# International Standard

**ISO 13141**

Second edition
2024-02

# Electronic fee collection — Localization augmentation communication for autonomous systems

*Perception de télépéage — Communications d'augmentation de localisations pour systèmes autonomes*

# Contents

# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This second edition cancels and replaces the first edition (ISO 13141:2015), which has been technically revised. It also incorporates the Amendment ISO 13141:2015/Amd. 1:2017.

The main changes are as follows:

— Clause 6 has been added, concerning conformance requirements;

— Clause 3 has been updated and ISO/TS 17573-2 has been made the primary source for terms and definitions;

— data definitions in Clause 8 have been updated, including making reference to ISO 17573-3 as the primary source;

— imported ASN.1 types with successors (i.e. including all future minor versions) have been used;

— Annex G has been revised to align with the evolution of the European Electronic Toll Service (EETS);[19],[20],[21]

— various editorial changes have been made to improve readability.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

# Introduction

On-board equipment (OBE) that uses satellite-based positioning technology to collect data required for charging for the use of roads operates in an "autonomous" way (i.e. generally without relying on dedicated roadside infrastructure). However, these autonomous systems can, in some places, need some roadside infrastructure support for proper identification of charge objects. Such assistance can be required at places where satellite-based localization accuracy or availability is insufficient or at places where the OBE is directly informed about the identity of the relevant charge object.

In an interoperable environment, it is essential that this localization information be available in a standardized way. This document specifies requirements for localization augmentation by dedicated short-range communication (DSRC) between roadside equipment (RSE) and OBE. This document makes no assumptions about the operator of the RSE in terms of its role according to ISO 17573-1, i.e. whether the RSE is operated by an entity in the service provision role or in the toll charging role.

This document has been prepared considering the following points.

— The localization augmentation communication (LAC) serves to transmit localization information to passing OBE without identifying individual OBE.

— The localization information contains both geographical location independent of charging context, and context-dependent identification of charge objects.

— A single roadside installation is able to provide localization augmentation for several overlapping electronic fee collection (EFC) contexts.

— This document is based on the EFC architecture specified in ISO 17573-1.

— The communication applies to all OBE architectures.

— This document is applicable to various DSRC media, especially the CEN DSRC stack.

— The communication supports security services for data origin authentication, integrity and non-repudiation.

This document specifies an attribute, LacData, which is communicated from the RSE to the OBE by means of an acknowledged writing service, which is implemented through the SET service of DSRC Layer 7 (ISO 15628 and EN 12834). The LAC application is specified as a self-contained DSRC application with its own application identifier (AID). Regarding the DSRC communications stack, this document provides specific definitions regarding the CEN DSRC stack as specified in EN 15509. Annexes C, D, E and H provide for use of the Italian DSRC as specified in ETSI/ES 200 674-1.[9] ISO CALM IR,[3] ARIB DSRC[10] and WAVE DSRC.[11]

All data relevant for the LAC application have been put into the attribute LacData, to create a single standard communications content which is transmitted by LAC RSE and always signed as a whole. LacData can transport both the geographic coordinates (latitude, longitude and altitude) and the identification of a specific charge object. All elements of LacData are mandatory, but Null values are specified to allow LAC installations to transmit only a selection of all specified data elements.

Access credentials are mandatory for writing LacData to protect OBE from non-authentic RSE. LacData are critical for charge determination and for providing evidence. For these purposes, the authenticators which are specified can be used to provide for data origin authentication, data integrity and non-repudiation for LacData. There are two separate authenticator fields specified to allow for separate authentication and non-repudiation, if required by the institutional arrangements of a toll system.

This document is "minimalist" in the sense that it covers what is required for operational systems and planned systems.

A test suite for checking an OBE or RSE implementation for conformance with ISO 13141:2015 is specified in ISO 13140-1:2016. This test suite will be updated to reflect the changes incorporated into this second edition of ISO 13141.

# Electronic fee collection — Localization augmentation communication for autonomous systems

## 1   Scope

This document establishes requirements for short-range communication for the purposes of augmenting the localization in autonomous electronic fee collection (EFC) systems. Localization augmentation serves to inform on-board equipment (OBE) about geographical location and the identification of a charge object. This document specifies the provision of location and heading information and security means to protect against the manipulation of the OBE with false RSE.

The localization augmentation communication (LAC) takes place between an OBE in a vehicle and fixed RSE. This document is applicable to OBE in an autonomous mode of operation.

This document specifies attributes and functions for the purpose of localization augmentation, by making use of the dedicated short-range communications (DSRC) communication services provided by DSRC Layer 7, and makes these LAC attributes and functions available to the LAC applications at the RSE and the OBE. Attributes and functions are specified on the level of application data units (ADUs; see Figure 1).

As depicted in Figure 1, this document is applicable to:

— the application interface definition between OBE and RSE;

— the interface to the DSRC application layer, as specified in ISO 15628 and EN 12834;

— the use of the DSRC stack.

The LAC is suitable for a range of short-range communication media. This document provides specific definitions regarding the CEN-DSRC stack as specified in EN 15509. Annexes C, D, E and H provide for the use of the Italian DSRC as specified in ETSI ES 200 674-1,[9] ISO CALM IR,[3] ARIB DSRC[10] and WAVE DSRC.[11]

This document contains a protocol implementation conformance statement (PICS) proforma in Annex B and transaction examples in Annex F. Annex G highlights how to use this document for the European Electronic Toll Service (EETS).

Test specifications are not within the scope of this document.

RSE                    OBE
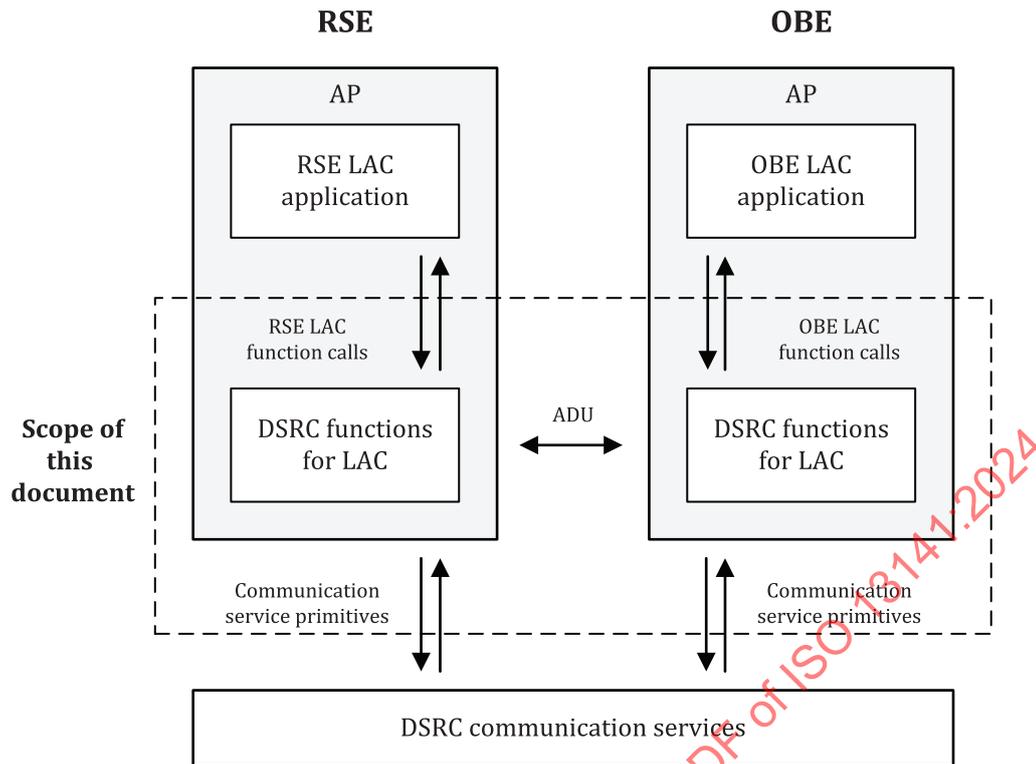


Key

AP    application process

ADU   application data unit

LAC   localization augmentation communication

OBE   on-board equipment

RSE   roadside equipment

**Figure 1 — The LAC application interface**

## 2   Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 8825-2, *Information technology — ASN.1 encoding rules — Part 2: Specification of Packed Encoding Rules (PER)*

ISO/IEC 9797-1:2011, *Information technology — Security techniques — Message Authentication Codes (MACs) — Part 1: Mechanisms using a block cipher*

ISO 14906:2022, *Electronic fee collection — Application interface definition for dedicated short-range communication*

ISO 15628:2013, *Intelligent transport systems — Dedicated short range communication (DSRC) — DSRC application layer*

ISO/IEC 18033-3:2010, *Information technology — Security techniques — Encryption algorithms — Part 3: Block ciphers*

EN 12834, *Road transport and traffic telematics — Dedicated Short Range Communication (DSRC) — DSRC application layer*

EN 15509:2023, *Electronic fee collection — Interoperability application profile for DSRC*

ISO 17573-3:2023, *Electronic fee collection — System architecture for vehicle-related tolling — Part 3: Data dictionary*

NIMA Technical Report TR8350.2 version 3, *Department of Defense World Geodetic System* 1984, *Its Definition and Relationships With Local Geodetic Systems*

# 3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

## 3.1
## access credentials
trusted attestation or secure module that establishes the claimed identity of an object or application

[SOURCE: ISO/TS 17573-2:2020, 3.4]

## 3.2
## attribute
addressable package of data consisting of a single data element or structured sequences of data elements

[SOURCE: ISO/TS 17573-2:2020, 3.13]

## 3.3
## authentication
security mechanism allowing verification of the provided identity

[SOURCE: EN 301 175 V1.1.1:1998, 3]

## 3.4
## authenticator
data, possibly encrypted, that is used for *authentication* (3.3)

[SOURCE: ISO/TS 17573-2:2020, 3.16]

## 3.5
## charge object
geographic or road related object for the use of which a charge is applied

[SOURCE: ISO/TS 17573-2:2020, 3.31]

## 3.6
## data integrity
property that data has not been altered or destroyed in an unauthorized manner

[SOURCE: ISO 7498-2:1989, 3.3.21]

## 3.7
## on-board equipment
all required equipment on-board a vehicle for performing required electronic fee collection (EFC) functions and communication services

[SOURCE: ISO/TS 17573-2:2020, 3.126]

**3.8**
**roadside equipment**
fixed or movable electronic fee collection (EFC) equipment located along or on the road

Note 1 to entry: Movable RSE can be mounted temporarily along the road or in a vehicle.

[SOURCE: ISO/TS 17573-2:2020, 3.161]

**3.9**
**service primitive**
elementary communication service provided by the application layer protocol to the application processes

[SOURCE: ISO/TS 17573-2:2020, 3.173]

**3.10**
**toll charger**
entity which levies toll for the use of vehicles in a toll domain

[SOURCE: ISO/TS 17573-2:2020, 3.194]

**3.11**
**toll context**
logical view as defined by *attributes* (3.2) and functions of the basic elements of a toll scheme consisting of a single basic tolling principle, a spatial distribution of the *charge objects* (3.5) and a single behaviour of the related front end

[SOURCE: ISO/TS 17573-2:2020, 3.196]

**3.12**
**toll service provider**
entity providing toll services in one or more toll domains

[SOURCE: ISO/TS 17573-2:2020, 3.206]

**3.13**
**transaction**
whole of the exchange of information between two physically separated communication facilities

[SOURCE: ISO/TS 17573-2:2020, 3.211]

# 4   Abbreviated terms

For the purposes of this document, the following abbreviated terms apply.

AC-CR        access credentials

ADU          application data unit

AID          application identifier

ASN.1        abstract syntax notation one

BST          beacon service table

CCC          compliance check communication

DSRC         dedicated short-range communication

EID          Element identifier

EFC          electronic fee collection

| ETRF | European terrestrial reference frames |
|------|----------------------------------------|
| IR | infrared |
| ITRF | international terrestrial reference frames |
| IUT | implementation under test |
| LAC | localization augmentation communication |
| MAC | message authentication code |
| OBE | on-board equipment |
| PICS | protocol implementation conformance statement |
| PSC | provider service context |
| RSE | roadside equipment |
| TC | toll charger |
| TSP | toll service provider |
| VST | vehicle service table |
| WGS84 | World Geodetic System 1984 |

# 5 Application interface architecture

## 5.1 General

This clause gives an insight into the LAC architecture by identifying the functions, the use of DSRC communication primitives, and the attributes addressed. A detailed description of the functions is given in Clause 7, while details of the attributes are in Clause 8.

The LAC application interface has been designed to make use of the CEN DSRC communication stack, via the application layer as specified in ISO 15628 and EN 12834. For other identified DSRC communication media, detailed mappings to corresponding services are given in Annexes C, D, E and H.

## 5.2 Services provided

The LAC application interface offers the following services to LAC applications:

— writing of data in order for the RSE to communicate location data to the OBE;

— authentication of the RSE by the OBE by means of access credentials.

There is no read service provided within the LAC communication. The RSE transmits data to the OBE using the underlying acknowledged communication services, to verify that the data are indeed properly transmitted over the DSRC interface.

The above services are realized by means of protocol exchanges performed by means of communication services and transactions as described in Clause 9.

The services are provided by the following functions:

— the "Initialise communication" function, which shall be used to establish the LAC communication link between the RSE and OBE;

— the "Write data" function, which shall be used to send LAC attributes to the OBE;

— the "Terminate communication" function, which shall be used to terminate the LAC communication.

## 5.3 Attributes

There is a single attribute specified for localization augmentation. This attribute contains a set of data which enables the OBE to determine its location with better accuracy and availability or to directly receive a charge object identification related to the local toll context. This set of data contains:

— geographic coordinates (latitude, longitude and altitude);

— a charge object reference.

When the RSE sends data to the set [i.e. write value(s) of the addressed attribute(s)] in the OBE, it shall transmit geographic coordinates or a charge object reference or both.

## 5.4 Contract and toll context

Regarding LAC, the OBE shall identify itself in the initialisation phase with a single LAC context mark in the VST. This context mark identifies the user contract in terms of the service provider, type of contract and version information. This information enables the RSE to decide whether the OBE carries a contract which it supports, and if so, to choose the corresponding security elements.

An RSE can provide the OBE with localization augmentation for several overlapping contexts simultaneously by writing the LAC attribute (which includes the applicable toll context) several times in one transaction.

NOTE       The LAC operates in a broadcast fashion, where the RSE has only minimal information about the OBE and is not able to assess the liability of a vehicle for tolls. For this reason, the OBE can receive LAC information which is not applicable.

## 5.5 Use of lower layers

### 5.5.1 Supported DSRC communication stacks

The LAC application interface makes use of the CEN DSRC communication stack as described in Table 1. Other communication media can be used as listed in Table 1 if an equivalent mapping to corresponding services is provided. Detailed examples are provided in Annexes C, D, E and H.

**Table 1 — Supported short-range communication stacks**

| Medium | Application layer | Lower layers | Detailed specifications |
|---|---|---|---|
| CEN DSRC | ISO 15628 and EN 12834 | EN 12795a and EN 12253a | Specification in 5.5.2 |
| Italian DSRC | ES 200 674–1 (2013, Clause 11 and Annex D)[9] | ES 200 674–1 (2013, Clauses 7 to 10 and Annex D)[9] | Implementation example in Annex C |
| ISO CALM IR | ISO 15628 and EN 12834a | ISO 21214 | Implementation example in Annex D |
| ARIB DSRC | ARIB STD-T75[10] and ISO 15628 | ARIB STD-T75[10] ITU-R.M1453–2[23] | Implementation example in Annex E |
| WAVE DSRC | IEEE 1609.11[15] ISO 15628 | IEEE 1609.3[13] IEEE 1609.4[14] IEEE 802.11[11] | Implementation example in Annex H |
| a        EN 12795[24] and EN 12253[25] have been adopted in ITU-R.M 1453–2.[23] | | | |

If more than one communication medium is implemented in an OBE, the OBE shall respond to RSE communications on the same medium as used by the RSE.

### 5.5.2 The use of the CEN DSRC stack

The LAC application shall be used with the CEN DSRC communication stack in the following ways:

— the OBE shall conform to EN 15509:2023, 6.1.2;

— the RSE shall conform to EN 15509:2023, 6.2.2.

NOTE      Conformance with EN 15509 implies conformance of the DSRC stack with ISO 15628 and EN 12834 regarding the application layer, and EN 12795[24] and EN 12253[25] for the lower layers.

## 6 Conformance

### 6.1 Conformance requirements

The following requirements apply to OBE and RSE:

— functions (including security functions) shall be as specified in Clause 7;

— application data shall be as specified in Clause 8 and supplemented by Annex A; and

— transaction model shall be as specified in Clause 9.

### 6.2 Conformance statement

A supplier of OBE that claims conformity of its OBE to the requirements specified in this document shall provide a statement of conformance by completing the PICS proforma as provided in B.3 and B.4.

A supplier of RSE that claims conformity of its RSE to the requirements specified in this document shall provide a statement of conformance to this document by completing the PICS proforma as provided in B.3 and B.5.

### 6.3 Conformance evaluation and testing

Suppliers of OBE or RSE claiming conformity of their equipment to this document for the communication medium CEN DSRC can perform their conformity tests according to specifications laid down in ISO 13140.

NOTE      The use of ISO 13140 implies the use of other underlying test standards for evaluation of conformance to this document.

## 7 Functions

### 7.1 General

In the view of the OBE, the LAC communication is a read-only data exchange. There is neither a request of OBE capabilities nor feedback from the OBE regarding the received data or commands. Consequently, the OBE shall support all standardized LAC RSE transaction sequences.

The RSE shall only broadcast, within the context of LAC transactions, attributes specified in this document.

### 7.2 Functional requirements

#### 7.2.1 Minimum supported transaction details

All functions specified in this subclause shall be available on the OBE.

For CEN DSRC, the functions shall be provided by the DSRC application layer as specified in ISO 15628 and EN 12834 (services INITIALISATION, SET and RELEASE).

Only the functions for CEN-DSRC are specified in 7.2.2 to 7.2.4. For other supported media according to 5.5.1, equivalent functionality shall be provided; for ETSI/ES 200 674-1 5,8 GHz microwave DSRC, see Annex C, for CALM infrared DSRC, see Annex D, for ARIB microwave DSRC, see Annex E, and for WAVE DSRC, see Annex H.

### 7.2.2 Initialising communication

Initialisation of the communication between the RSE and the OBE shall be initiated by the RSE, by means of the invocation of an initialisation request by the RSE. After successful initialisation, the function "Initialise communication" shall notify the applications on the RSE and OBE.

The initialisation notification on the OBE shall carry at least the identity of the beacon (e.g. the beacon serial number) and absolute time. The initialisation notification on the RSE shall carry the LAC application identity and also the data required for the security services (e.g. random number and key identifier).

The function "Initialise communication" shall be provided by the application layer INITIALISATION services, as specified in ISO 15628 and EN 12834. It is specified in Annex A (see `LacInitialiseCommRequst` and `LacInitialiseCommResponse`).

### 7.2.3 Writing of data

The function "Write data" shall be provided by the application layer SET service as specified in ISO 15628 and EN 12834. It is specified in Annex A (see `LacDataTxRequest` and `LacDataTxResponse`).

NOTE 1   The "mode" parameter in the `LacDataTxRequest` indicates whether the corresponding response is expected or not. If mode = false, the response primitive is not used and the reception is only acknowledged by the OBE on lower layers.

In the SET service primitives, `iid` shall not be used.

NOTE 2   The invocation of a service primitive by an application process implicitly calls upon and use services offered by the lower protocol layers.

The SET shall always carry access credentials.

### 7.2.4 Termination of communication

The RSE may terminate the communication on the application level with the OBE with the function "Terminate communication", by means of the invocation of a release request by the RSE.

NOTE   A termination of the communication on the link level is outside of the scope of this document.

The function "Terminate communication" shall be provided by the application layer service EVENT-REPORT, as specified in ISO 15628 and EN 12834. It is specified in Annex A (see `LacTerminateComm`).

## 7.3   Security

### 7.3.1   General

Security is an essential part of LAC applications. This document provides for both communication-related security services and communication-transparent data elements, which may provide security characteristics.

This document provides for a "Write data" function and uses access credentials as a mandatory communication security provision. Access credentials provide for protection against unauthorized writing of LAC data, and hence for authentication of the LAC RSE and the LAC data to the OBE. The detailed implementations of the communication security services are media-specific (see 7.3.2 and 7.3.3 for CEN DSRC and Annexes C, D, E and H for other communication media).

NOTE 1   Authentication of the OBE to the RSE according to ISO 14906 is not supported as the identity of the OBE and contract are not relevant for the LAC application.

This document provides for data elements, which may provide data origin authentication, data integrity and non-repudiation characteristics to the LAC data. The LAC application is transparent to these authenticators, which may be stored together with the other LAC data elements as a data packet, which is either protected against forgery or protected against repudiation (between the user and the LAC operator, for example) or protected against both.

NOTE 2    This document does not provide for an encryption service. No privacy-sensitive data are transferred by LAC.

### 7.3.2    Authentication of RSE — Access credentials

Access credentials shall be used to manage access to the LAC attribute. Access credentials are mandatory. The "Write data" function shall always carry access credentials.

The CEN DSRC OBE shall support the calculation of access credentials according to security level 1, as specified in ISO 14906:2022, 7.1.4.

The CEN DSRC RSE shall be able to calculate access credentials according to security level 1, as specified in ISO 14906:2022, 7.1.4.

Access credentials are specified as being of ASN.1 type `OCTET STRING`. This only pertains to the ASN.1 syntax; the semantics are media-dependent.

### 7.3.3    Authentication of LAC Data

The data elements `macTc` and `mac2` (see 8.5) may contain authenticators, as well as key references which are used for the calculation of those authenticators, and are provided to guarantee data origin authentication, integrity and non-repudiation characteristics to the LAC data.

The two data elements are provided to allow for separate elements for authentication and non-repudiation, if required. The LAC application is transparent to these authenticators, which implies that it supports various system security concepts.

The data element `macTc` shall be of type `MacTc`.

The data element `mac2` shall be of ASN.1 type `OCTET STRING`. The semantics of the data elements are media-independent.

## 8    Attributes

### 8.1    General

Within the LAC context, the attributes and data elements listed in Table 2 shall be made available.

**Table 2 — LAC attributes**

| AttributeID[a] | Attribute | Data element | Length in Octets[b] | Remarks |
|---|---|---|---|---|
| n.a. | LacContextMark | contractProvider | 3 | |
| | | typeOfContract | 2 | |
| | | contextVersion | 1 | |
| 54 | LacData | lacOperator | 3 | |
| | | rseId | 2 | |
| | | latitude | 4 | in micro degrees |
| | | longitude | 4 | in micro degrees |
| | | altitude | 2 | resolution 0,25 m |
| | | tollCharger | 6 | |
| | | chargeObject | 6 | |
| | | distanceToObject | 2 | |
| | | lacTime | 4 | |
| | | macTc | 8 | |
| | | mac2 | 8 | |
| 87-127 | ReservedForPrivateUse | — | — | |

[a]   The assignment of attribute IDs is aligned with ISO 17573-3, ISO 14906 and ISO 12813. Attributes 87 to 127 are assigned for private use. All other remaining IDs are reserved for future use.

[b]   Including the length determinant as specified in ISO/IEC 8825-2 (packed encoding rules for ASN.1 are used in this document). In case of discrepancies between the length and the ASN.1 module, the ASN.1 module specified in Annex A shall take precedence.

The data primitive lacContextMark shall be part of ApplicationContextMark as specified in Annex A. lacContextMark shall be of data type LacContextMark.

NOTE      lacContextMark is not an addressable attribute. It is part of the VST and can neither be read nor written by the RSE as part of the LAC application.

In the following subclauses, LAC attributes and data elements are specified in terms of:

— the names of the data elements forming the LAC attributes;

— the semantic definition of the data element; and

— informative remarks, including references to other standards.

The specification of the corresponding data types in ASN.1 is provided in Annex A.

## 8.2   Data regarding location reference

To translate longitude, latitude and altitude coordinates to the corresponding real position on Earth or vice versa, the geodetic datum shall be WGS84(G1150), according to NIMA TR8350.2 version 3, per default unless another Earth-centred, Earth-fixed polar coordinate geodetic datum is agreed mutually by the toll charger (TC) and toll service provider (TSP).

Furthermore, by default any Earth-centred, Earth-fixed polar coordinate geodetic datum may be used, as long as the maximum datum displacement relative to the geodetic datum prescribed is acceptable to the TC of the related toll domain.

The maximum tolerated datum displacement, also called datum shift, should not exceed 0,4 m.

NOTE 1      The recommended maximum tolerated displacement allows, for example, for using one of the International Terrestrial Reference Frames (ITRF), the Russian PZ90.2 or one of the European Terrestrial Reference Frames (ETRF) as geodetic datums alternative to the WGS84.

The calculated datum displacement should be determined according to the definitions in ASME Y14.5 – 2009. [8]

The data element `latitude` shall contain the latitudinal coordinate of the centre of the road surface covered by the specific LAC implementation, value in microdegrees. For values > 0 = north, < 0 = south, absolute value shall not exceed 90 degrees.

The data element `longitude` shall contain the longitudinal coordinate of the centre of the road surface covered by the specific LAC implementation, value in microdegrees. For values > 0 = east, < 0 = west, absolute value shall not exceed 180 degrees.

The data element `altitude` shall contain the altitude according to definition of the chosen geodetic model of the centre of the road surface covered by the specific LAC implementation, where a unit is 0,25 m.

In case no geographic coordinates are provided, a coding of all zero shall be used (`latitude`, `longitude` and `altitude` equal zero).

NOTE 2    The location indicated by the coding for "no geographic coordinates provided" is not on land surface and does not need to be supported.

The data element `chargeObject` shall identify the charge object for which LAC is operated, according to the local definition of the TC owning the respective toll scheme. The data element contains `chargeObjectDesignation` with the same syntax and semantics as in `chargeObjectDesignation` specified in ISO 17573-3. The second data element `regimeId` is kept for backward compatibility and shall no longer be used, i.e. shall be zero.

NOTE 3    The data element `tollContext` (of type `Provider`) in `tollCharger` together with `chargeObjectDesignation` from `chargeObject` provide the information contained in `ChargeObjectId` as used and as specified in ISO 17573-3.

In case no TC-dependent information is provided, a coding of all zero shall be used (`tollCharger` and `chargeObject` equal to zero).

NOTE 4    The data element `chargeObject` in combination with `tollCharger` can be used to identify any kind of charge object, e.g. road section, passage of cordon. Identification of lanes can be provided in accordance with the restrictions of the communication medium.

The data element `distanceToObject`, shall contain the distance, in metres, to the charge object as identified by the element `chargeObject`, from the point of operation of the LAC. Negative values indicate that the charge object precedes the RSE in the sense of direction of traffic.

NOTE 5    In order to avoid charging errors, it is advisable to not allow vehicles to exit to another road after receiving the LAC message and without using the charge object.

## 8.3   Operational data

The data element `lacOperator` shall identify the organization that operates LAC, i.e. the entity responsible for data content of the LAC transaction. The data element is as specified in ISO 17573-3. It contains the country code and the Id of the operator assigned on a national basis.

The data element `rseId` shall contain an operator-specific identification of the RSE which operates LAC.

The data element `tollCharger` shall identify the TC which owns the toll scheme for which LAC is operated. The data element is as specified in ISO 17573-3.

The data element `lacTime` shall contain the time at which the LAC transaction occurred. The data element is as specified in ISO 17573-3.

## 8.4   OBE contractual data

The data element `lacContextMark` shall identify the user contract in terms of the service provider, type of contract and context version information. It contains the same information as `EfcContextMark`, specified in ISO 17573-3.

The coding and usage of this data element is service-provider specific. It shall be used as a minimum to manage and distinguish OBE supporting different future versions of this document and to identify the related LAC security elements.

NOTE    It is assumed that the OBE supports only this edition of this document (in order to reduce the OBE's complexity) and that the LAC RSE will support all existing OBE conforming to different editions of this document.

## 8.5   Security-related data

The data element `macTc` shall be used for authentication of LAC data to the TC for non-repudiation reasons.

The MAC value of `macTc` shall be calculated by the RSE using the LAC authentication master key over the octet string represented by:

— the LAC data elements without `macTc` and `mac2`; and

— a nonce value (a random generated number) from `macTc` (this is a string of 33 octets from the first nine `LacData` data elements concatenated with 2 octets from nonce).

The padding of this octet string shall be according to the rules of the used enciphering and MAC algorithm.

NOTE 1    The data elements `lacTime`  and `nonce` from `macTc` are the only variable parts (6 octets) of the input to calculate the MAC for the same LAC RSE.

The RSE shall use one of the following algorithms for calculating the MAC:

1) CBC-DES according to ISO/IEC 9797-1:2011 MAC algorithm 1 using the DEA algorithm according to ISO/IEC 18033-3:2010 with a LAC authentication key of 8 octets;

2) CMAC according to ISO/IEC 9797-1:2011 MAC algorithm 5 using AES-128 according to ISO/IEC 18033-3:2010 with a LAC authentication key of 16 octets.

NOTE 2    The MAC and encryption algorithm of the first option are identical to the requirements specified in ISO 14906:2022.

The data element `macTc` contains:

— `keyRef`: the reference to the key to be used for the enciphering algorithm;

— `algorithmId`: the algorithm option 1 or 2 to be used from the list above;

— `mac`: the leftmost 32 bits (4 octets) of the calculated MAC;

— `nonce`: 2 random octets generated by the RSE used in the MAC calculation.

The data element `mac2` may contain security-related data regarding the first nine data elements of the attribute `LacData` (a string of 33 octets). This may comprise authenticators, as well as key references. The calculation, the coding and the applicability of this data element is outside of the scope of this document.

# 9   Transaction model

## 9.1   General

The transaction model related to the LAC Application Interface for DSRC shall conform to ISO 14906:2022, Clause 6, with the restrictions and amendments specified in 9.2 and 9.3, for implementation using the CEN DSRC communication stack. Details on the transaction model and addressing for other communication media (if any) are given in the relevant annexes.

The transaction model comprises two phases: the initialisation phase and the transaction phase.

## 9.2   Initialisation phase

### 9.2.1   General structure

Initialisation of the communication shall be carried out by the RSE by means of the function "Initialise communication".

The OBE evaluates the initialisation request to decide whether the LAC application is supported. If the OBE does not support the LAC application, it shall not respond to the initialisation request. If the OBE supports the LAC application, it shall respond to the initialisation request.

### 9.2.2   LAC application-specific contents of the BST

AID = 21 shall be used for the LAC application.

The RSE shall initialise only one instance of the LAC application; this means that there shall be only one instance of AID = 21 in the BST.

NOTE        This does not exclude the BST from carrying information related to other applications, which can be active at the RSE (e.g. the CCC application as given in ISO 12813).

The LAC application shall be qualified as a mandatory application. EID shall not be transmitted in the BST related to the EFC application. No parameter shall be transmitted in the BST related to the LAC application.

### 9.2.3   LAC application-specific contents of the VST

There shall be only one instance of AID = 21 in the `ApplicationList` in the VST. This instance shall contain the parameter `ApplicationContextMark`, as specified in EN 15509:2023, Annex A, corresponding to security level 1.

The TSP shall make use of the data element `contextVersion` to ensure that the value of the `LacContextMark` corresponds to one unique dated version of ISO 13141 (this document) through a reference table, which is made available to the TC, allowing it to identify to which specific version of the LAC application interface definition the OBE conforms.

## 9.3   Transaction phase

After completion of the initialisation phase, the RSE application shall be notified.

The transaction phase may be performed as a sequence of one or more "Write data" functions on the LAC attribute. Each "Write data" function shall write the LAC data for one particular toll context for which the LAC service is provided. "Write data" functions may be concatenated as far as allowed by the specific communication medium.

NOTE        To ease the implementation of an OBE supporting the LAC application, the LAC data attribute can be implemented as an instance attribute which stores various instances of the LAC attribute, which are written during one single LAC transaction using subsequent write functions.

The OBE shall respond to the functions invoked by the RSE and shall not initiate any functions.

The RSE may terminate the communication using the function "Terminate communication".

# Annex A
## (normative)

# LAC data type specifications

This annex contains the Abstract Syntax Notation One (ASN.1) definition of:

— the data types related to the LAC functions as specified in Clause 7,

— the data types related to the LAC attributes described in Clause 8, and

— the ASN.1 container types for ISO Layer 7.

These definitions use the ASN.1 technique in accordance with ISO/IEC 8824-1. The unaligned packed encoding rules given in ISO/IEC 8825-2 with the restrictions specified in ISO 15628:2013, 6.2.7, shall apply.

The ASN.1 module is identified by the Object Identifier {iso(1) standard(0) 13141 version2(2) minor version(1)}.

The actual ASN.1 module is contained in the attached file "ISO13141(2023)EfcLacV2.1.asn", which can be directly imported by a compiler. This file is available for download via https://standards.iso.org/iso/13141/ed-2/en.

The syntax and semantics of the data types in the ASN.1 types in the attachment "ISO13141(2023) EfcLacV2.1.asn" that are imported shall conform to ISO 17573-3 and ISO 14906, respectively.

Table A.1 provides the SHA-256 cryptographic hash digest for the referenced file, offering a means to verify the integrity of the file. The SHA-256 algorithm is specified in NIST 180-4.[16]

**Table A.1 — SHA-256 cryptographic hash digest**

| File name | SHA-256 cryptographic hash digest |
|---|---|
| ISO13141(2023)EfcLacV2.1.asn | 89b4b7363215d0db2ecd4dd0c615df4cbc763a230dde3b1b0c16f9abc1536c4e |

NOTE    Pasting the text of the file into one of the hash digest computation pages available on the web can result in a non-matching hash digest due to changes in the underlying coding.

# Annex B
## (normative)

# PICS proforma for the data elements in the attribute

## B.1 General

This annex includes the protocol implementation conformance statement (PICS) proforma to be used for the attributes specified in Clause 8 and Annex A.

To evaluate conformance of a particular implementation, a statement of which capabilities and options have been implemented shall be provided. Such a statement is called an implementation conformance statement (ICS) or more specifically, in case it covers transactions, a PICS. This annex provides PICS templates, which shall be filled in by equipment suppliers.

## B.2 Requirements and guidance for completing the PICS proforma

### B.2.1 Purpose and structure

The purpose of this PICS proforma is to provide a mechanism whereby a supplier of an implementation of the requirements specified in this document may provide information about the implementation in a standardized manner.

The PICS proforma is subdivided into the following categories of information:

— identification of the implementation;

— identification of the protocol;

— global statement of conformance;

— PICS proforma tables.

### B.2.2 Abbreviated terms and conventions

#### B.2.2.1 General

The PICS proforma contained in this annex comprises information in tabular form in accordance with the guidelines given in ISO/IEC 9646-7.

#### B.2.2.2 Item column

The item column contains a number which identifies the item in the table.

#### B.2.2.3 Item description column

The item description column describes each respective item (e.g. parameters, data element). It implicitly means "is <item description> supported by the implementation?"

#### B.2.2.4 Status column

This column indicates the level of support required for conformance to this document. The values are as follows:

m        mandatory support is required;

o        optional support is permitted for conformance to the standard. If implemented, it shall conform to the specifications and restrictions contained in the standard. These restrictions can potentially affect the optionality of other items.

In the PICS proforma tables, every leading item marked "m" shall be supported by the IUT. Sub-items marked "m" shall be supported if the corresponding leading item is supported by the IUT.

### B.2.2.5   Reference column

The reference column refers to this document, except where explicitly stated otherwise.

### B.2.2.6   Support column

This column shall be completed by the supplier or implementer to indicate the level of implementation of each item. The proforma has been designed such that values are:

Y or y                yes, the item has been implemented;

N or n                no, the item has not been implemented;

N.A or n.a.           the item is not applicable.

All entries within the PICS proforma shall be made in ink. Alterations to such entries shall be made by crossing out, not erasing nor making the original entry illegible, and writing the new entry alongside. All such alterations to records shall be initialised by the staff making them.

### B.2.2.7   References to item

Each line within the PICS proforma which requires that implementation details be entered is numbered on the left-hand edge of the line. This numbering is included as a means of uniquely identifying all possible implementation details within the PICS proforma. This referencing is used both inside the PICS proforma and for references from other test specification documents.

The means of referencing individual responses is carried out in the following sequence:

a)    a reference to the smallest individual response enclosing the relevant item;

b)    a solidus character, '/';

c)    the reference number of the row in which the response appears;

d)    if, and only if, more than one response occurs in the row identified by the reference number, then each possible entry is implicitly labelled a, b, c, etc., from left to right and this letter is appended to the sequence.

EXAMPLE 1      B.10/4 is the reference to the answer of item 4 in Table B.10.

EXAMPLE 2      B.10/3b is the reference to the second answer (i.e. in the second support column, if present) of item 3 in Table B.10.

## B.3   Instructions for completing the PICS proforma

### B.3.1   General

The supplier of the implementation shall complete the PICS proforma in each of the spaces provided. In particular, an explicit answer shall be entered in each of the support or supported column boxes provided, using the notation described in B.2.2.6.

If necessary, the supplier may provide additional comments in the space at the bottom of the tables or separately.

### B.3.2 Definition of support

A capability is said to be supported if the implementation under test (IUT) is able to:

— generate the corresponding operation parameters (either automatically or because the end user requires that capability explicitly);

— interpret, handle and when required, make available to the end user the corresponding error or result.

A protocol element is said to be supported for a sending implementation if it is able to generate it under certain circumstances (either automatically or because the end user requires relevant services explicitly).

A protocol element is said to be supported for a receiving implementation if it is correctly interpreted and handled and also, when appropriate, made available to the end user.

## B.4 PICS proforma for the OBE

### B.4.1 Identification of the implementation

The supplier of the OBE shall provide information about the identification of the OBE implementation by filling out the templates provided in Tables B.1, B.2, B.3 and B.4.

**Table B.1 — Identification of PICS**

| Item No. | Question | Response |
|---|---|---|
| 1 | Date of statement (DD/MM/YY) | |
| 2 | PICS serial number | |
| 3 | System conformance statement cross-reference | |

**Table B.2 — Identification of the implementation or system or both**

| Item No. | Question | Response |
|---|---|---|
| 1 | TSP or EFC context name | |
| 2 | Version number | |
| 3 | Other information | |

**Table B.3 — Identification of the OBE supplier**

| Item No. | Question | Response |
|---|---|---|
| 1 | Organization name | |
| 2 | Contact name(s) | |
| 3 | Address | |
| 4 | Telephone number | |
| 5 | Email address | |
| 6 | Other information | |

### Table B.4 — Identification of the OBE

| Item No. | Question | Response |
|---|---|---|
| 1 | Brand name | |
| 2 | Type, version | |
| 3 | Manufacturer ID | |
| 4 | Equipment class | |
| 5 | Serial numbers of supplied units | |
| 6 | Other information | |

### B.4.2 Identification of the applied standard version

The supplier of the OBE shall provide information about the identification of the applied standard by filling out the template provided in Table B.5.

### Table B.5 — Identification of the standard

| Item No. | Question | Response |
|---|---|---|
| 1 | Title, reference no., publication date of the document | |
| 2 | Document edition number | |
| 3 | Implemented annexes | |
| 4 | Implementer's guide version no. | |
| 5 | Implementation defect reports (ref. no.) | |
| 6 | Other information | |

### B.4.3 Global statement of conformance

Are all mandatory capabilities implemented? (Yes/No) ............

NOTE 1    Answering "No" to this question indicates non-conformance with the specification. Non-supported mandatory capabilities are identified in the ICS, with an explanation of why the implementation is non-conforming, on pages attached to the ICS proforma.

Which security level is implemented (0/1)............

NOTE 2    For definitions of the security levels, see 7.3.

### B.4.4 PICS proforma tables

This part of the PICS proforma identifies the supported application context, the communication services and attributes (ADUs).

The supplier of the OBE shall provide the respective information by filling out the templates provided in Tables B.6, B.7, B.8, B.9 and B.10.

### Table B.6 — Security requirements

| Item No. | Element | Reference | Status | Support |
|---|---|---|---|---|
| 1 | Security level 1 — Access credentials | ISO 14906 | m | |

**Table B.7 — Required Layer 7 functions**

| Item No. | Element | Subclause No./Reference | Status | Support |
|---|---|---|---|---|
| 1 | INITIALISATION | 7.2.2 | m | |
| 2 | SET | 7.2.3 | m | |
| 5 | EVENT_REPORT | 7.2.4 | m | |

**Table B.8 — Implemented DSRC stacks**

| Item No. | Element | Subclause No./Reference | Status | Support |
|---|---|---|---|---|
| 1 | CEN DSRC | 5.5.2 | o[a] | |
| 2 | CALM IR | Annex D | o[a] | |
| 3 | Italian DSRC ETSI/ ES 200 674–1[9] | Annex C | o[a] | |
| 4 | ARIB DSRC[10] | Annex E | o[a] | |
| 5 | WAVE DSRC | Annex H | o[a] | |
| a  One or more DSRC stacks shall be implemented. | | | | |

**Table B.9 — Data requirements regarding the LAC-Context Mark**

| Item No. | Element | Subclause No./Reference | Status | Support coding |
|---|---|---|---|---|
| 1 | lacContextMark | 8.4 | m | |

**Table B.10 — Data requirements regarding location reference**

| Item No. | Element | Subclause No./Reference | Status | Support read protection | Support coding |
|---|---|---|---|---|---|
| 1 | lacOperator | 8.3 | m | | |
| 2 | rseId | 8.3 | m | | |
| 3 | latitude | 8.2 | m | | |
| 4 | longitude | 8.2 | m | | |
| 5 | altitude | 8.2 | m | | |
| 6 | tollCharger | 8.3 | m | | |
| 7 | chargeObjectId | 8.2 | m | | |
| 8 | distanceToObject | 8.2 | m | | |
| 9 | lacTime | 8.3 | m | | |
| 10 | macTc | 8.5 | m | | |
| 11 | mac2 | 8.5 | m | | |

## B.5   PICS proforma for the RSE

### B.5.1   Identification of the implementation

The supplier of the RSE shall provide information about the identification of the OBE implementation by filling out the templates provided in Tables B.11, B.12, B.13 and B.14.

**Table B.11 — Identification of PICS**

| Item No. | Question | Response |
|---|---|---|
| 1 | Date of statement (DD/MM/YY) | |
| 2 | PICS serial number | |
| 3 | System conformance statement cross-reference | |

**Table B.12 — Identification of implementation or system or both**

| Item No. | Question | Response |
|---|---|---|
| 1 | TSP or EFC context name | |
| 2 | Version number | |
| 3 | Other information | |

**Table B.13 — Identification of the RSE supplier**

| Item No. | Question | Response |
|---|---|---|
| 1 | Organization name | |
| 2 | Contact name(s) | |
| 3 | Address | |
| 4 | Telephone number | |
| 5 | Email address | |
| 6 | Other information | |

**Table B.14 — Identification of the RSE**

| Item No. | Question | Response |
|---|---|---|
| 1 | Brand name | |
| 2 | Type, version | |
| 3 | Manufacturer ID | |
| 4 | Serial numbers of supplied units | |
| 5 | Other information | |

## B.5.2 Identification of the applied standard version

The supplier of the RSE shall provide information about the identification of the applied standard by filling the template provided in Table B.15.

**Table B.15 — Identification of the standard**

| Item No. | Question | Response |
|---|---|---|
| 1 | Title, reference no., publication date of the document | |
| 2 | Document edition number | |
| 3 | Implemented annexes | |
| 4 | Implementer's guide version no. | |
| 5 | Implementation defect reports (ref. no.) | |
| 6 | Other information | |

## B.5.3 Global statement of conformance

Are all mandatory capabilities implemented? (Yes/No)..........

NOTE 1     Answering "No" to this question indicates non-conformance to the specification. Non-supported mandatory capabilities are identified in the ICS, with an explanation of why the implementation is non-conforming, on pages attached to the ICS proforma.

Which security level is implemented? (0/1)...........

NOTE 2     For definitions of the security levels, see 7.3.

## B.5.4 PICS proforma tables

This part of the PICS proforma identifies the supported application context, the communication services and attributes (ADUs).

The supplier of the RSE shall provide the respective information by filling out the templates provided in Tables B.16, B.17, B.18, B.19 and B.20.

**Table B.16 — Security requirements**

| Item No. | Element | Reference | Status | Support |
|---|---|---|---|---|
| 1 | Security level 1 – Access credentials | ISO 14906 | m | |
| 2 | LAC data non-repudiation to the TC | 7.3.3 | o | |

**Table B.17 — Required Layer 7 functions**

| Item No. | Element | Subclause No./ Reference | Status | Support |
|---|---|---|---|---|
| 1 | INITIALISATION | 7.2.2 | m | |
| 2 | SET | 7.2.3 | m | |
| 5 | EVENT_REPORT | 7.2.4 | m | |

**Table B.18 — Implemented DSRC stacks**

| Item No. | Element | Subclause No./ Reference | Status | Support |
|---|---|---|---|---|
| 1 | CEN DSRC | 5.5.2 | o[a] | |
| 2 | CALM IR | Annex D | o[a] | |
| 3 | Italian DSRC ETSI/ES 200 674–1[9] | Annex C | o[a] | |
| 4 | ARIB DSRC[10] | Annex E | o[a] | |
| 5 | WAVE DSRC | Annex H | o[a] | |
| [a] One or more DSRC stacks shall be implemented. | | | | |

**Table B.19 — Data requirements regarding the LAC-Context Mark**

| Item No. | Element | Subclause No./ Reference | Status | Support coding |
|---|---|---|---|---|
| 1 | lacContextMark | 8.4 | m | |

**Table B.20 — Data requirements regarding location reference**

| Item No. | Element | Subclause No./ Reference | Status | Support write protection | Support coding |
|---|---|---|---|---|---|
| 1 | lacOperator | 8.3 | m | | |
| 2 | rseId | 8.3 | m | | |
| 3 | latitude | 8.2 | m | | |
| 4 | longitude | 8.2 | m | | |
| 5 | altitude | 8.2 | m | | |
| 6 | tollCharger | 8.3 | m | | |
| 7 | chargeObjectId | 8.2 | m | | |
| 8 | distanceToObject | 8.2 | m | | |
| 9 | lacTime | 8.3 | m | | |
| 10 | macTc | 8.5 | m | | |
| 11 | mac2 | 8.5 | m | | |

# Annex C
## (informative)

# ETSI/ES 200 674-1 communication stack usage for LAC applications

## C.1  General

This annex:

— lists the requirements which are fulfilled by an LAC application in order to use ETSI/ES 200 674-1[9] as a communication media;

— shows how LAC generalized communication functions are mapped onto ETSI/ES 200 674-1 service primitives;

— gives the memory locations of specific LAC attributes.

Security algorithms and calculations, as well as the transaction model, are as specified in ETSI/ES 200 674-1:2013, Annex D.

## C.2  Requirements

Using the ETSI/ES 200 674-1 communication stack for transferring LAC data requires being conformant to the whole standard, including its Annex D.

## C.3  Function correspondences

Table C.1 shows the correspondence between LAC functions and the directives specified in ETSI/ES 200 674-1:2013, Clause 11. Different directives are used to access data, which are located in different memory regions.

**Table C.1 — Functions correspondences**

| LAC function | ETSI/ES 200 674–1 directive[9] |
|---|---|
| Initialise communication | `Open-Rq` concatenated with `Get-TBA-Random-Rq`, concatenated with `Get-Master-Record-Rq` |
| Data writing | For Application Core: `Write-Appl-Core-Rq`<br>For Application Record: `Write-Appl-Record-Next-Rq` |
| Authenticated data writing | Concatenation of:<br>`Set-Credential-Rq`, a Data-writing operation as above in this table |
| Terminate communication | `Close-Rq` |

The following recommendations apply.

a)  After the first interaction to initialise the communication link, a `Select-TBA-Id-Rq` directive should be concatenated to all other requests.

b)  If the write transaction spans a number of DSRC interactions, the RSE should repeat its authentication, as long as there is room for authentication data and primitives in that interaction.

The address of the LAC application (AID parameter) corresponds to the "Called AP Invocation Identifier" parameter in the A-Associate service primitive.

## C.4  Data storage and addressing

The main characteristic of OBE data addressing in ETSI/ES 200 674-1 is that data are referenced by position, i.e. by specifying their location in the OBE virtual memory. There is a specific virtual memory structure for each application type. This clause describes the OBE virtual memory structure for the LAC application.

The ETSI/ES 200 674-1 virtual memory is structured for each and every application into two areas:

1)  master;

2)  application.

The master area is common to all applications. It is read-only and contains information that is of common use. It is divided into two sub-areas that can be accessed via specific directives, as specified in Table C.2.

**Table C.2 — Master sub-area directives**

| Sub-area | Directives |
|---|---|
| Core | Read-Master-Core-Rq |
| Record | Get-Master-Record-Rq |

The application area is application-specific and generally read/write. It is also divided into two sub-areas that can be accessed via specific directives, as specified in Table C.3.

**Table C.3 — Application subarea directives**

| Subarea | Directives |
|---|---|
| Core | Read-Appl-Core-Rq, Write-Appl-Core-Rq |
| Record | Read-Appl-Record-Rq, Write-Appl-Record-Curr-Rq |

NOTE        Other ETSI/ES 200 674–1 directives are available for writing and reading in the Application area, but these are not used for LAC applications and are not listed here.

Table C.4 shows where relevant LAC information is stored in the ETSI/ES 200 674–1 virtual memory.

**Table C.4 — ETSI/ES 200 674–1 data storage for LAC attributes**

| Area | Displacement | Length | Description |
|---|---|---|---|
| Master Core | 0 | 2 | ManufacturerId |
|  | 2 | 2 | Equipment Class |
|  | 4 | 10 | Reserved |
| Master Record | 0 | 2 | EFC application. Has the value of 50F0 (Hex) |
|  | 2 | 2 | EFC application sub-identifier. Has the value of 0001 (Hex) for the LAC application |
|  | 4 | 6 | EFC ContextMark (LAC Context Mark) |
|  | 10 | 2 | AC_CR-KeyReference |
| Application Core | 0 | 8 | MAC-TC |
|  | 8 | 8 | MAC2 |

**Table C.4** *(continued)*

| Area | Displacement | Length | Description |
|---|---|---|---|
| Application Record | 0 | 3 | LAC Operator |
| | 3 | 2 | RSEId |
| | 5 | 4 | Latitude |
| | 9 | 4 | Longitude |
| | 13 | 2 | Altitude |
| | 15 | 6 | TollCharger |
| | 21 | 6 | ChargeObject |
| | 27 | 2 | DistanceToObject |
| | 29 | 4 | LACTime |

Reading or writing multiple attributes in a single DSRC interaction is possible for attributes which are stored sequentially in the same memory region. This can be accomplished by specifying a displacement corresponding to first attribute to be read or written, and a length equal to the sum of the attributes' lengths.

EXAMPLE    Setting the latitude and longitude attributes can be accomplished by means of an operation like: `Write-Appl-Record-Curr-Rq`, with offset = 5, and length = 8.

# Annex D
(informative)

# IR communication usage for LAC applications

## D.1 Using the IR Communication stack (CALM IR)

This annex specifies the use in localization augmentation applications of the CALM (communications access for land mobiles) IR (infrared) stack, as specified in ISO 21214.

## D.2 DSRC requirement

The OBE and RSE should be according to ISO 21214 in the compatibility mode.

NOTE        ISO 21214 specifies the physical and data link layer of CALM IR.

## D.3 Functions

The LAC-specific functions should be implemented as specified in Clause 7.

## D.4 Data requirements

The addressing of the EFC system and application data implemented by the OBE and RSE should be according to the rules given in ISO 14906:2022, 5.3.

The OBE should implement the LAC attributes specified in Clause 8.

The RSE should support any OBE that is otherwise conformant.

## D.5 Security requirements

The security requirements should be as specified in 7.3.

## D.6 Transaction requirements

The transaction requirements should be as specified in Clause 9.

# Annex E
## (informative)

# ARIB DSRC communication stack usage for LAC applications

## E.1 Using the ARIB DSRC communication stack

This annex specifies the use of the ARIB 5,8 GHz microwave DSRC link for localization augmentation applications.[10]

## E.2 DSRC requirements

The DSRC should be according to ARIB STD-T75, Clause 2. The DSRC communication stack should be according to ARIB STD-T75, Clause 4.

## E.3 LAC functions

The LAC functions should be implemented as DSRC Layer 7 services, as specified in ARIB STD-T75, 4.4.2.1.2.

The SET service should always carry AC-CR for secure communication.

## E.4 Data requirements

The addressing of the EFC system and application data implemented by the OBE and RSE should be according to the rules given in ISO 14906:2022, 5.3. For LAC application data, EID should always be used.

The OBE should implement the LAC attributes specified in Clause 8.

The RSE should support any OBE that is otherwise conformant.

## E.5 Security requirements

A security mechanism can be specified independently of ARIB DSRC in the future, in the form of security guidelines, as given in ISO/TS 17574.

## E.6 Transaction requirements

### E.6.1 General

The EFC transaction model is conformant with ISO 14906:2022, Clause 9, with the restrictions and amendments defined in E.6.2 to E.6.4.

### E.6.2 Initialisation phase — LAC application-specific contents of the BST

AID = 21 should be used for the LAC application. There should be only one instance of AID = 21 in the BST.

The LAC application should be qualified as a mandatory application.

### E.6.3 Initialisation phase — LAC application-specific contents of the VST

There should be only one instance of AID = 21 in the ApplicationList in the VST. This instance should contain the parameter `ApplicationContextMark` as specified in ISO 15628:2013, Clause A.2.

Hence, the reference to security level 1 and the last sentence shall be deleted [i.e. Numbering of AID should be according to ISO 15628 (where AID from 0 to 19 are already defined) shall be deleted].

### E.6.4   Transaction phase

The transaction phase should be performed as described in Clause 9.

# Annex F
## (informative)

# LAC transaction example

This annex gives an example of an LAC transaction for the case of an RSE sending localization augmentation data for two overlapping toll contexts.

For the two toll contexts, the LAC data provided differ in the data field `tollCharger` and can also differ in the identification of the charge object (`chargeObject`) and possibly in the field LACOperator. These differences in data content naturally also lead to different message authentication codes.

Table F.1 provides an example of a LAC transaction for the case of an RSE sending localization augmentation data for two overlapping toll contexts.