI context, and those interested in this context are advised to also refer to ISO 24534 (all parts) and ISO 24535.

This International Standard has the following structure:

— Clauses 1 to 5 comprise the Scope, Conformance, Normative references, Terms and definitions, and Abbreviated terms.

— In Clause 6, the AVI/AEI transaction requirements are defined, which are independent of any air interface protocol.

— In Annex A, the AVI/AEI application interface architecture is described in terms of its relation to the DSRC communication architecture, based on EN 12834/ISO 15628.

— In Annex B, the AVI/AEI application interface architecture is described in terms of its relation to the air interfaces defined by the ISO/IEC 18000 series.

— In Annex C, AVI/AEI transaction examples are provided.

Intelligent transport systems — Automatic vehicle and equipment identification — Interfaces

1 Scope

This International Standard provides the specifications of:

— common AVI/AEI transaction requirements, which define the common steps of any AVI/AEI transaction;

— AVI/AEI application interface to standardized wireless protocols (referred to as the "Air Interface") supporting the AVI transaction requirements, so as to enable interoperability.

In Figure 1 the conceptual architecture model is shown for AVI transactions between "On-board Equipment" and "Fixed Equipment". The air interface concerns the reference point DELTA in ISO 14814.

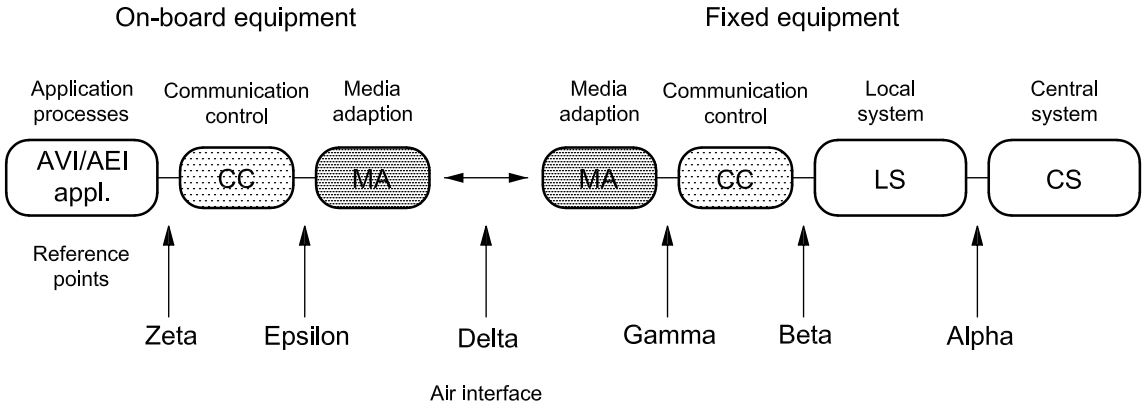

Figure 1 — Overall conceptual reference architecture model showing the context of AVI/AEI (ISO 14814)

This is an interface standard, adhering to the open systems interconnection (OSI) philosophy (ISO/IEC 7498-1), and it is as such not concerned with the implementation choices to be realized at either side of the air interface between the "Fixed Equipment" and "OBE".

2 Conformance

Conformance may be claimed where equipment conforms to the provisions of this International Standard.

No specific performance tests are defined within this International Standard.

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/IEC 8824-1, *Information technology — Abstract Syntax Notation One (ASN.1): Specification of basic notation — Part 1*

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

ISO 15628, *Road transport and traffic telematics — Dedicated short range communication (DSRC) — DSRC application layer*

ISO/TS 17262, *Automatic vehicle and equipment identification — Intermodal goods transport — Numbering and data structures*

ISO/IEC 18000-3, *Information technology — Radio frequency identification for item management — Part 3: Parameters for air interface communication at 13,56 MHz*

ISO/IEC 18000-4, *Information technology — Radio frequency identification for item management — Part 4: Parameters for air interface communication at 2,45 GHz*

ISO/IEC 18000-6, *Information technology — Radio frequency identification for item management — Part 6: Parameters for air interface communications at 860 MHz to 960 MHz*

ISO/IEC 18000-7, *Information technology — Radio frequency identification for item management — Part 7: Parameters for active air interface communications at 433 MHz*

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

EN 12834, *Road Transport and Traffic Telematics — Dedicated Short Range Communication (DSRC) — DSRC application layer*

4 Terms and definitions

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

4.1
action
function that an application process resident at the **roadside equipment** can invoke in order to make the on-board equipment execute a specific operation during the **AVI/AEI transaction**

4.2
air interface
conductor-free medium between an **OBE** and the reader/interrogator through which the linking of the **OBE** to the reader/interrogator is achieved by means of electro-magnetic signals

[ISO 14814:2006, definition 3.2]

4.3
attribute
application information formed by one or by a sequence of data elements, and managed by different actions used for implementation of an **AVI/AEI transaction**

4.4
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

[ISO 14815:2005, definition 4.19]

4.5
component
logical and physical entity composing **on-board equipment** supporting a specific functionality

4.6
element
in the context of DSRC, a directory containing application information in the form of **attributes**

4.7
fixed equipment
roadside equipment
equipment located at a fixed position along the road transport network, for the purpose of communication and data exchanges with the **on-board equipment** of passing vehicles

NOTE See also **reader**.

4.8
on-board equipment
OBE
device on board or attached to the vehicle/equipment to perform the functionality of **AVI/AEI**

[ISO 14814:2006, definition 3.18]

4.9
on-board unit
minimum component of on-board equipment, whose functionality always includes at least the support of the air interface

4.10
reader
device that transmits a signal as a means of initiating a response in a compatible **OBE** and subsequently receives the modulated electro-magnetic response and decodes the data

[ISO 14814:2006, definition 3.22]

NOTE The reader is or can be, part of the **roadside equipment/fixed equipment**.

4.11
service
AVI/AEI
road transport related facility provided by a **service provider**

NOTE Normally this is a type of infrastructure, the use of which is offered to the user and for which the user may be requested to identify his/her **OBE**.

4.12
service primitive (communication)
elementary communication service provided by the air interface to the application **AVI/AEI**

NOTE The invocation of a service primitive by an application process implicitly calls upon and uses services offered by the lower protocol layers.

4.13
service provider (AVI/AEI)
entity that reads the user's **OBE** and in return provides a service (**AVI/AEI**) to the user

5 Abbreviated terms

For the purposes of this document, the following abbreviations apply.

— AEI automatic equipment identification

— APDU application protocol data unit

— ASN.1 abstract syntax notation one

— AVI automatic vehicle identification

— BST beacon service table (DSRC application layer)

— DSRC dedicated short-range communications

— EID element id (DSRC application layer)

— I-KE initialization kernel element (DSRC application layer)

— IID invoker id (DSRC application layer)

— LID link id (DSRC application layer)

— OBE on-board equipment

— OBU on-board unit

— PICS protocol implementation conformance statement

— RSE road-side equipment

— RTTT road transport and traffic telematics

— VST vehicle service table (DSRC application layer)

6 Requirements — AVI/AEI transaction profiles

6.1 General

AVI/AEI transaction implies collecting data residing within an OBE that is compliant with ISO 14816, ISO/TS 17262 and/or ISO/TS 24534-3 or writing such data to the OBE.

This International Standard defines two AVI/AEI transaction profiles, "**AVI/AEI Read**" and "**AVI/AEI Read and Write**" that shall be implemented in the OBE and RSE supporting the AVI/AEI application.

6.1.1 AVI/AEI read transaction profile

An AVI/AEI read transaction profile shall comprise the set of service primitives as defined in Table 1.

Table 1 — AVI/AEI read transaction profile

Service primitive	Parameter	Required feature during transaction	Description
Initialization	AVI/AEI attribute(s)	Optional	Depending on the air interface used, the RSE may initialize the OBE before data exchange. This feature is mandatory when air interface is compliant with EN 12834/ISO 15628.
GET	AVI/AEI attribute(s)	Optional	Action of reading data from the OBE.
Release	None	Optional	After the completion of data exchange the RSE may release the OBE.

6.2 AVI/AEI read and write transaction profile

An AVI/AEI read transaction profile shall comprise the set of actions as defined in Table 2.

Table 2 — AVI/AEI read and write transaction profile

Service Primitive	Parameter	Required feature during transaction	Description
Initialization	None	Optional	Depending on the air interface used, the RSE may initialize the OBE before data exchange. This feature is mandatory when air interface is compliant with ISO 15628.
GET	AVI/AEI attribute(s)	Optional	Action of reading data from the OBE.
SET	AVI/AEI attribute(s)	Mandatory	Action of writing data to the OBE.
Release	None	Optional	After the completion of data exchange the RSE may release the OBE.

6.3 Air interface definitions

The detailed definitions of the AVI/AEI transaction are dependent on the air interface. Air interface definitions are included in Annexes A and B.

7 Test methods

Test methods are not specified in this International Standard.

Annex A
(normative)

AVI/AEI Application interface using EN 12834/ISO 15628

A.1 Usage of the DSRC application layer

AVI/AEI application uses the following services offered by DSRC application layer (as defined in EN 12834/ISO 15628):

— Initialization service, see Clause A.2.

— Transaction phase, using `GET`, `SET` or `ACTION` service primitives, see Clause A.3.

— Attribute definitions, see Clause A.4.

— ASN.1 Container module named "`AVIAEIInterfaceModule`", see Clause A.5.

In the remainder of this annex, the AVI/AEI-specific usage of the DSRC application layer is further specified.

A.2 Initialization phase

A.2.1 Overview

This clause provides an overview of the functionality of, and the information exchanges in, the initialization phase.

The initialization service, by means of BST and VST exchanges, is defined in EN 12834/ISO 15628.

Sub-clauses A.2.2 and A.2.3 account for the AVI/AEI application-specific information that shall be included in the BST and VST, respectively.

A.2.2 AVI/AEI application-specific contents of the BST

An RSE supporting AVI/AEI shall have configured its I-KE to carry the following information related specifically to the AVI/AEI application(s):

— the application identifier (AID) shall be equal to 11 (i.e. the value assigned for AVI);

— the AVI/AEI application shall be qualified as a mandatory application;

— the EID component may be omitted and, if present, shall be ignored by the ERI application;

— the parameter component may be omitted or may be contained in the necessary data.

A.2.3 AVI/AEI application-specific contents of the VST

Each AVI/AEI application and corresponding contract shall be associated with an "`AVI-ContextMark`", as defined below. An OBE may support several AVI/AEI applications. If several AVI/AEI applications are supported by an OBE, then the order in which the "`AVI-ContextMarks`" are presented in the VST shall

correspond to the user's order of preference. The RSE shall normally use the first "AVI-ContextMark" that it supports as presented in the VST.

An OBE supporting AVI shall have configured its I-KE to carry the following information related specifically to the concerned AVI application:

— the AID shall be equal to "AVI/AEI" (=11);

— the EID value may be unique within the OBE throughout the complete DSRC session, and may be logically associated with the corresponding e.g. "AVI-ContextMark" contained in the "Parameter";

— the "Parameter" may be of Container CHOICE type OCTET STRING and may comprise the e.g. "AVI-ContextMark" as defined below, and may also be configured to carry additional AVI attributes.

The "AVI-ContextMark" has the following ASN.1 type definition:

```
AVI-ContextMark ::=SEQUENCE{
       aVIProfile        INTEGER {
                            AttributeInTransactionPhaseOnly (0),
                            Iso14816CS1AttrPointer (1), --CS1 appended in VST
                            Iso14816CS2AttrPointer (2), --CS2 appended in VST
                            Iso14816CS3AttrPointer (3),
                            Iso14816CS4AttrPointer (4),
                            Iso14816CS5AttrPointer (5),
                            Iso14816CS6AttrPointer (6),
                            Iso14816CS7AttrPointer (7),
                            Iso14816CS8AttrPointer (8),
                            ReservedforFutureISOUse1 (9),
                            ReservedforFutureISOUse2 (10),
                            ReservedforFutureISOUse3 (11),
                            ReservedforFutureISOUse4 (12),
                            ReservedforFutureISOUse5 (13),
                            ReservedforFutureISOUse6 (14),
                            ReservedforFutureISOUse7 (15),
                            ReservedforFutureISOUse8 (16),
                            ReservedforFutureISOUse9 (17),
                            Private1To65535 (18),… }(0..65535),--Private profiles
       profileVersion       INTEGER(0..127,..) – Version control can be added
       }
```

The value of the ISO 14816 "**CSPointer**" determines the ISO 14816 ASN.1 type included in the VST "**Parameter**" as part of the "AVI-ContextMark".

NOTE 1 If the AVIProfile value is set to the values 1 to 9, ISO 14816 attribute is included in the VST, if AVIProfile value is set to 0, the attributes are sent in data exchange phase.

NOTE 2 The above is the AVI/AEI application-specific contents of the VST. The complete VST is defined in EN 12834/ISO 15628 and is given below for readability:

```
VST ::=    SEQUENCE {
   fill      BIT STRING (SIZE(4))
   profile      Profile,
   applications    ApplicationList,
   obeConfiguration ObeConfiguration
   }

where:
ApplicationList ::= SEQUENCE (0..127,...) OF
   SEQUENCE{
   aid       DSRCApplicationEntityID,   --aid =11
   eid       Dsrc-EID  OPTIONAL,        --eid = e.g. 1
   parameter Container OPTIONAL  --e.g. 'AVI-ContextMark'
--depending on the value of the AVIProfile, see Note 1, an ISO 14816
attribute may also be included.
   }
```

Container shall be of type 2 (OCTET STRING).

NOTE 3 An AVI/AEI application provider retains the ultimate control of his security domain, i.e. the security level and the associated security mechanisms to be used within his system.

A.3 Transaction phase

After completion of the initialization phase, the appropriate RSE application is informed (by means of the notify application beacon service) of the "AVI-ContextMark"(s) and associated EID(s). The RSE shall use the functions defined in Clause 6 to complete the AVI/AEI transaction.

The RSE may invoke any sequence of AVI/AEI functions to complete the AVI/AEI transaction, provided that they are supported by the "AVI-ContextMark". The OBE shall respond to the AVI/AEI functions invoked by the RSE, and shall not initiate any AVI/AEI functions (by usage of a request service primitive) on its side.

Due to the construction of the AVI/AEI part of the VST, each EID identifies a certain "AVI-ContextMark" and shall be used by the RSE as a parameter of every function to unambiguously address data elements within the context given by the "AVI-ContextMark". More than one EID may be used in one session.

Both the type of attribute, and the maximum number of instances of an attribute is the implementation option of the OBE and is outside the scope of this International Standard.

These implementation dependent aspects are referenced unambiguously by the ProfileVersion data element in the "AVI-ContextMark". In this way, the DSRC enables various AVI/AEI transaction types, such as:

— Type 1: AVI/AEI read Profile Using INITIALISATION

— Type 2: AVI/AEI read Profile using INITIALISATION and GET

— Type 3: AVI/AEI read/write Profile using INITIALISATION, GET and SET

— Type 4: AVI/AEI read/write Profile using INITIALISATION, GET, SET or ACTION

— Type 5: AVI/AEI read/write Profile using INITIALISATION, GET, SET and ACTION

The supplier shall declare which transaction profile, type and set of attributes is supported in his OBE and RSE in a "**Protocol Implementation Conformance Statement**" (PICS). The contents and format of the PICS are outside the scope of this International Standard.

NOTE 1 Although not mandatory, it is recommendable that an RSE compliant with ISO 15628 support all service primitives `INITIALISATION`, `GET`, `SET` and `ACTION`.

NOTE 2 The PICS can be a protocol specification or similar, which provides unambiguous implementation specification of the AVI/AEI transaction type as well as air interface protocol details.

NOTE 3 `ACTION` service primitive shall be used for secure channelling of data between the OBE and RSE. Although not mandatory, action types defined in ISO 14906 can be applied for such mechanisms.

A.4 AVI/AEI attributes

Within the context of AVI/AEI, the AVI/AEI attributes listed in Table A.1 or a subset thereof shall be available to perform an AVI/AEI transaction:

Table A.1 — AVI/AEI attributes

AttributeID	Attribute	Standard reference
0	AVI-ContextMark	
1	CS1	ISO 14816
2	CS2	ISO 14816
3	CS3	ISO 14816
4	CS4	ISO 14816
5	CS5	ISO 14816
6	CS6	ISO 14816
7	CS7	ISO 14816
8	CS8	ISO 14816
9	AccessControlStatus	ISO 17262
10	AEIMessageType	ISO 17262
11	DisplayMessageType	ISO 17262
12	TransportComponentStatus	ISO 17262
13	MsgInfo	ISO 17262
14	Position	ISO 17262
15	ReaderLocation	ISO 17262
16	TerminalMonitoringType	ISO 17262
17	TransportObjectIdentifier	ISO 17262
18	TransportObjectMessageType	ISO 17262
19	TransportObjectType	ISO 17262
20	UNLocode	ISO 17262
21	Vehicle Id	ISO 24534-3
22	RaSpecificVehicleId	ISO 24534-3
23	EriData	ISO 24534-3
24	Iso3833Vehicletype	ISO 24534-3
25	EuVehicleCategoryCode	ISO 24534-3
26	EuVehicleCategoryM	ISO 24534-3
27	EuVehicleCategoryN	ISO 24534-3
28	EuVehicleCategoryO	ISO 24534-3
29	EuTwoOrThreeWheelCategory	ISO 24534-3
30	EuroType	ISO 24534-3
31	OfficialVehicleTestData	ISO 24534-3
32	PowerSource	ISO 24534-3
33-87	ReservedforfutureCENUse	
88-127	ReservedForPrivateUse	

NOTE 1 Not every AVI/AEI attribute has to be present in a certain implementation of this International Standard in order to be compliant. An AVI/AEI transaction can be made with a combination of standardized and “Private Attributes”.

NOTE 2 Which AVI/AEI attributes are present and which are not is implementation dependent. The implementation is identified by the context given in the `"AVI-ContextMark"` of the VST.

A.5 AVI/AEI container module definition

The AVI/AEI data types and associated coding related to the AVI/AEI action parameters, response parameters and attributes, are defined using the “Abstract Syntax Notation One” (ASN.1) technique according to ISO/IEC 8824-1:

```
-- AVIAEINumberingAndDataStructures is ISO14816

-- AVIAEIIntermodalNumberingAndDataStructures is ISO17262

-- ElectronicRegistrationIdentificationVehicleDataModule is ISO24534 part 3

-- ElectronicRegistrationIdentificationTransactionsModule is ISO24534 part 4

-- EriSecretKeyTransactionsModule is ISO24534 part 5

AVIAEIDSRCInterfaceModule {iso standard iso (17264) version (0)}

DEFINITIONS AUTOMATIC TAGS ::= BEGIN
IMPORTS
CS1, CS2, CS3, CS4, CS5, CS6, CS7, CS8 FROM AVIAEINumberingAndDataStructures
AccessControlStatus, AEIMessageType, CS9, DisplayMessageType,
TransportComponentStatus, MsgInfo, Position, ReaderLocation,
TerminalMonitoringType, TransportObjectIdentifier, TransportObjectMessageType,
TransportObjectType, UNLocode FROM AVIAEIIntermodalNumberingAndDataStructures
VehicleId, RaSpecificVehicleId, EriData, Iso3833VehicleType,
EuVehicleCategoryCode, EuVehicleCategoryM, EuVehicleCategoryN,
EuVehicleCategoryO,  EuTwoOrThreeWheelCategory, EuroType ,
OfficialVehicleTestData, PowerSource FROM
ElectronicRegistrationIdentificationVehicleDataModule
EriRequestPdu, EriResponsePdu FROM
ElectronicRegistrationIdentificationTransactionsModule
SecretKeyEriReqPdu, SecretKeyEriRspPdu FROM EriSecretKeyTransactionsModule;


AVI-ContextMark ::= SEQUENCE {
   aVIProfile   INTEGER {
          attributeInTransactionPhaseOnly (0),
          iso14816CS1AttrPointer (1), --CS1 appended in VST
          iso14816CS2AttrPointer (2), --CS2 appended in VST
          iso14816CS3AttrPointer (3),
          iso14816CS4AttrPointer (4),
          iso14816CS5AttrPointer (5),
          iso14816CS6AttrPointer (6),
          iso14816CS7AttrPointer (7),
          iso14816CS8AttrPointer (8),
          reservedforFutureISOUse1 (9),
          reservedforFutureISOUse2 (10),
          reservedforFutureISOUse3 (11),
          reservedforFutureISOUse4 (12),
          reservedforFutureISOUse5 (13),
          reservedforFutureISOUse6 (14),
```

```
reservedforFutureISOUse7 (15),
reservedforFutureISOUse8 (16),
reservedforFutureISOUse9 (17),
private18To65535 (18) } (0..65535),--Private profiles
profileVersion   INTEGER(0..127) -- Version control can be added
}

--XX1 .. XX8 are reserved for future use
XX1 ::= NULL
XX2 ::= NULL
XX3 ::= NULL
XX4 ::= NULL
XX5 ::= NULL
XX6 ::= NULL
XX7 ::= NULL
XX8 ::= NULL

Container  ::= CHOICE {
int           [0] INTEGER,
bitstr        [1] BIT STRING,
octstr     [2] OCTET STRING (SIZE(0 .. 127, ...)),
unitstr       [3] UniversalString (SIZE(0 .. 127, ...)),
utctime       [4] UTCTime,
real          [5] REAL,
bool          [6] BOOLEAN,
objid      [7] OBJECT IDENTIFIER,
sequ          [8] SEQUENCE SIZE(0 .. 127, ...) OF OCTET STRING,
null          [9] NULL,
xx1        [10] XX1,
xx2        [11] XX2,
xx3        [12] XX3,
xx4        [13] XX4,
xx5        [14] XX5,
xx6        [15] XX6,
xx7        [16] XX7,
xx8        [17] XX8,
avicm      [18] AVI-ContextMark,
cs1        [19] CS1,
cs2        [20] CS2,
cs3        [21] CS3,
cs4        [22] CS4,
cs5        [23] CS5,
cs6        [24] CS6,
cs7        [25] CS7,
cs8        [26] CS8,
cs9        [27] CS9,
acst          [28] AccessControlStatus,
amt        [29] AEIMessageType,
dmt        [30] DisplayMessageType,
tcs        [31] TransportComponentStatus,
mi         [32] MsgInfo,
pos        [33] Position,
rl         [34] ReaderLocation,
tmt        [35] TerminalMonitoringType,
tmi        [36] TransportObjectIdentifier,
tomt          [37] TransportObjectMessageType,
tot        [38] TransportObjectType,
unlocode      [39] UNLocode,
vi         [40] VehicleId,
rsvi          [41] RaSpecificVehicleId,
ed         [42] EriData,
```

```
ivt       [43] Iso3833VehicleType,
evcc         [44] EuVehicleCategoryCode,
evcm      [45] EuVehicleCategoryM,
evcn         [46] EuVehicleCategoryN,
evco         [47] EuVehicleCategoryO,
ettwc     [48] EuTwoOrThreeWheelCategory,
et        [49] EuroType,
ovtd         [50] OfficialVehicleTestData,
ps        [51] PowerSource, . . . }
--x [52..87]ReservedForFutureCENISOuse, x is a number between 52 to 87
--y [98..127] ReservedForPrivateUse, y is a number between 80 to 110

END
```

Annex B
(normative)

AVI/AEI transactions using ISO/IEC 18000

An AVI/AEI transaction using air interface protocols based on the ISO/IEC 18000 series shall follow the relevant protocol requirements. The supplier shall include a "**Protocol Implementation Conformance Statement**" (PICS) when claiming compliance with the relevant standard defining the air interface protocol selected for the AVI/AEI transaction. The following parts of ISO/IEC 18000 are applicable for AVI/AEI transactions:

— ISO/IEC 18000-3

— ISO/IEC 18000-4

— ISO/IEC 18000-6

— ISO/IEC 18000-7

Other parts of ISO/IEC 18000 might apply once they become approved International Standards.

NOTE The ASN.1 Module, "`AVIAEIInterfaceModule`" defined in Clause A.5 can be considered used in any protocol defined by ISO/IEC 18000.

Annex C
(informative)

AVI/AEI transaction examples

C.1 Simple AVI transaction

C.1.1 General

Below, an example encoding of a simple AVI transaction (using initialization service through BST-VST) is provided. In this example there is no data transfer save for the initialization phase.

C.1.2 Beacon service table content

Octet #	Bit 7..0	Hex	Attribute/field	Description
0	1 1 1 1 1 1 1 1	FF	LID	Link-address for broadcast
1	1	A0/ A8	MAC.L	The frame contains an LPDU
	0		MAC.D	Direction is downlink
	1		MAC.A	Window allocated
	0		MAC.C/R	Command LPDU
	S		MAC.S	Sequence bit is irrelevant for BST
	0 0 0		MAC.RES	Reserved. Set to 0
2	0 0 0 0 0 0 1 1	03	LLC	
3	1 x x x x 0 0 1	xx		Fragmentation header
4	1 0 0 0			Initialization request
	X			X= 1: Non-mandatory applications present
	0 0 0		BeaconId.ManufacturerId	16 bit ID. ISO 14816. Denso (=9)
5	0 0 0 0 0 0 0 0	00		
6	0 1 0 0 1		BeaconId.IndividualId	27 bit ID available for manufacturer
	i i i			
7	i i i i i i i i			
8	i i i i i i i i			
9	i i i i i i i i			
10	t t t t t t t t		Time	UNIX real time, octet 3, MSB
11	t t t t t t t t			UNIX real time, octet 2
12	t t t t t t t t			UNIX real time, octet 1
13	t t t t t t t t			UNIX real time, octet 0, LSB
14	0 0 0 0 0 0 0 p	00/01	BeaconProfile	Mandatory profile for the OBU 0= 1,5 MHz sub-carrier 1= 2,0 MHz sub-carrier
15	0 0 0 0 0 0 0 1		MandApplications	Number of mandatory applications in list
16	0 0 0 0 1 0 1 1			Application = AVI
17	0 0 0 0 0 0 0 0		ProfileList	Number of profiles in list

It is required that the BST length including FCS and flags does not exceed 128 octets.

C.1.3 Vehicle service table (VST) content

Octet #	Bit 7..0	Hex	Attribute/field	Description
0	x x x x x x x 0		LID	Private link-address
1	x x x x x x x 0			
2	x x x x x x x 0			
3	x x x x x x x 1			
4	1	C0	MAC.L	The frame contains an LPDU
	1		MAC.D	Direction is uplink
	0		MAC.R	No request for private window
	0		MAC.C/R	Command LPDU
	0 0 0 0		MAC.RES	Reserved. Set to 0
5	0 0 0 0 0 0 1 1	03	LLC	
6	1 x x x x 0 0 1	Xx	Fragmentation header	
7	1 0 0 1	90		Initialization response
	0 0 0 0			Fill bits set to '0'
8	0 0 0 0 0 0 0 p	00/01	OBUProfile	The OBU response with OBUProfile=BSTProfile
9	0 0 0 0 0 0 0 1	01	Application list	Number of applications = 1
10	1	CB		EID present
	1			Parameter present
	0 0 1 0 1 1			AID=11 (AVI)
11	0 0 0 0 0 0 0 1	01	EID	EID 1
12	0 0 0 0 0 0 1 0	02	Parameter type	OCTET STRING
13	0 0 0 0 1 0 0 1	09	Parameter length	9 octets (including "AVI context mark" + CS2)
14	0 0 0 0 0 0 0 0	00		CS2 is indicated. Context -Version 1
15	0 0 0 0 0 0 1 0	02		
16	0 0 0 0 0 0 0 1	01		
17	0 0 0 0 0 0 0 0	00	manufacturerId	CS2 manufacturer ID: *example Toyota = 23*
18	0 0 0 1 0 1 1 1	17		
19..22	NN	Nn	OBU SerialNumber (4 bytes)	CS2 "service number" from EN/ISO 14816
23	1	81	OPTION	OBEstatus present
	0 0 0 0 0 0 0 1		EquipmentClass	EquipmentClass = 01 97
24	1 0 0 1 0 1 1 1	97		
25	0 0 0 0 0 0 0 0	00	manufacturerId	Toyota = 23
26	0 0 0 1 0 1 1 1	17		
27	0	Xx	OBUStatus	Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
28	0 0 0 0 0 0 0 0	00		Reserved, set to 0

C.2 AVI transaction with GET

C.2.1 General

This example includes an AVI transaction using the BST, VST and GET functions. The BST is the same as in example C.1.2 (simple AVI). No data are sent in the initialization (VST). The use of GET function includes both a GET.Request issued by the RSE and GET.Response issued by the OBU.

C.2.2 Beacon service table (BST) content

See C.1.2.

C.2.3 Vehicle service table (VST) content

Octet #	Bit 7..0	Hex	Attribute/field	Description
0	x x x x x x x 0		LID	Private link-address
1	x x x x x x x 0			
2	x x x x x x x 0			
3	x x x x x x x 1			
4	1	C0	MAC.L	The frame contains an LPDU
	1		MAC.D	Direction is uplink
	0		MAC.R	No request for private window
	0		MAC.C/R	Command LPDU
	0 0 0 0		MAC.RES	Reserved. Set to 0
5	0 0 0 0 0 0 1 1	03	LLC	
6	1 x x x 0 0 1	Xx	Fragmentation header	
7	1 0 0 1	90		Initialization response
	0 0 0 0			Fill bits set to '0'
8	0 0 0 0 0 0 0 p	00/01	OBUProfile	The OBU response with OBUProfile=BSTProfile
9	0 0 0 0 0 0 0 1	01	Application list	Number of applications = 1
10	1	CB		EID present
	1			Parameter present
	0 0 1 0 1 1			AID=11 (AVI)
11	0 0 0 0 0 0 0 1	01	EID	EID 1
12	0 0 0 0 0 0 1 0	02	Parameter type	OCTET STRING
13	0 0 0 0 0 0 1 1	03	Parameter length	3 octets
14	0 0 0 0 0 0 0 0	00		Attributes only in GET service Context Version 1
15	0 0 0 0 0 0 0 0	00		
16	0 0 0 0 0 0 0 1	01		
17	1	81	OPTION	OBEstatus present
18	0 0 0 0 0 0 0 1		EquipmentClass	EquipmentClass = 01 97
19	1 0 0 1 0 1 1 1	97		
20	0 0 0 0 0 0 0 0	00	manufacturerId	CS2 manufacturer ID: example Toyota = 23
21	0 0 0 1 0 1 1 1	17		
22	0	00	OBUStatus	Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
	0			Reserved, set to 0
23	0 0 0 0 0 0 0 0	00		Reserved, set to 0

C.2.4 GET request content

Using the GET request, the RSU requests specific attributes from the OBU, in this example CS2 (attribute number 2).

Octet #	Bit 7..0	Hex	Attribute/field	Description
0	x x x x x x x 0		LID	Private link-address
1	x x x x x x x 0			
2	x x x x x x x 0			
3	x x x x x x x 1			
4	1	A0	MAC.L	The frame contains an LPDU
	0		MAC.D	Direction is downlink
	1		MAC.R	Request for private window
	0		MAC.C/R	Command LPDU
	0 0 0 0		MAC.RES	Reserved. Set to 0
5	n 1 1 1 0 1 1 1	N7	LLC	
6	1 x x x x 0 0 1	Xx	Fragmentation header	
7	0 1 1 0	62	Get Request	Get Request
	0 0 1 0			No Access Credentials, No IID, AttributeIdlist present, Fill
8	0 0 0 0 0 0 0 1	01	EID	Element Identifier
9	0 0 0 0 0 0 0 1	01	AttridList.Length	Attribute Id List Length
10	0 0 0 0 0 0 1 0	02	Attribute Id (=2)	Attribute ID = 2, meaning CS2, see Annex A.5

C.2.5 GET response content

The OBU responds to the `GET.Request` with the `GET.response`.

Octet #	Bit 7..0	Hex	Attribute/field	Description
0	x x x x x x x 0		LID	Private link-address
1	x x x x x x x 0			
2	x x x x x x x 0			
3	x x x x x x x 1			
4	1	D0	MAC.L	The frame contains an LPDU
	1		MAC.D	Direction is uplink
	0		MAC.R	No request for private window
	1		MAC.C/R	Command LPDU
	0 0 0 0		MAC.RES	Reserved. Set to 0
5	n 1 1 1 0 1 1 1	X7	LLC control field	
5	0 0 0 0 0 0 0 0	00	LLC response	APDU Present
6	1 x x x x 0 0 1	Xx	Fragmentation header	
7	0 1 1 1	74		Get response
	0 1 0 0			No IID, attribute present, ret not present, fill
8	0 0 0 0 0 0 0 1	01	EID (as in the request)	
9	0 0 0 0 1 0 0 0	08	`attributelist.length` = 1	
10	0 0 0 0 0 0 1 0	02	attributeID = CS 2	See Annex A.5
11	0 0 0 1 1 1 0 1	1D	Container = 29	See Annex A.6
12	0 0 0 0 0 1 1 0	06	Value length = 6 octets	
13	0 0 0 0 0 0 0 0	00	`manufacturerId`	CS2 manufacturer ID: example Toyota = 23
14	0 0 0 1 0 1 1 1	17		
15	x x x x x x x x	XX	Manufacturer serial no	Manufacturer serial no
16	x x x x x x x x	XX		
17	x x x x x x x x	XX		
18	x x x x x x x x	XX		

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