
Electronic Fee Collection (EFC) — Interface definition between DSRC- OBE and external in-vehicle devices

*Perception du télépéage — Définition de l'interface entre
l'équipement à bord à communications dédiées à courte portée
(DSRC-OBE) et les dispositifs externes embarqués*



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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.

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 documents 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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](#)

The committee responsible for this document is ISO/TC 204, *Intelligent transport systems*.

Introduction

Background and motivation

With regards to reassessing the present fuel tax schemes to cope with prevailing plug-in hybrid vehicle and electric vehicle or introducing congestion charging system to urban roads or inter-urban roads etc., the needs for expanding toll roads are becoming worthy of notice in the world.

In countries where Dedicated Short-Range Communication (DSRC)-based Electronic Fee Collection (EFC) systems were introduced for toll roads and have been operated widely, making their EFC equipment applicable to present non-toll roads, such as urban roads or inter-urban roads, becomes a significant issue to be considered and solved.

There are three cases of introducing EFC to cope with those situations:

- Case-1: DSRC-based EFC should be introduced to new toll roads, as well as present toll roads.
- Case-2: Autonomous EFC should be introduced to new toll roads and present toll roads as replacing.
- Case-3: DSRC-based EFC should be operated for present toll roads as they are, and autonomous EFC should be introduced to new toll roads.

In case of both Case-1 and Case-2, necessary interface definitions and test procedures are already covered by existing EFC standards. However, in Case-3, as shown in [Figure 1](#), current On-Board Equipment (OBE) used for DSRC-based EFC should be considered to be used for autonomous EFC covering new toll roads in keeping consistency with present toll roads.

DSRC-OBE should be expanded functionally by cooperating with external in-vehicle devices composed of a Global Navigation Satellite Systems (GNSS) module and/or a cellular module and/or other related modules; therefore, DSRC-OBE is possible to be reused for new EFC environment consisting of DSRC-based EFC and autonomous systems.

Consequently, an application interface definition between DSRC-OBE and external in-vehicle devices is essential and should be standardized.

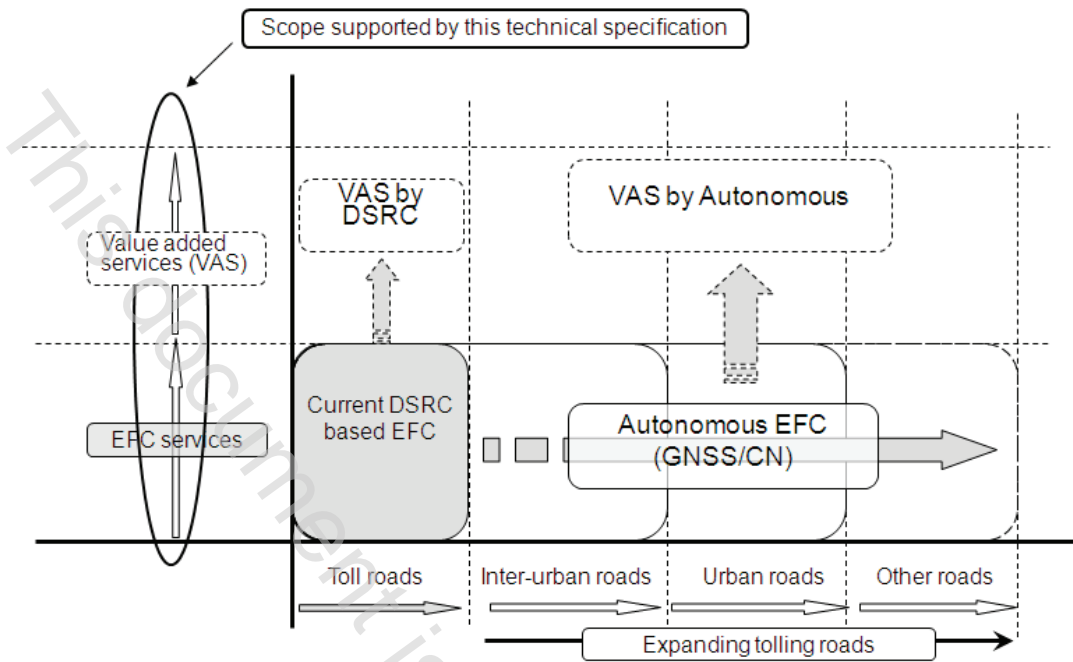


Figure 1 — Image of expanding toll roads and services (Case-3)

Purpose of this Technical Specification

This Technical Specification aims to make it possible for toll road operators to introduce autonomous systems to present non-toll roads by enhancing the functionalities of DSRC-On-Board Equipment (OBE) cooperating with external in-vehicle devices.

As listed below, this Technical Specification defines several tolling models, message sets, and data elements to cope with diversified EFC environment in the main body, as well as data type definition and Protocol Implementation Conformance Statement (PICS) proforma defined in [Annex A](#) and [Annex B](#) respectively. Finally, applicable ITS-services with cooperation of DSRC-OBE and external in-vehicle devices are listed in [Annex E](#) with an example for each of them. This Technical Specification aims at defining the following:

- tolling models with external in-vehicle devices (in main body);
- definitions of message sets and data elements;
- data type definition and PICS proforma (in [Annexes A](#) and [B](#));
- related example and applicable Intelligent Transport System (ITS) services (in [Annex E](#)).

Electronic Fee Collection (EFC) — Interface definition between DSRC-OBE and external in-vehicle devices

1 Scope

This Technical Specification defines an application interface between DSRC-based OBE and external in-vehicle devices to make DSRC-OBE applicable for diversified tolling environment.

The scope of this Technical Specification covers the following items (also shown in [Figure 2](#));

- Definitions of the application interface between DSRC-OBE and external in-vehicle devices (including GNSS, cellular units, CAN interface, etc.).
- Definitions of message sets and data elements on the interface (based on a sets of base standards, such as ISO 14906:2011, ISO/TS 17575, ISO/TS 13141, ISO/TS 12813, and ISO/TS 25110).
- For use in autonomous EFC systems, as well as DSRC-based EFC.
- For use in diversified tolling environment (in toll roads, inner-urban, inter-urban, etc.).
- For use in every kind of DSRC-OBE (based on CEN, UNI, ARIB, TTA, and GB/T).

The following items are out of the scope for this TS:

- Definitions of hardware in the external in-vehicle devices such as GNSS modules, cellular modules, mobile devices, smartphones, etc.
- Definitions of physical interface between DSRC-OBE and external in-vehicle devices such as USB, Bluetooth, etc.
- Definition of any ITS service other than EFC.
- Definition of algorithms for authentication, as well as encryption, and key management.

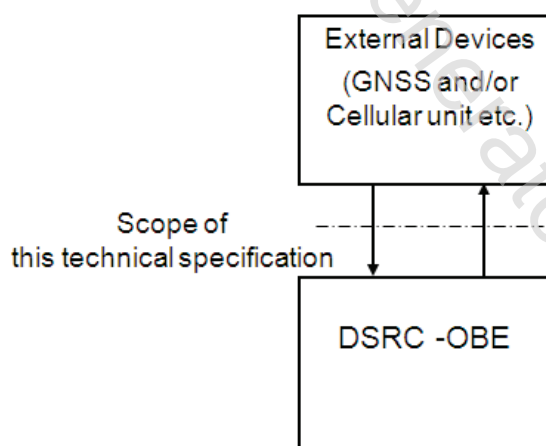


Figure 2 — Scope of this Technical Specification

Applicable DSRC-OBE

When standardizing an application interface between DSRC-OBE and external in-vehicle devices, external in-vehicle devices should be commonly applied for every kind of DSRC-based OBE as shown in [Figure 3](#).

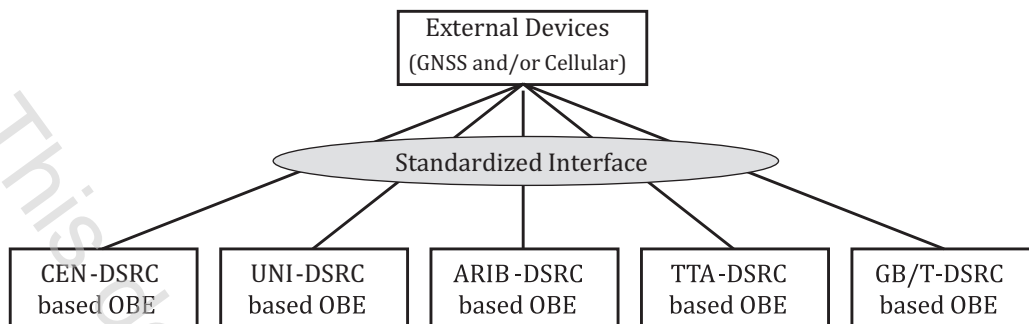


Figure 3 — Applicable DSRC-OBE

The solid and proven DSRC technology makes it possible for DSRC-OBE to have long product-life that enables DSRC-based EFC to be operated still in the future.

On the other hand, each component of external in-vehicle devices has been developed year by year to cope with user's demands on high performance, as well as multi-functional devices; therefore, they have shorter product-life rather than DSRC-OBE. Once an application interface is standardized, DSRC-OBE can be used continuously for diversified EFC environment with enhanced new external in-vehicle devices. See [Figure 4](#).

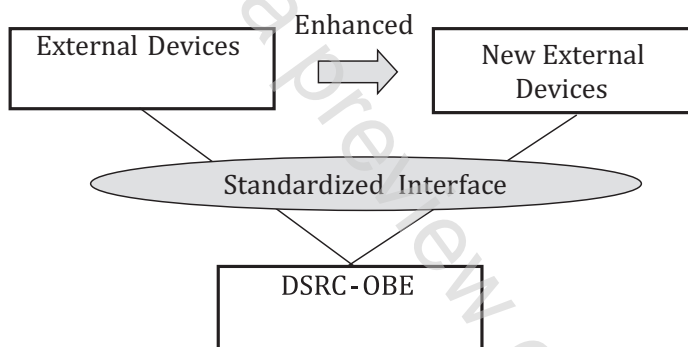


Figure 4 — Applicability for future upgrading

2 Normative references

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

ISO/IEC 9798-4:1999, *Information technology — Security techniques — Entity authentication — Part 4: Mechanisms using a cryptographic check function*

ISO 14906:2011, *Electronic Fee Collection — Application interface definition for dedicated short-range communication*

ISO/TS 17575-1:2010, *Electronic Fee Collection — Application interface definition for autonomous systems — Part 1: Charging*

ISO/TS 17575-3:2011, *Electronic Fee Collection — Application interface definition for autonomous systems — Part 3: Context data*

ISO/TS 13141:2010, *Electronic Fee Collection — Localisation augmentation communication for autonomous systems*

ISO/TS 12813:2009, *Electronic Fee Collection — Compliance check communication for autonomous systems*

3 Terms and definitions

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

3.1

access credentials

trusted attestation or secure module that establishes the claimed identity of an object or application

3.2

attribute

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

3.3

autonomous systems

one method of EFC that operate without relying on dedicated road-side infrastructure by employing wide-area technologies such as Global Navigation Satellite Systems (GNSS) and Cellular Communications Networks (CN)

3.4

authenticator

data, possibly encrypted, that is used for authentication

3.5

contract

expression of an agreement between two or more parties concerning the use of the road infrastructure

[SOURCE: ISO 14906:2011, 3.7]

3.6

cryptography

principles, means, and methods for the transformation of data in order to hide its information content, prevent its undetected modification, or prevent its unauthorised use

[SOURCE: ISO 7498-2:1989, 3.3.20, modified]

3.7

data group

class of closely related attributes

3.8

external in-vehicle devices

devices such as mobile phones or dedicated units consisting of GNSS and/or cellular modules that are connected to DSRC-OBE for upgrading the functionalities of it

3.9

issuer

entity responsible for issuing the payment means to the user

3.10

on-board equipment

OBE

equipment located on-board a vehicle including nomadic devices with the function of exchanging information with external systems

Note 1 to entry: The OBE does not need to include payment means.

[SOURCE: ISO 14906:2011, 3.13]