Annex H (Testing)

Annex to the EETS Domain Statement concerning the Danish Kilometer Tolling Scheme

Version: 1.2

Date: 13 December 2024

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1 DOCUMENT HISTORY

Date of first appearance of this entry into the register	1 February 2024
Last update	13 December 2024
Next review	First quarter 2025

2 DEFINITIONS AND ABBREVIATIONS

All definitions in the EETS Domain Statement shall have the same meaning in this Annex.

In addition to the definitions in the EETS Domain Statement the following definitions shall apply for this Annex:

"EC Declaration" shall have the meaning as described in section 5.1.

"**Pilot Operation**" shall have the meaning as described in section 5.4.

"**Service Trial**" shall have the meaning as described in section 5.5.

"Suitability for use" means the ability for interoperability constituents to achieve and maintain a specified performance when in service, integrated representatively into EETS in relation with a toll charger system.

3 INTRODUCTION

Testing under the KmToll Scheme will follow the Time Schedule described in Annex C (Accreditation Procedure).

As described in Annex C (Accreditation Procedure) the first round of Accreditation Procedure calls for a special approach, thus, testing will also be adapted accordingly since the Toll Charger will have to manage testing with several EETS Providers in parallel. This places a high expectation on the EETS Provider's participation during test phases and contribution related to test activities.

This Annex will in its first version be focused on testing during the first round of Accreditation Procedure. As the implementation of the KmToll Scheme, and thus the Accreditation Procedure, progresses this Annex will be adapted to reflect the expected testing relevant to any new EETS Provider applying to the KmToll Scheme after the date where the scheme has been commissioned.

The next sections of this Annex are structured as follows:

(i) **Section 4**: In this section, general requirements related to test is detailed including information regarding roles and responsibilities and approval of test;

(ii) **Section 5:** In this section, information relevant for the EETS Provider related to testing during the Accreditation Procedure are described;

(iii) **Section 6**: In this section, information relevant for the EETS Provider related to testing during operation are described; and

(iv) **Section 7:** In this section, the Toll Charger's requirements related to re-certification are described.

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4 GENERAL REQUIREMENTS RELATED TO TEST

4.1 Roles and responsibilities

The division of roles and responsibilities of tasks between the EETS Provider and the Toll Charger shall be as follow:

The Toll Charger's responsibilities

(i)   Propose the overall test planning and validate it with the EETS Provider;

(ii)   Define the test plans, the test cases and the detailed tests requirements. This includes the criteria on which the success and/or the failure of a test will be based;

(iii)   Execute, or collaborate in the execution by the EETS Provider of the test(s) according to the test plan defined by the Toll Charger;

(iv)   Draw up a test report detailing the progress and results of the test(s);

(v)   Share this test report with the EETS Provider; and

(vi)   Based on the test report, validate or not the success of the test.

The EETS Provider's responsibilities

(i)   Prepare detailed test planning and validate it together with the Toll Charger;

(ii)   Provide the Toll Charger with the resources necessary for the execution of the test(s);

(iii)   Provide APIs and the necessary information for the Toll Charger to access these APIs, according to requirements in Annex F (Interface specifications);

(iv)   Provide the Toll Charger with configured OBE to be used for the tests, according to requirements in Annex E (Technical Conditions);

(v)   Provide the vehicles necessary for test drives for execution of specific test(s) according to the requirements of this Annex; and

(vi)   Execute, or collaborate in the execution by the Toll Charger of the test(s) according to the test plan and test protocols defined by the Toll Charger.

4.2 Approval of test

In order for the EETS Provider to pass a test, and for the Toll Charger to approve the test report, the following requirements must be met:

(i)   The test(s) must be completed according to this Annex, the test plan and test case requirements of the Toll Charger;

(ii)   The Toll Charger must have access to follow / oversee the test(s) as agreed;

(iii)   The test and test results of tests conducted by the EETS Provider must be documented in a test report demonstrating the EETS Provider's successful execution of the test; and

(iv)   If the Toll Charger chooses to approve a test notwithstanding the presence of defects, known to both parties, such defects must be entered on the EETS Provider's defect list, and subsequently be remedied by the EETS Provider. The EETS Provider must inform the Toll Charger and obtain the Toll Charger's approval when the defects have been remedied.

Any test is only deemed approved when the test report has been produced and approved by the Toll Charger and a written notification has been given to the EETS Provider.

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4.3 Tools

The Toll Charger uses the Azure DevOps for development activities respectively for planning, executing and reporting test activities related to the Accreditation Procedure. The EETS Provider will not be granted access to the Toll Charger's Azure DevOps. The EETS Provider will be granted access to test cases and reporting templates in other formats and in both cases to be provided to the EETS Provider by the Toll Charger.

To help the EETS Provider integrate towards the Toll Charger's APIs, a Developer Portal will be deployed. For details, please refer to Annex F (Interface Specifications).

The Toll Charger makes use of TOPdesk for service management during the Accreditation Procedure. In other words, TOPdesk is used for any communication, incident reporting etc. related to execution of tests with the EETS Provider. It is the Toll Charger's responsibility that the EETS Provider gets a registered user in TOPdesk and that the EETS Provider receives the necessary information to use the tool correctly.

4.4 Environments

As part of developing its' back office the Toll Charger will provide and operate environments for development and test activities. The Toll Charger will use five (5) environments as listed in Table 1.

The educational environment (KMToll-EDU) will be available to the EETS Provider to demonstrate connectivity as part of Phase 3 (Preparation of test). The educational environment mirrors the production environment (KMToll-PROD). The service level agreement is the same for the KMToll-EDU and the KMToll-PROD.

The development environment (KMToll-DEV) and the integration environment (KMToll-SIT) are used for internal test of the Toll Charger's back office systems. These environments have no outbound integration towards the EETS Provider.

The user-acceptance environment (KMToll-UAT) is used for a wide variety of test activities which involves both the EETS Provider, the Toll Charger and the Toll Charger's other suppliers.

Many stakeholders are involved in test activities to be executed in the KMToll-UAT. Therefore, the EETS Provider is required to follow the guidelines for testing in this environment to be described by the Toll Charger in relevant test plan. This includes guidelines concerning communication, test data retention policy in the Toll Charger's environments, environment maintenance activities, e.g., patches, upgrades, and data refresh.

The KMToll-PROD is used for the Pilot Operation.

Table 1. Environments provided and operated by the Toll Charger

The Toll Charger's Environments				
Env. name	**Env. purpose**	**Env. Description**	**Test Level Ref.**	**Env. Users/ Groups**
KMToll-EDU	Educational	Toll collection subscription used as accreditation environment for EETS Providers.	Preparation for test (connectivity test)	EETS Provider and Toll Charger
KMToll-UAT	User acceptance test	Toll collection subscription for user acceptance environment.	Interface test GNSS test End-to-end test	EETS Provider, Toll Charger and 3rd party suppliers
KMToll-PROD	Production	Toll collection subscription for production environment.	Pilot Operation	EETS Provider, Toll Charger and 3rd party suppliers

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KMToll-DEV	Development	Toll collection subscription for development environment.	Not applicable for the EETS Provider	Toll Charger and 3rd party suppliers
KMToll-SIT	System integration test	Toll collection subscription for test environment (outbound integration not possible).	Not applicable for the EETS Provider	Toll Charger and 3rd party suppliers

5 TESTING DURING THE ACCREDITATION PROCEDURE

5.1 Conformity to specifications

The proof of conformity of the OBE according to Article 15 of the Directive EU/2019/520 shall be provided by the EETS Provider in the format of a manufacturer's declaration of conformity to specification as defined in the Directive (the "**EC Declaration**"). The EC Declaration is assessed during the procedure for registering EETS Provider in the Member State where the EETS Provider is registered according to Article 4b of the Directive EC/2019/520.

The Toll Charger requires that the EC Declaration is valid and not outdated and prove conformity of the OBE according to EN/ISO TS 12813:2019. Detailed OBE requirements are found in Annex E (Technical Conditions).

The Toll Charger must receive the EC Declaration from the EETS Provider as part of Phase 1 (Application and Evaluation), cf. Annex C (Accreditation Procedure). The Toll Charger is entitled to examine the EC Declaration and perform specific tests of the EETS Provider's OBE if it is deemed necessary. The Toll Charger is furthermore entitled to request specific test reports from the EETS Provider to support the examination of the EC Declaration.

5.2 Preparation of test ("Phase 3")

5.2.1 Objective

The objective of Phase 3 is to allow the EETS Provider and Toll Charger to prepare for Phase 4 (Suitability for use tests) by ensuring that the EETS Provider can integrate towards the Toll Charger's APIs and demonstrating this by completing a connectivity test. In general, the EETS Provider must during Phase 3 demonstrate successful connectivity between the EETS Provider's and the Toll Charger's back office systems, including evidence of correctly configured network and security set-up to be allowed to initiate suitability for use tests.

The detailed requirements for Phase 3 (Preparation of test) towards the EETS Provider is described in the test plan 'TSI06 Test Plan EETS connectivity test (Phase 3 – Preparation of test)' containing information on e.g., test scope, prerequisites, acceptance criteria, time schedule.

Detailed test documentation concerning Phase 3 is not publicly available, instead the Toll Charger will make the test plan as well as detailed test cases available to the EETS Provider as part of the Accreditation Procedure.

5.3 Suitability for use test ("Phase 4")

The required proof of suitability for use shall be provided by means of suitability for use tests. The procedure for the suitability for use test constitute Phase 4 of the Accreditation Procedure. Overall Phase 4 includes the following type of tests, which will be described in the following sections.

(i)   Interface test

(ii)   DSRC test

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(iii)   GNSS test

(iv)   End-to-end test

The detailed requirements for Phase 4 (Suitability for use test) towards the EETS Provider is de-scribed in the test plan 'TSI07 Test Plan EETS suitability for use test (Phase 4)' containing infor-mation on e.g., test scope, prerequisites, acceptance criteria, time schedule.

Detailed test documentation concerning Phase 4 is not publicly available, instead the Toll Charger will make the test plan as well as detailed test cases available to the EETS Provider as part of the Accreditation Procedure.

5.3.1   Objective

Interface test

The purpose of the Interface test is to verify the exchange of data between the EETS Provider's and the Toll Charger's back office systems to ensure proper functioning of the toll collection system. The EETS Provider shall demonstrate that they can handle and support EETS interfaces and related business logic.

The interface specifications to be tested during the Interface test are to be found in Annex F (Interface Specifications).

The EETS Provider shall follow the described security and authentication requirements for REST APIs as described in section 5.2 of Annex F (Interface Specifications).

DSRC test

The purpose of the DSRC test is to check if DSRC communication is correct, complete and reliable and, thus, verify compatibility between the EETS Provider's OBE and the Toll Charger's roadside equipment.

The Toll Charger will make roadside equipment available for the DSRC test, which will be used to check that the OBE communicates correctly under realistic circumstances.

The EETS Provider shall provide the Toll Charger with three (3) specimens of each of the OBE type to be approved for use in the KmToll Domain. The OBE must be correctly configured including security keys (trust objects). The DSRC test will be performed by the Toll Charger using test vehicles equipped with the OBE provided by the EETS Provider.

In general, the DSRC test consists of lab tests followed by roadside tests. The objective of the lab tests is to verify that the provided trust objects from the EETS Provider can be used to successfully communicate with the RSE of the Toll Charger and verify that the DSRC transceiver in the OBE of the EETS Provider is properly configured to support communication with the Toll Charger's RSE.

The objective of the roadside tests is to verify that DSRC data from the OBE of the EETS Provider can be successfully read and contains data structured according to specification to ensure interop-erability when deployed in production and verify that DSRC data from the OBE of the EETS Provider can be successfully read from an OBE correctly mounted in a vehicle passing by a flexible enforce-ment point in normal traffic driving scenarios.

For OBE that have not previously been used in a an EETS Domain or have only been used in a limited number of EETS Domains the Toll Charger may decide to request additional laboratory tests from the EETS Provider to check the OBE. If such additional tests are requested by the Toll Charger, the appropriate documentation including test reports must be provided by the EETS Provider to the Toll Charger as part of Phase 3 of the Accreditation Procedure.

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DSRC test is applicable in rule for any OBE proposed by the EETS Provider. In cases, where the OBE proposed by the EETS Provider does not rely on DSRC technology, the Toll Charger reserves the right to waive the requirement for DSRC test and impose other relevant tests.

GNSS tests

The purpose of the GNSS test is to verify the accuracy, availability and correctness of the positioning data forwarded from the EETS Provider's OBE to the Toll Charger through the EETS interfaces.

The Toll Charger will define routes for representative parts of the tolled road network representing both normal conditions and challenges within urban and rural areas.

The GNSS test will be performed by the Toll Charger driving the defined routes using vehicles equipped with the OBE provided by the EETS Provider.

In general, the GNSS test will consists of a roadside test followed by data assessment. The objective of the roadside test will be to verify that GNSS position data is transferred continuously and in correct sequence to the Toll Charger driving in urban and rural areas with the EETS Provider's OBE. The objective of the data assessment will be to evaluate the received Toll Declarations and generate Billing Details with the purpose of verifying the level of correct detection of toll segments by the EETS Provider's OBE.

The EETS Provider is required to provide multiple specimens of each OBE type to be approved for use in the KmToll Domain.

- For accreditation of OBE Type 1 the EETS Provider is required to provide three (3) specimens of each OBE type to be approved for use in the KmToll Domain.

- For accreditation of OBE Type 2 the EETS Provider is required to provide at least three (3) specimens of each OBE type to be approved for use in the KmToll Domain. The number of OBE Type 2 units must be at least three (3) for each OS platform and agreed with the Toll Charger. The EETS Provider must document that the number and selection of OBE Type 2 hardware is suitable to be representative for the variation in the population of hardware platforms and versions on which the application is designed to operate on.

End-to-end test

The objective of the End-to-end test is to validate the correct functioning of all components of the technical solution and the business processes of the EETS Provider to ensure proper functioning of the toll collection system.

Several test scenarios related to operation of the KmToll Scheme will be tested, representing both the "happy flow" and "special scenarios".

The End-to-end test must be executed by the EETS Provider in close collaboration with the Toll Charger. Concerning roadside test, the EETS Provider's on-site presence in Denmark is required as the EETS Provider is responsible for executing the roadside test. The Toll Charger is responsible for specifying the test route characteristics to be driven as part of the test.

Test must be performed with three (3) specimens of each OBE as part of the accreditation procedure. It is allowed for the EETS Provider to use light-weight vehicle(s) below 3.5 tonnes for execution of the End-to-end test. The Toll Charger has the right and obligation to oversee the test.

The End-to-end test will in general consists of the following test scenarios:

- Toll collection

- Exception List handling

- Financial flow

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- Customer complaint

- Tolling – special cases

- Interface load test

- OBE Type 2 Enforcement (only relevant for an EETS Provider with OBE Type 2)

5.4 Pilot Operation ("Phase 5")

5.4.1 Objective

The first round of accreditation takes place simultaneously with the KmToll Scheme being implemented, thus, the purpose of the Pilot Operation is trialling the entire KmToll Scheme to ensure the system is ready for commissioning.

During Phase 5 participation by the EETS Provider and real EETS Users is required, and entire business processes are tested under operational like conditions in the KMToll-PROD environment. The EETS Provider shall engage its EETS Users which shall have their vehicles equipped with OBE and is required to circulate on the tolled road network. All systems will work as if the Toll was collected, however, no EETS Users are billed.

The Pilot Operation will make it possible for the Toll Charger to correct issues and make the necessary adjustment to the technical, procedural and/or organisational processes prior to the go-live date of the KmToll Scheme. Furthermore, the Pilot Operation will help the EETS Provider ramp up and ensure readiness of its Services and equipment of its' EETS Users prior to the date where the KmToll Scheme enters into force.

The following is in scope for the Pilot Operation:

From the 1 September to 30 September 2024 the EETS Provider shall conduct a connectivity test in the KMToll-PROD environment for all EETS interfaces. As soon as the EETS Provider preparation activities are done, and no later than the 1 October 2024 the EETS Provider shall activate the installed OBE in the EETS Users vehicles. The EETS Provider is encouraged to activate the OBE as soon as possible.

From the 1 October to 31 October 2024 the EETS Provider shall demonstrate:

- 50 active OBE (with unique ID)

- 15,000 kilometres driven on the tolled road network (the KmToll Domain).

From 1 November to 31 December 2024 there will be no upper limit for active OBE or driven kilometres, thus the EETS Provider shall each month demonstrate:

- A minimum 50 active OBE (with unique ID).

- A minimum of 15,000 kilometres driven on the tolled road network (the KmToll Domain).

During the Pilot Operation no EETS Users are billed, and no money shall be transferred to the Toll Charger. Amounts outstanding between the EETS Provider and Toll Charger will be handled by the Toll Charger ensuring to credit the amount once the Pilot Operation has ended.

5.5 Service trial ("Phase 6")

5.5.1 Objective

From the time of initiation of Phase 6 the EETS Provider starts operation and is required to deliver its Service to the EETS Users, cf. the Agreement. The purpose of Phase 6 is for the EETS Provider to monitor KPI and service levels and demonstrate to the Toll Charger that the EETS Provider

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sufficiently can perform according to the required performance levels, cf. Annex G (Key Performance Indicators). The EETS Provider must demonstrate that the Services are in operation with normal and/or better functions, and that all KPIs and service levels in a period of at least 100 consecutive days without any large system changes or reconfigurations are performed.

During Phase 6 the EETS Provider and the Toll Charger will conduct weekly operational status meetings. Furthermore, the EETS Provider will have to present the Toll Charger with a weekly status report including operational information of the Services provided by the EETS Provider. Elements to include are;

(i)   The number of users with activated service for the KmToll Domain;

(ii)   The number of active users in the KmToll Domain;

(iii)   The number of Toll Declaration packages sent to the Toll Charger;

(iv)   The number of Billing Details received;

(v)   The amount of Toll due for collection; and

(vi)   Any technical anomalies detected by the EETS Provider.

When the EETS Provider has fulfilled the requirements for Phase 6, the Toll Charger will approve this in writing. The Toll Charger will also provide the EETS Provider with a Proof of Accreditation stating that the EETS Provider has fulfilled its obligations under the Addendum. The Proof of Accreditation will be provided by the Toll Charger in writing, in a format deemed relevant by the Toll Charger.

During the Service Trial the EETS Provider is responsible for keeping its development team available in case of issues, so these issues can be resolved as quickly as possible and furthermore from time to time optimise their technical solution to any extent necessary. The EETS Provider must be at the Toll Charger's disposal for answering questions of operational nature, including providing a hotline service.

6   TESTING DURING OPERATION

The Toll Charger may ask the EETS Provider to conduct any test necessary in case the Toll Charger has reason to believe that EETS Provider's technical solution does not meet requirements and/or is not performing according to requirements. In the event that Toll Charger's suspicions are confirmed and an issue/defect is identified, the EETS Provider will be responsible for bearing the cost associated with the test, and any remedial action required. In the event that Toll Charger's suspicion is refuted, the Toll Charger will bear the cost associated with the test.

7   THE RECERTIFICATION PROCEDURE

The recertification procedure enters into force from the Operation Date.

In the event that changes to the OBE provided by the EETS Provider are expected, the EETS Provider must inform the Toll Charger hereof. Some of the most relevant cases which may give rise for re-certification of an OBE are as follows:

(i)   Changes to other OBE hardware and/or software;

(ii)   Changes to the OBE management system;

(iii)   New OBE functionality; and

(iv)   Changes to the back office interfaces between the EETS Provider and Toll Charger.

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The EETS Provider shall always report changes to the OBE to the Toll Charger in writing. The EETS Provider must prove to the Toll Charger that the configured/changed OBE meets the applicable requirements. The Toll Charger decides on the basis of this report whether the entire procedure for conformity to specifications and suitability for use tests, or just parts of the procedure is required to be redone.

Relevant changes to the EETS Provider's back office systems that is expected to impact the Toll Charger shall be made in consultation with the Toll Charger. The EETS Provider shall report to the Toll Charger in writing. Based on the change report, the Toll Charger will assess the impact of the change(s) and decide which tests procedure, if any, must be redone. It is the EETS Provider's prerogative to add new and/or improve existing functions of its' back office without informing the Toll Charger as long as operation of the Services is not impacted and the EETS Provider is compliant with the Toll Charger requirements.

The Toll Charger will present the requirements, if any, for the format of the report from the EETS Provider related to the recertification procedure.