Specification for EETS suitability for use tests within EasyGo

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Document Revision History

Version	Date	Author	Main changes
0.1	2012.02.22	LHB	Draft
0.2	2012.04.10	LHB	Adjustments made to reflect EasyGo perspective – proposal for internal commenting in the working group
0.31	2012.05.31	LHB	Adjustments made after comments in meeting 9 May.
0.4	2012.10.31	LHB	Update of annexes and small editorial changes.
0.5	2012.11.20	LHB	Updated references to EasyGo specifications, removal of detailed test case specifications, and clarification of declaration for conformity to specification.
0.9	2012.11.30	LHB	Yellow markings at referenced documents not yet included in the list of EasyGo agreement annexes. Approved by the working group.
0.10	2012.12.13	SGA	Change of document number from doc. 908
0.91	2012.12.13	SGA	Change of document number from doc. 908
0.92	2013.01.08	SGA/ASK	Implemented suggested changes
0.93	2013.01.21	LHB/SGA/ASK	Minor changes
1.0	2013.02.27	SC	Approved by Steering Committee

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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 TCs shall make available appropriate test facilities and support the EP in the verification and certification process of OBE and EP back office system interface.

2 Scope and objective

The scope of this document is to provide a specification for EETS assessment of EETS OBEs and EPs to be introduced in EFC systems within EasyGo. The EETS decision defines two types of tests – 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 actors as well as for possible EPs, 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* relates 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

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certificate validity period or when an essential change in the interoperability constituent (OBE) or the EP back office interface is introduced.

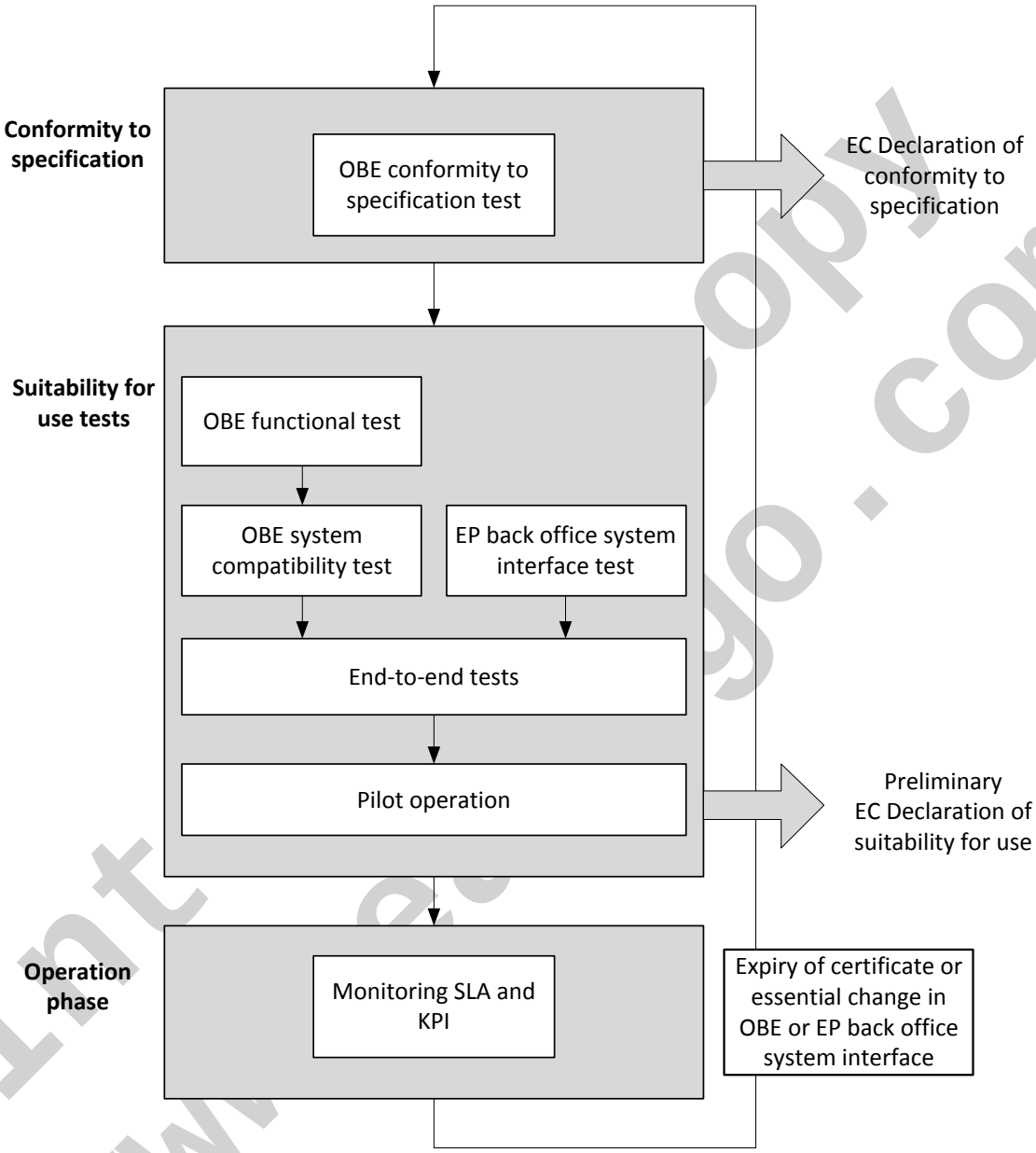

Figure 3-1 EETS assessment process for OBE and EP back office interfaces

3.1 Conformity to specification

The OBE conformity to specification assessment shall be done using the assessment procedures choosing among the modules set out in the Decision 768/2008/EC. For the OBE–RSE interface the relevant standards and specifications are 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 shall be implemented by the TC and the EP.

3.2 Suitability for use

The suitability for use tests covered by this document covers the assessment of OBEs as well as EPs back office interfaces.

The following test stages are defined:

1. OBE functional tests – consisting of 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.
3. Back office system interface tests – which consist of a verification of back office data interchange in a test environment.
4. End-to-end tests – which have the purpose of testing the whole value chain of the EETS service within the toll domain/TC's system.
5. Trial period – is the verification of the OBE operation over a certain time period (but only involving "friendly" SUs) 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 EP to prequalify this OBE for acceptance in the EasyGo tolling system. The EP would subsequently have to carry out the back office interface test as well as end-to-end and trial period tests (stages 3 – 5).

The EETS suitability for use tests shall be performed in accordance with Annex 2.6.

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 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 EP 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.

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4 Actors and roles

The roles defined for an EFC service can be illustrated by the following figure:

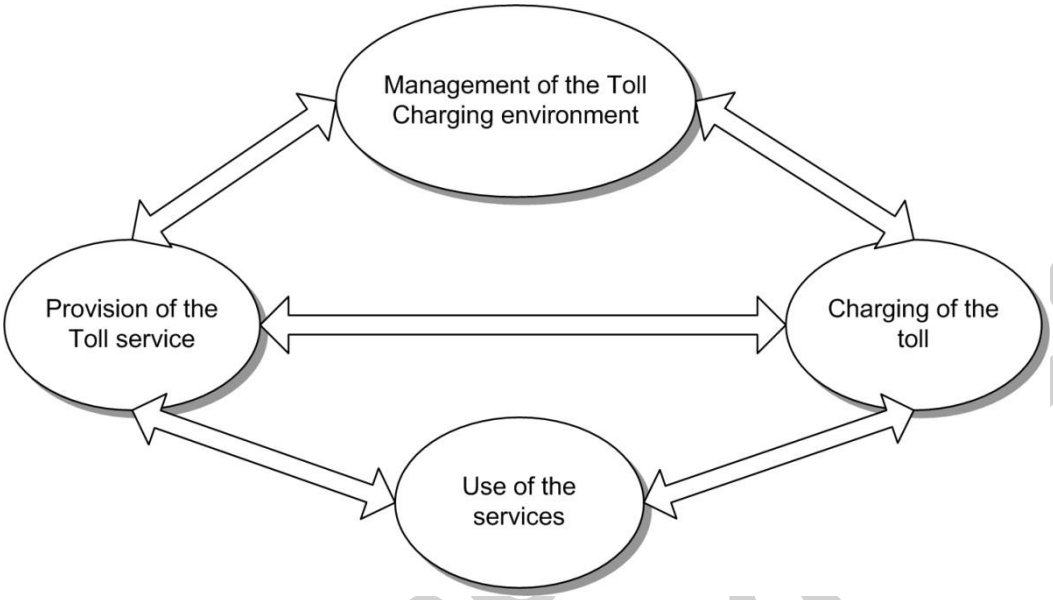

Figure 4.1 Roles in the toll charging environment

The roles as defined in the EasyGo context and for the purpose of EETS suitability for use tests are described in Annex 2.6.

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4.1 System architecture

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

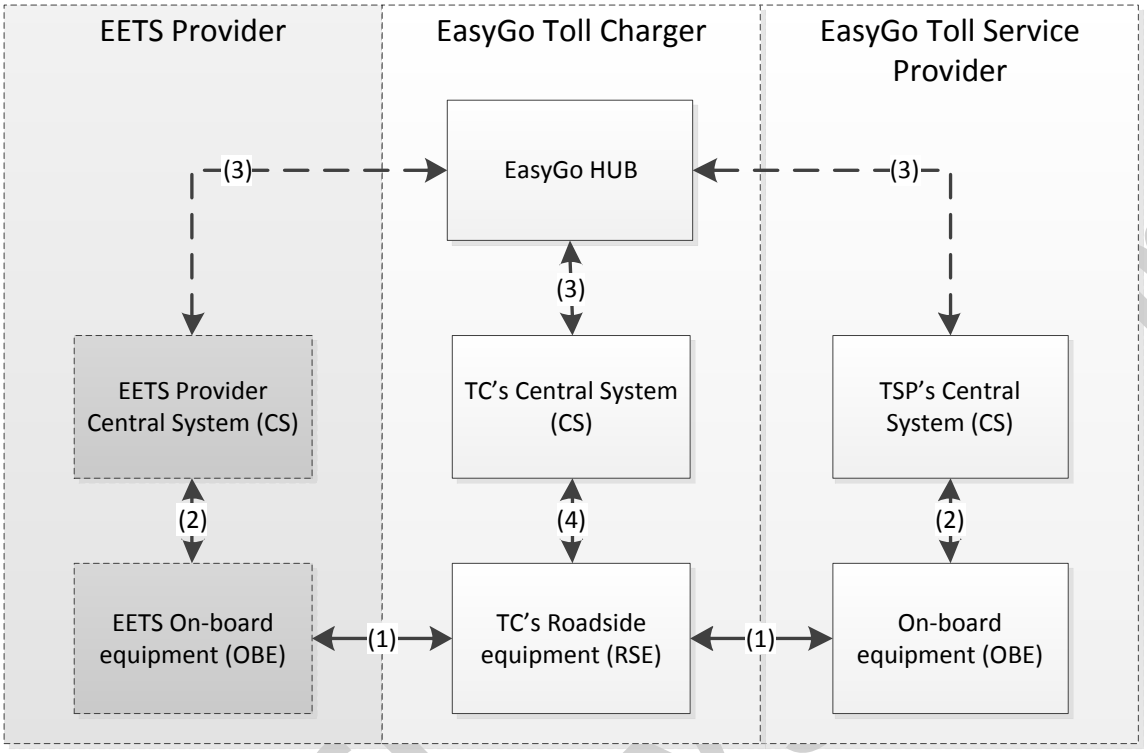

Figure 4-2 EETS system architecture - interfaces to EasyGo TCs

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 for RSE and OBEs as specified in Annex 2.2.

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 Annex 2.1, 2.3 and 2.4, which are based upon the EN ISO 12855 standard.

The other interfaces in the figure are internal. Interface 2 is a proprietary interface between EP's OBE / EasyGo TSP's OBE and the EPs / EasyGo TSPs back office systems for personalisation purposes. Interface 4 is between TC RSE and TC back office system.

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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 roadside systems 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 **roadside 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 if necessary.
- 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 back office interface in a real operating environment.

The test procedures and related acceptance criteria according to Annex 2.6 and Annex 2.7 shall be used. A sufficiently large sample number[1] of test OBE's from a mass production series shall be provided by the EP 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. Trial period

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).

[1] Minimum number is 5 test OBEs.

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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 Annex 2.6.

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 Annex 2.2.

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 a 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 RSEs in a multi-lane configuration shall verify correct OBE transactions for each OBE, when putting minimum 10 OBEs in the communication zone at the same time.

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.

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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 RSEs in a multi-lane configuration shall verify correct OBE transactions for each OBE, when putting minimum 10 OBEs in the communication zone at the same time.

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 Annex 2.2.

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 roadside 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 valid/not valid.

Exactly one correct transaction recorded.

Tests shall verify correct OBE transaction when driving with multiple EETS OBEs at the same time in the communication zone. When passing with three OBEs three correct transactions shall be recorded.

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Tests shall verify correct OBE transactions performed with different contract data. Various OBEs 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 OBEs (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 roadside 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 EP, the EasyGo HUB and the TC.

The tests cover interface 3 as shown in Figure 4-2.

The objective of the back office interface test is to verify that all the EasyGo file formats 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 exchange 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 in Annex 2.1, 2.3, 2.4 and the associated test procedures described in Annex 2.7.

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 TC. Different transaction scenarios at

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roadside shall be followed up by verifications of data processing and invoicing at the back office system.

Only when successful end-to-end testing is achieved trial period may start.

- The requirements and test case scenarios for end-to-end tests are described Annex 2.6.

6.6 Trial period

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

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

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

The requirements and set up for the trial period test is described in Annex 2.6.

6.7 Test report

For each test stage and test case a test report shall be provided by the EP and approved by the TC. 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
- Description of test run
- Test result – passed/not passed
- Name of tester
- Reference to test logs or supplementary documentation of test result

For OBE/RSE tests the following information is additionally required:

- Hardware and software version of OBE tested
- Test location: RSE/toll station name and version identification

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7 Recertification

All OBE hardware or software changes shall be reported to the TC prior to the change, describing the nature of the change and its consequences. The report should contain the 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 require a certification of the new OBE type.

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

Changes of the EP back office system shall be reported to the TC prior to the change, describing the nature of the change and its consequences. The report should contain the result of back office manufacturer internal testing. The change report is basis for decision of whether and which test stage should be repeated. Major changes of EP back office system will require a certification of the new EP back office system.

Any EP back office system changes not reported to the TC will result in a withdrawal of the suitability for use certification.

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Annex 1 – Conformity to specification declaration

The OBE conformity to specification assessment shall be done using the assessment procedures choosing 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 TC and the EP.

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 Annex 2.2

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:

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- 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 EP 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 fulfils 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

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- 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 Annex 2.1 and 2.3.

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