Specification for EETS Suitability for use tests within EasyGo
Table of contents

DOCUMENT REVISION HISTORY ................................................................. 3
REFERENCED DOCUMENTS ....................................................................... 4
DEFINITIONS AND ABBREVIATIONS ...................................................... 5
1  BACKGROUND ....................................................................................... 6
2  SCOPE AND OBJECTIVE ....................................................................... 6
3  OVERVIEW OF TESTS .......................................................................... 6
   3.1  CONFORMITY TO SPECIFICATION .............................................. 8
   3.2  SUITABILITY FOR USE .............................................................. 8
   3.3  EC DECLARATIONS ................................................................. 9
4  ACTORS AND ROLES .......................................................................... 9
   4.1  SYSTEM ARCHITECTURE .......................................................... 10
5  TEST SITE PREPARATIONS ............................................................... 11
6  SUITABILITY FOR USE TESTS ........................................................... 11
   6.1  GENERAL TEST REQUIREMENTS ............................................. 11
   6.2  OBE FUNCTIONAL TESTS ......................................................... 12
       6.2.1  OBE communication tests .............................................. 12
       6.2.2  Transaction reliability tests .......................................... 12
       6.2.3  Communication zone tests ........................................... 12
   6.3  OBE SYSTEM COMPATIBILITY TESTS ...................................... 13
       6.3.1  Tests at test site ............................................................. 13
       6.3.2  Tests in real operating system ....................................... 14
   6.4  EP BACK OFFICE INTERFACE TESTS ...................................... 14
   6.5  END-TO-END TESTS .............................................................. 15
   6.6  PILOT OPERATION ................................................................. 15
   6.7  TEST REPORT ........................................................................... 15
7  RECERTIFICATION ............................................................................. 16
   ANNEX 1 – CONFORMITY TO SPECIFICATION DECLARATION ............. 17
## Document Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Author</th>
<th>Main changes</th>
</tr>
</thead>
<tbody>
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## Referenced documents

<table>
<thead>
<tr>
<th>Ref. nr.</th>
<th>Document name</th>
<th>EasyGo doc nr.</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>Requirements for central systems and collection and forwarding centrals</td>
<td>201</td>
</tr>
<tr>
<td>[2]</td>
<td>Road side equipment and on board units</td>
<td>202</td>
</tr>
<tr>
<td>[3]</td>
<td>Technical requirements data formats and interface specifications</td>
<td>203</td>
</tr>
<tr>
<td>[4]</td>
<td>EasyGo Test strategy</td>
<td>206</td>
</tr>
<tr>
<td>[5]</td>
<td>CS-EasyGo HUB-CS Interface test specification</td>
<td>207</td>
</tr>
<tr>
<td>[6]</td>
<td>Invoicing specifications</td>
<td>304</td>
</tr>
<tr>
<td>[9]</td>
<td>Decision 768/2008/EC on a common framework for the marketing of products</td>
<td></td>
</tr>
<tr>
<td>[10]</td>
<td>EN 15509 - RTTT - EFC - Interoperability application profile for DSRC</td>
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<td>[12]</td>
<td>EN 12855 - RTTT - EFC - Information exchange between service provision and toll charging</td>
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</tr>
</tbody>
</table>
### Definitions and abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSRC</td>
<td>Dedicated Short Range Communication</td>
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<tr>
<td>EasyGo HUB</td>
<td>Common EasyGo interconnecting server for exchange of data (e.g. toll declaration data) between TC and TSP</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<tr>
<td>EC declarations</td>
<td>Proof of European Conformity according to EC legislation (DECISION 768/2008/EC)</td>
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<tr>
<td>EETS</td>
<td>European Electronic Tolling System</td>
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<td>EFC</td>
<td>Electronic Fee Collection</td>
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<tr>
<td>EP</td>
<td>EETS Toll Service Provider</td>
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<tr>
<td>ID</td>
<td>Identification, as in OBE ID</td>
</tr>
<tr>
<td>JVA</td>
<td>Joint Venture Agreement</td>
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<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
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<tr>
<td>MAC</td>
<td>Message Authentication Code</td>
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<tr>
<td>OBE</td>
<td>On Board Equipment</td>
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<tr>
<td>PAN</td>
<td>Personal Account Number</td>
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<tr>
<td>RSE</td>
<td>Road Side Equipment</td>
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<tr>
<td>SFU</td>
<td>Suitability for use</td>
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<td>SLA</td>
<td>Service Level Agreement</td>
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<td>SU</td>
<td>Service User</td>
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<tr>
<td>TC</td>
<td>Toll Charger</td>
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<td>TSP</td>
<td>Toll Service Provider</td>
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<td>VAT</td>
<td>Value Added Tax</td>
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1 Background

As required by the EFC Directive (2004/52/EC) and EETS Decision (2009/750/EC) an EETS Provider shall perform verification of the interoperability constituent (OBE) within each EETS Toll Domain. The Toll Chargers shall make available appropriate test facilities and support the EETS Provider (EP) in the verification and certification process of On-board Equipment (OBE) and EP Back-office system interface.

EasyGo is a Joint Venture (cluster) of Toll Chargers cooperating to make available a common EFC service providing for Service Users (SU) to pay the tolls using one contract and one OBU. The EasyGo cooperation comprises EFC Toll Chargers and Toll Service Providers within Norway, Sweden, Denmark and Austria.

The EasyGo cooperation has a common information website www.easygo.com where all participating EFC Toll Chargers and Toll Service Providers are presented.

The specification presented in this document has been prepared by a Working Group within EasyGo represented by the partners of the EasyGo cooperation – Sund&Baelt, Öresundsbro Konsortiet, Norwegian Public Roads Administration, Swedish Transport Agency and ASFINAG.

2 Scope and objective

The scope of this document is to provide a specification for EETS assessment of EETS OBE’s and EETS Toll Service Providers (EP) to be introduced in the EFC systems within EasyGo. The EETS decision defines two types of test – Conformity to specifications and Suitability for use. This document considers requirements for provision of test results related to Conformity to specification of OBE’s as well as test specifications for Suitability for use tests.

The objective is to provide a common test procedure facilitating the EETS Suitability for use assessment process for the EasyGo partners as well as for possible EETS Providers, taking advantage of the EasyGo architecture, functionality and organisation. The EasyGo interface specifications, test strategy and EETS suitability for use assessment procedure complies with the requirements of the EFC Directive (2004/52/EC) and EETS Decision (2009/750/EC).

3 Overview of tests

The EETS decision defines the verification process for EETS in the following phases:

- Conformity to specification
- Suitability for use

The following distinction is made between interoperability constituents ‘conformity to specifications’ and ‘suitability for use’.

- **Conformity to specifications** is relative to the requirements of Directive 2004/52/EC, Decision 2009/750/EC and all relevant standards and technical
specifications. OBE’s conformity to specifications can be assessed without physically accessing the Toll Chargers’ toll domains.

- **Suitability for use** means the ability of an interoperability constituent to achieve and maintain in-service interoperability at a specified level of performance when integrated representatively into EETS in relation to a Toll Charger’s toll system.

Where relevant, conformity to specifications or suitability for use certificates may stipulate an expiry date. In this case recertification should take place at the end of the certificate validity period.

![Diagram of EETS assessment process for OBE and EP back office interfaces](image)

**Figur 3.1 EETS assessment process for OBE and EP back office interfaces**
3.1 Conformity to specification

The OBE conformity to specification assessment shall be done using the assessment procedures and chose among the modules set out in the Decision 768/2008/EC. For the OBE – RSE interface the relevant standards and specifications would be EN 15509, their related test documents as well as EasyGo requirement and test specifications.

With regard to the back office there are several interfaces that should be implemented by the Toll Charger and the EETS Provider.

3.2 Suitability for use

The Suitability for use tests covered by this document covers the assessment of On-Board Equipment as well as EETS Toll Service Providers.

The following test stages are defined:

1. OBE functional tests – consisting of on board equipment (OBE) functionality and performance testing under controlled conditions in a laboratory and test site environment.

2. OBE system compatibility tests – aiming at verification of OBE functionality under realistic conditions at a test site environment.


4. End-to-end tests – which has the purpose of testing the whole value chain of the EETS service within the Toll Domain/Toll Charger system.

5. Pilot operation – is the verification of the OBU operation over a certain time period (but only involving “friendly” Service Users) to prove the reliable operation in a life TC environment.

Depending on what level of assessment is required some of the different test stages could be omitted.

For example it can be agreed to carry out the OBE functional tests (stage 1 and 2) for a particular OBE model with a defined hard- and software version together with the manufacturer independently of a specific EETS Provider to prequalify this OBE for acceptance in the EasyGo tolling system. The EETS provider would subsequently have to carry out the back office interface test as well as end-to-end and pilot operation tests (stages 3 – 5).

The EETS Suitability for use tests shall be performed in accordance with the EasyGo Test strategy [4].

The different test stages are described in detail in the chapter 6 below.
### 3.3 EC declarations

EC declarations are defined by the Decision 768/2008/EC and article 5 states that that a single declaration shall be drawn up in respect of all Community acts applicable to the product.

The EETS Decision (2009/750/EC) requires that an EC Declaration is drawn up by the manufacturer, the EETS Provider or an authorised representative related to the two assessment processes Conformity to specification and Suitability for use. The content of the EC declaration is defined in Annex IV of the EETS Decision.

Before the suitability for use tests the EP should provide necessary proofs (EC declarations) of conformity to specification of the OBE.

Details of requested declaration documents and test reports are described in Annex 1.

### 4 Actors and roles

The roles defined for an Electronic Toll Collection service can be illustrated by the following figure:

![Roles in the Toll Charging environment](image)

**Figur 4.1 Roles in the Toll Charging environment**

The roles as defined in the EasyGo context and for the purpose of EETS Suitability for use tests are described in the EasyGo Test strategy [4].
4.1 System architecture

The modules and interfaces relevant for the EETS service are shown in the figure below.

![EETS system architecture - interfaces to EasyGo Toll Chargers](image)

**Figur 4.2 EETS system architecture - interfaces to EasyGo Toll Chargers**

The interfaces subject for test are between EP OBE and TC RSE – marked 1, and between back offices of EP and TC – marked 3 in the figure above.

The requirements for the interfaces are:

- The DSRC charging data (Interface 1) is specified by the EN 15509 and 15876-1/2 standards, and the EasyGo specification Road side equipment and on board units [2].

- The back office interface (Interface 3) covers the exchange of toll declaration data, invoicing, exception handling, black lists, trust objects and toll context data. To benefit from the EasyGo architecture and facilitate the suitability for use assessment the data shall be exchanged through the EasyGo HUB. The interface requirements are described in the EasyGo documents Requirements for central systems and collection and forwarding centrals [1], Technical requirements data formats and interface specifications [3] and Invoicing specifications [6], which are in accordance with the EN 12855 standard.

- The other interfaces in the figure are internal. Interface 2 is between EETS Providers OBE / EasyGo Providers OBE and back office systems for personalisation purpose. Interface 4 is between Toll Chargers RSE and back office system.
5 Test site preparations
The tests shall be performed at various sites for the different test stages. The following test sites shall be available:

- **Tests in laboratory conditions** shall consist of indoor installed road-side system including beacons (microwave antenna/receivers) and necessary computing systems (lane controller) for reading out transaction results. For transaction performance tests a conveyor belt test environment or a communication field simulator system is used.

- **Tests in road-side test environment** shall consist of outdoor test sites with all types of RSE (including microwave antenna, vehicle detectors, lane controller, etc.) simulating a real toll station, configurable both for single-lane and multilane conditions.

- **Tests in real operating tolling stations** shall be carried out in all toll station contexts to meet all TC’s requirements.

6 Suitability for use tests

6.1 General test requirements
The purpose of the Suitability for use assessment is to verify the functionality and performance of a new OBE or a new EP in a real operating environment (Toll Domain).

Prior to the tests all test procedures and related acceptance criteria should be approved by the EasyGo. A sufficiently large sample number\(^1\) of test OBE’s from a mass production series should be provided for the tests.

The Suitability for use tests are composed of the following test stages:

1. OBE functional tests
2. OBE system compatibility tests
3. EP Back office interface tests
4. End-to-end tests
5. Pilot operation

The sections below describe the different test stages in detail.

When performing Suitability for use tests for a new OBE the test stages 1, 2, 4 and 5 shall be performed (stage 3 is omitted).

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\(^1\) Minimum number is 5 test OBE’s.
When performing Suitability for use test for a new TSP the test stages 3, 4 and 5 shall be performed (stages 1 and 2 are omitted if the OBE is already qualified).

The tests shall be performed in accordance with the EasyGo Test strategy [4].

**6.2 OBE Functional tests**

The purpose of the functional tests is to verify the OBE performance under controlled conditions. The verification should prove correct OBE communication and transaction reliability when communicating with receiver systems (beacons) in a laboratory condition. The functional tests also cover verification of OBE performance within a communication zone in a road side test environment.

Detailed test case specifications are described in the EasyGo document Road side equipment and on board units [2].

General information about the tests is given in the sections below.

**6.2.1 OBE communication tests**

Tests are performed under laboratory conditions.

Tests shall verify communication with RSE and correct OBE transactions performed with different personalisation data:

- Vehicle class
- Licence plate
- Expiry date

The receipt received by the OBE shall be read out in a second transaction after the test transaction.

Tests shall verify correct OBE transaction in blacklist situation.

**6.2.2 Transaction reliability tests**

Tests are performed under laboratory conditions.

Tests shall verify correct OBE transaction when put in the communication zone for more than 5 minutes. Only one transaction shall be recorded.

Tests shall verify correct consecutive OBE transactions using a conveyor belt with periodically changing BeaconID of the RSE. Minimum 10 000 cycles shall be performed.

Tests using RSE’s in a multilane configuration shall verify correct OBE transactions for each OBE, when putting minimum 10 OBE’s in the communication zone.

**6.2.3 Communication zone tests**

Tests are performed at a road side test environment (test track).

Definitions of minimum and maximum communication zone and specific acceptance criteria for OBE communication shall be defined together with the RSE supplier.
Tests shall verify communication with RSE (single lane) and correct transactions performed with different personalisation data,

- Vehicle class
- Licence plate
- Expiry date

The receipt received by the OBE shall be read out in a second transaction after the test transaction.

Tests shall verify correct OBE transactions with the OBE mounted at different positions of the wind screen and different vehicle types:

- Passenger car (car)
- Heavy vehicle (lorry)
- Vertical positions
- Horizontal positions

Tests using RSE’s in a multilane configuration shall verify correct OBE transactions for each OBE, when putting minimum 10 OBE’s in the communication zone.

### 6.3 OBE system compatibility tests

The purpose of the system compatibility tests is to test normal transactions and exception handling at realistic / real operating conditions.

Detailed test case specifications are described in the EasyGo document Road side equipment and on board units [2].

General information about the tests is given in the sections below.

#### 6.3.1 Tests at test site

The tests are performed at a test site (test track).

Tests shall verify correct OBE transactions in a realistic road-side environment with a valid contract (not expired, not blacklisted, etc.) driving with various speeds.

- 50 km/h, 80 km/h and 130 km/h (only passenger cars)

Tests shall verify a correct OBE transaction with two types of OBE installed – only one valid at the time of passing.

- EETS OBE valid / not valid (expiry date or blacklisted)
- EasyGo OBE not valid / valid.

Only one correct transaction recorded.

Tests shall verify correct OBE transaction when driving with multiple EETS OBE’s at the same time in the communication zone. When passing with three OBE’s three correct transactions shall be recorded.
Tests shall verify correct OBE transactions performed with different contract data. Various OBE’s shall be used with different OBE data:

- Vehicle class
- Licence plate
- Expiry date
- OBE on exception list (blacklist)

6.3.2 Tests in real operating system

The tests are performed on the road at toll stations in operation.

Tests shall verify correct OBE transactions performed with different contract data. Passing shall be done at different types of toll stations and with various OBE’s (minimum 5) with different OBE data, for example (not limited to):

- Vehicle class
- Licence plate
- Expiry date

All contracts shall be real and valid, i.e. registered in EP back office. EP ContextMark shall be valid at the road-side system (RSE).

Tests shall verify correct OBE transactions when OBE on exception list.

- OBE on exception list (blacklist)

6.4 EP Back office interface tests

The EP back office interface tests covers testing between the EETS Toll Service Provider, the EasyGo HUB and the EasyGo Toll Service Providers.

The tests covers the interface 3 described under system architecture of chapter 4.1.

The objective of the back office interface test is to verify that all the EasyGo file format and interfaces are implemented correctly and that the validations of files are done according to specifications.

Tests shall be performed using back office systems in test environment but using real operation communication lines and facilities. The data exchanges shall not interfere with the back office systems in operation.

The EP back office interface tests shall verify conformance to the back office interface specifications Requirements for central systems and collection and forwarding centrals [1], Technical requirements data formats and interface specifications [3] and Invoicing specifications [6], and the associated test procedures described in the EasyGo document CS-EasyGo HUB-CS Interface test specification [5].
6.5 *End-to-end tests*

The purpose of the end-to-end tests is to verify the EETS OBE and EP back office system functionality within the tolling system of the Toll Charger. Different transaction scenarios at road-side shall be followed up by verifications of data processing, invoicing and settlement at the back office system.

Only when successful end-to-end testing is achieved the pilot operation may start.

- The requirements and test case scenarios for end-to-end tests are described in the document EasyGo Test strategy [4].

6.6 *Pilot operation*

The pilot operation aims at testing the OBE functionality over a certain time period only using friendly users. Pilot operation may only start upon passed and approved end-to-end test.

Contracts issued for the pilot operation shall be real contracts and continue their use after the pilot period. The pilot users should be selected so that a maximum of toll stations will be covered and even have a high passing frequency.

When the pilot operation test is passed, a preliminary EC declaration for suitability for use can be drawn.

The requirements and set up for the pilot operation test is described in the document EasyGo Test strategy [4].

6.7 *Test report*

For each test stage and test case a test report shall be provided by the EETS Provider and approved by the Toll Charger. The test report shall at a minimum contain the following information:

- Test name and number
- Date and time
- Run number and total of test runs
- Hardware and software version of OBE tested
- Test location: RSE/toll station name and version identification
- Description of test run
- Test result – passed/not passed
- Name of tester
- Reference to test logs or supplementary documentation of test result
7 Recertification

All OBE hardware or software changes shall be reported to the Toll Charger prior to the change. The report should contain result of OBE manufacturer internal testing. The change report is basis for decision of whether and which test stage should be repeated. Major changes of OBE will result in a certification of a new OBE type.

Any OBE changes not reported to the Toll Charger will result in a withdrawal of the suitability for use certification.

Changes of the EETS Provider back office system shall be agreed with the Toll Charger. It should be agreed if some parts of the testing should be repeated.
Annex 1 – Conformity to specification declaration

The OBE conformity to specification assessment shall be done using the assessment procedures and chose among the modules set out in the Decision 768/2008/EC and an EC Declaration shall be drawn up by the manufacturer, covering the manufacturers self-assessment and/or be subject to obtaining an examination certificate from a Notified Body.

For the OBE – RSE interface the relevant standards and specifications would be EN 15509 and their related test documents.

With regard to the back office there are several interfaces that should be implemented by the Toll Charger and the EETS Provider.

**OBE Conformity declaration constituents**

The conformity declaration shall consider conformity to the OBE

- To the DSRC transaction according to EN 15509 and related DSRC standards, and
- To the requirements and related test specifications defined in EasyGo document Road side equipment and on board units [2].

The “EC” declaration should contain all relevant information to identify

- The OBE which is declared to be conform
- The European legislation according to which it is issued
- The manufacturer or its authorized representative
- The Notified Body if applicable
- Reference to relevant standard
- Other normative or required documents as appropriate

The EC declaration of conformity shall have the model structure as set out in Annex III of Decision 2008/768/EC.

Depending on the chosen modules from 2008/768/EC, the following documents shall be provided by the EETS Provider:

**A - Internal production control:**

- None (manufacturer's technical documentation at the disposal of national authorities)

**B - Type examination:**

- EC-type examination certificate
- Evaluation report

C - Conformity to type:
- Module C, C1 and C2 require EC-type examination certificate (module B)

D and E - Production quality assurance:
- Module D and E require EC-type examination certificate (module B), not required for module D1 and E1
- Visit and/or audit report of production quality system (e.g. ISO 9001 quality management certificate)

F - Product verification:
- Module F requires EC-type examination certificate (module B), not required for module F1
- Certificate of conformity (in respect with the examinations and tests)

G - Unit verification:
- Certificate of conformity (in respect with the examinations and tests)

H - Full quality assurance:
- Quality system assessment report (for the design and production phase, including for example an ISO 9001 quality management certificate)
- Only H1: EC design examination certificate

In case of module B the EETS Provider shall provide the EC-type examination certificate and the evaluation report (with the permission of the manufacturer) containing the results of the systematic examination of the extent to which the OBE and/or the manufacturer fulfills the specific functional and quality system requirements.

Test reports
The manufacturer and/or the Notified Body shall provide detailed test reports from all performed DSRC relevant OBE tests. The following, not exhaustive list shows the expectation of the performed DSRC interoperability tests:

- OBE tests defined in EN 15876-1 for all layers
- a set of tests comparable to the tests defined in chapter 6.2 of the current document.
The OBE test results of EN 15876-1 shall be reported by the Proforma Conformance Test Report (PCTR) defined in Annex C of this test standard. The PCTR shall include conformance log and detailed test results whenever possible.

Test reports about additional tests shall contain a description of the test and the constituents similar to the list in chapter 6.7.

**Back office interface conformity declaration**

The EP shall deliver a conformity declaration that the system fulfils the back office interface specifications defined in the EasyGo documents 201 and 203.