
**Electronic fee collection — Test
procedures for user and fixed
equipment —**

**Part 1:
Description of test procedures**

*Perception du télépéage — Modes opératoires relatifs aux
équipements embarqués et aux équipements fixes —
Partie 1: Description des modes opératoires*

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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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.

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

This edition cancels and replaces the third edition of ISO/TS 14907-1:2015, *Intelligent transport systems – Part 1: Intelligent transport systems – Part 1: Intelligent transport systems*, which has been amended by ISO/TS 14907-1:2015/AM 1:2016 and ISO/TS 14907-1:2015/AM 2:2016.

The main changes compared to the previous edition are as follows:

- the document has been converted from a Technical Specification to an International Standard;
- the references have been revised.

A list of all parts in the ISO 14907 series can be found on the ISO website.

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

For an electronic fee collection (EFC) system, approvals and tests are required to determine whether the system (or individual components of the system) conforms to standards and application requirements and to enable parameters such as quality, availability, and maintainability to be measured.

There are complete EFC systems available, including documentation and approvals, and these could already be in operation in some European countries. This document provides a toolbox of tests and procedures for the assessment and proof of such EFC systems that they are suitable for specified EFC applications under specific operational conditions. Dependent on a system to be tested and based on the available documentation and the status of previously performed approvals, this document enables parties involved, e.g. system provider, operators, and test houses, to take into consideration already proven references and to identify such parameters which still have to be tested according to the specified applications.

At the time of publication of this document, the determination of common system requirements for Europe (or any other region) has not been agreed. For this reason, this document does not specify any particular performance requirements, unless these are already determined elsewhere (such as safety or radio regulations), but rather identifies the key parameters which will comprise such requirements. Where reference to an existing test is available, this document provides that reference. This document defines only the test and test procedures, not the benchmark figures that these are to be measured against. Benchmark figures which the systems or components under test can be compared with and validated against might form the subject of a future part of this series of standards. Within the framework of the European Electronic Toll System (EETS), this document could provide inputs for the work of the notified bodies in view to certify the different systems' part of the EETS in particular to check the suitability for use.

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This document is furthermore limited to automated (electronic) payment using a standardized dedicated short-range communication (DSRC). The scope of this document does not include manual payment, conventional money transaction, nor payment by means of sticker, vignettes, tickets, or magnetic-stripe cards, etc. The applications to which EFC is related are toll collection, road pricing, parking, and individual traffic information.

This document enables groups of operators to determine common specific performance levels and operating conditions and to enable regional variation where appropriate. It provides operating and environmental parameters (or classes of operating and environmental parameters) within which such systems shall successfully function without impairing interoperability to ensure that the person who specified the system can state their requirements clearly to implementation designers and integrators and to enable the measurement of the performance of such systems.

The following guidelines have been followed when selecting the test procedures for test parameters:

- reference as far as possible to existing standardized test procedures;
- focusing on those tests that are essential to ensure that EFC equipment is able to exchange information and mutually use the exchanged information.

A brief guide describing how to use this document is provided by [Annex A](#).

While this document relates to general test procedures, certain provisions relate specifically to test procedures for certification purposes. Many features of this document are relevant internationally; it is recognized that due to different regulatory requirements outside Europe, extension may be required to make its applicability as comprehensive in non-EU countries, before this International Standard can be reviewed for acceptance as in EU countries.

The ISO/TS 17444 series provides an examination framework for EFC charging performance.

This document relates only to the equipment of the user and the service provider as illustrated in [Figure 1](#).

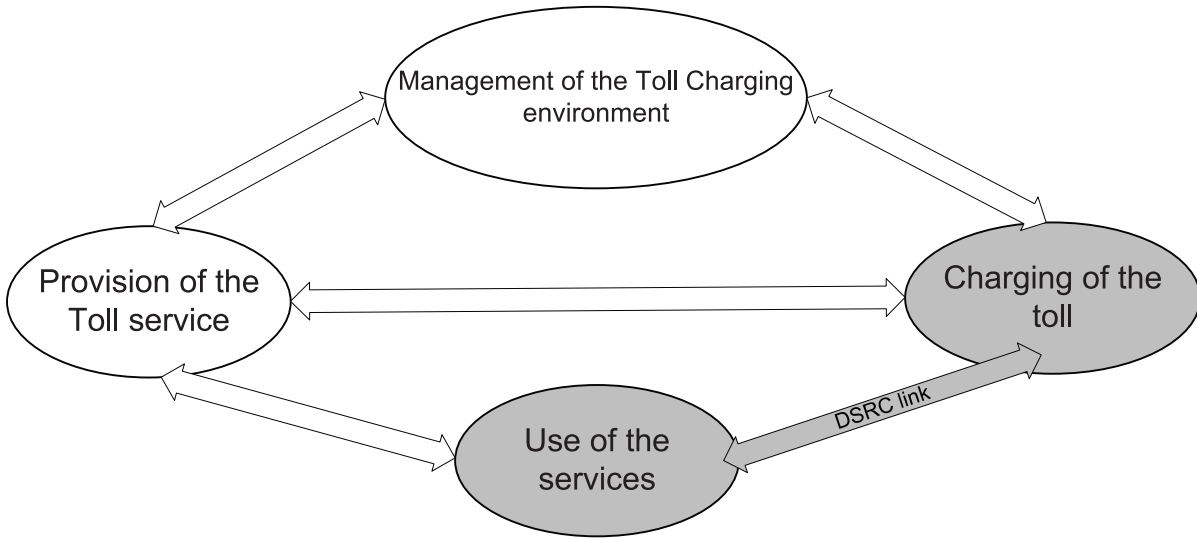


Figure 1 — Conceptual model of EFC

The scope of this document relates solely to OBE and RSE and the DSRC interface between OBE and RSE including its functions to perform the fee collection as illustrated by Figure 2.

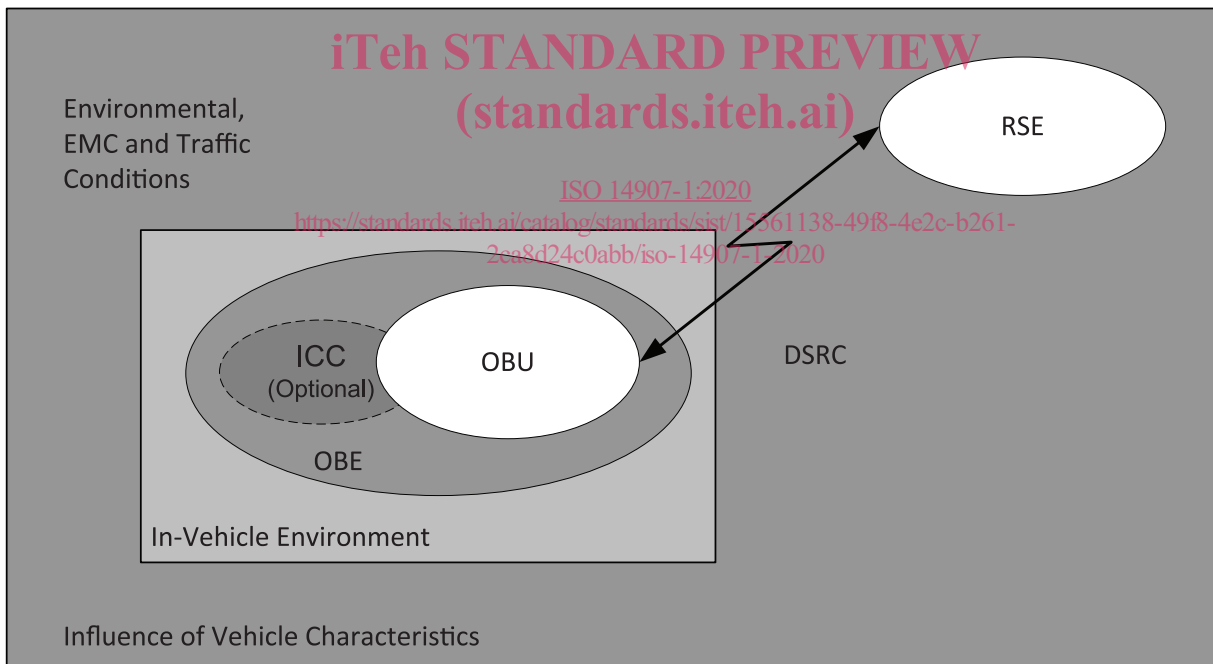


Figure 2 — OBE/RSE interface and associated environments

Electronic fee collection — Test procedures for user and fixed equipment —

Part 1: Description of test procedures

1 Scope

This document specifies the test procedures of electronic fee collection (EFC) roadside equipment (RSE) and on-board equipment (OBE) with regard to the conformance to standards and requirements for type approval and acceptance testing which is within the realm of EFC application specifically.

The scope of this document is restricted to systems operating within the radio emission, electromagnetic compatibility (EMC) regulations, traffic, and other regulations of the countries in which they are operated.

This document identifies a set of suitable parameters and provides test procedures to enable the proof of a complete EFC system, as well as components of an EFC system, e.g. OBE, related to the defined requirements of an application. The defined parameter and tests are assigned to the following groups of parameters:

- functionality;
- quality;
- referenced pre-tests.

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An overview of the tests and parameters provided by this document is given in [5.1](#) and [5.2](#).

This document describes procedures, methods and tools, and a test plan which shows the relation between all tests and the sequence of these tests. It lists all tests that are required to measure the performance of EFC equipment. It describes which EFC equipment is covered by the test procedures; the values of the parameters to be tested are not included. It also describes how the tests are to be performed and which tools and prerequisites are necessary before this series of tests can be undertaken. It is assumed that the security of the system is inherent in the communications and EFC functionality tests, therefore they are not addressed here. All tests in this document provide instructions to evaluate the test results.

This document defines only the tests and test procedures, not the benchmark figures that these are to be measured against. The test procedures defined in this document can be used as input, e.g. by scheme owners, for prototype testing, type approvals, tests of installations and periodic inspections.

Related to a conceptual model of an EFC system, this document relates only to the equipment of the user and the service provider. Any other entities are outside the scope of document.

EFC systems for dedicated short-range communication (DSRC) consist, in principle, of a group of technical components, which in combination fulfil the functions required for the collection of fees by electronic automatic means. These components comprise all, or most, of the following:

- OBE within a vehicle;
- OBE containing the communications and computing sub-functions;
- optional integrated circuit card which may carry electronic money, service rights, and other secured information;

- communication between OBE and RSE based on DSRC;
- equipment for the fee collection at the RSE containing the communications and computing sub-functions;
- equipment for the enforcement at the roadside;
- central equipment for the administration and operation of the system.

The scope of this document relates solely to OBE and RSE and the DSRC interface between OBE and RSE including its functions to perform the fee collection. All the equipment used for enforcement (e.g. detection, classification, localization, and registration) and central equipment are outside the scope of this document.

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 17025, *General requirements for the competence of testing and calibration laboratories*

ISO/IEC 17065:2012, *Conformity assessment — Requirements for bodies certifying products, processes and services*

3 Terms and definitions

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

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

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- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 acceptance testing

examination that a product, process, or service is in conformity with the system specification

3.2 accreditation

third-party *attestation* (3.3) related to a *conformity assessment body* (3.7) conveying formal demonstration of its competence, consistent operation and *impartiality* (3.15) in performing specific conformity assessment activities

[SOURCE: ISO/IEC 17000:2020, 2.4.7]

3.3 attestation

issue of a statement, based on a *decision* (3.8) that fulfilment of *specified requirements* (3.27) has been demonstrated

Note 1 to entry: The resulting statement, referred to in this document as a “statement of conformity”, is intended to convey the assurance that the specified requirements have been fulfilled. Such an assurance does not, of itself, afford contractual or other legal guarantees.

Note 2 to entry: First-party and third-party attestations are distinguished by the terms 2.4.2 to 2.4.7 in ISO/IEC 17000:2020. For second-party attestation, no such term is available.

[SOURCE: ISO/IEC 17000:2020, 2.4.3]

3.4**availability**

property of being accessible and useable upon demand by an authorized entity

[SOURCE: ISO 7498-2:1989, 3.3.11]

3.5**certification**

third-party *attestation* (3.3) related to *objects of conformity assessment* (3.20), with the exception of *conformity assessment bodies* (3.7)

Note 1 to entry: Certification is applicable to all objects of conformity assessment except for conformity assessment bodies themselves, to which *accreditation* (3.2) is applicable.

[SOURCE: ISO/IEC 17000:2020, 2.4.6]

3.6**compatibility**

suitability of products, processes, or services for use together under specific conditions to fulfil relevant requirements without causing unacceptable interactions

3.7**conformity assessment body**

body that performs conformity assessment activities, excluding *accreditation* (3.2)

[SOURCE: ISO/IEC 17000:2020, 2.1.6]

3.8**decision**

conclusion based on the results of *review* (3.24), that fulfilment of *specified requirements* (3.27) has or has not been demonstrated

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[SOURCE: ISO/IEC 17000:2020, 2.4.2]

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3.9**EFC equipment**

equipment comprising roadside equipment (RSE) and on-board equipment (OBE)

3.10**EFC system**

system that enables electronic debiting for the use of transport services

3.11**evaluation**

systematic process of determining how individuals, procedures, systems, or programs have met formally agreed objectives and requirements

[SOURCE: ISO/TS 10798:2011, 1.90]

3.12**evaluation assurance level**

set of assurance requirements, usually involving documentation, analysis and testing, representing a point on a predefined assurance scale, that forms an assurance package

3.13**field test**

test that is performed under real-life conditions

**3.14
functionality test**

assessing the performance of an EFC system, based on specific parameters

Note 1 to entry: Functionality parameters can include communication, application, and vehicle and traffic characteristics.

**3.15
impartiality**

objectivity with regard to the outcome of a conformity assessment activity

Note 1 to entry: Objectivity can be understood as freedom from bias or freedom from conflicts of interest.

[SOURCE: ISO/IEC 17000:2020, 2.2.3]

**3.16
inspection**

examination of an *object of conformity assessment* (3.20) and determination of its conformity with detailed requirements or, on the basis of professional judgement, with general requirements

Note 1 to entry: For additional information on the concepts of testing and inspection see A.2.2.4.

Note 2 to entry: The procedure can be intended to control variables within testing as a contribution to the accuracy or reliability of the results.

Note 3 to entry: The output of testing can include comments (e.g. opinions and interpretations) about the test results and fulfilment of specified requirements.

[SOURCE: ISO/IEC 17000:2020, 2.3.3]

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**3.17
interoperability**

ability of systems to exchange information and to make mutual use of the information that has been exchanged

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2ca8d24c0abb/iso-14907-1-2020

[SOURCE: ISO/IEC/TR 10000-1:1998, 3.2.1, modified — "systems" has been changed to "two or more IT systems"]

**3.18
laboratory test**

test which is performed in a laboratory under specified conditions

**3.19
maintainability**

ability of a system or subsystem to be maintained or restored to specified conditions within a given period of time

**3.20
object of conformity assessment
object**

entity to which *specified requirements* (3.27) apply

Note 1 to entry: Examples are product, process, service, system, installation, project, data, design, material, claim, person, body or organization or any combination thereof.

Note 2 to entry: The term "body" is used in this document to refer to *conformity assessment bodies* (3.7) and accreditation bodies. The term "organization" is used in its general meaning and may include bodies according to the context. The more specific ISO/IEC Guide 2 definition of an organization as a body based on membership is not applicable to the field of conformity assessment.

[SOURCE: ISO/IEC 17000:2020, 2.1.2]

3.21
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: OBE is composed of the on-board unit (OBU) and other sub-units whose presence is considered optional for the execution of the DSRC interface.

[SOURCE: ISO 14906:2011, 3.14]

3.22
quality

degree to which a set of inherent characteristics fulfils requirements

Note 1 to entry: User requirements can include ease of use, safety, availability, reliability, sturdiness, economy, and environmental safety. Such requirements can be explicit or implicit.

[SOURCE: ISO 9000:2015, 3.6.2]

3.23
reliability

ability of a device or a system to perform its intended function under given conditions of use for a specified period of time or number of cycles

3.24
review

consideration of the suitability, adequacy and effectiveness of selection and determination activities, and the results of these activities, with regard to fulfilment of *specified requirements* (3.27) by an *object of conformity assessment* (3.20)

[SOURCE: ISO/IEC 17000:2020, 2.4.1] <https://standards.iso.org/standards/catalog/standards/sist/15561138-49f8-4e2c-b261-2ca8d24c0abb/iso-14907-1-2020>

3.25
roadside equipment
RSE

equipment located along the road, either fixed or mobile

3.26
simulation

representation of selected behavioural characteristics of one physical or abstract system by another system

[SOURCE: ISO/IEC 2382-1:1993, definition 01.06.01]

3.27
specified requirement

need or expectation that is stated

Note 1 to entry: Specified requirements may be stated in normative documents such as regulations, standards and technical specifications.

Note 2 to entry: Specified requirements can be detailed or general.

[SOURCE: ISO/IEC 17000:2020, 2.2.1]

3.28
test

procedure designed to measure characteristics of a component or system in specified conditions

3.29

test parameter

parameter that specifies one or more characteristics of a system to be tested

3.30

test procedure

instructions for the setup, execution, and evaluation of results for a given test case

[SOURCE: ISO/IEC 25051:2014, 4.1.22, modified]

3.31

test status

nature of a test, either basic or conditional

Note 1 to entry: A test labelled “conditional” is performed if, and only if, it is applicable to a feature identified in the specification of the system or component, whereas a test labelled “basic” indicates a highly recommended test as part of a foundation for meaningful evaluation. See [5.2](#).

3.32

test type

kind of test

EXAMPLE Inspection, simulation, laboratory test, field test.

3.33

test house

third party that carries out the test

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3.34

type approval

approval based on conformity testing on the basis of one or more specimens of a product representative of the production

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3.35

validation

confirmation of plausibility for a specific intended use or application, through the provision of objective evidence that *specified requirements* ([3.27](#)) have been fulfilled

Note 1 to entry: Validation can be applied to claims to confirm the information declared with the claim regarding an intended future use.

[SOURCE: ISO/IEC 17000:2020, 2.3.5]

3.36

verification

confirmation of truthfulness, through the provision of objective evidence that *specified requirements* ([3.27](#)) have been fulfilled

Note 1 to entry: Verification can be applied to claims to confirm the information declared with the claim regarding events that have already occurred or results that have already been obtained.

[SOURCE: ISO/IEC 17000:2020, 2.3.6]

4 Abbreviated terms

ARIB Association of Radio Industries and Businesses

NOTE A Japanese standards development organisation.

DSRC dedicated short-range communication

EAL	Evaluation Assurance Level
EFC	Electronic Fee Collection
EIRP	Equivalent Isotropically Radiated Power
EMC	Electromagnetic Compatibility
ETSI	European Telecommunications Standards Institute
ICC	Integrated Circuit Card
IEC	International Electrotechnical Commission
MMI	Man-Machine Interface
MTBF	Mean Time Between Failure
MTTF	Mean Time to Failure
MTTR	Mean Time to repair
OBE	On-board Equipment
OBU	On-board Unit
QMS	Quality Management System
RSE	Roadside Equipment
SUT	System Under Test
tbd	To be determined
TOE	Target of Evaluation

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5 Test parameters and test procedures for EFC

5.1 Tests overview

5.1.1 General

The test parameters for EFC systems or components are categorized in three groups as follows:

- a) functionality tests;
- b) quality tests;
- c) referenced pre-tests.

[Figure 3](#) shows the general structure of all test parameter groups relevant for EFC systems and those which are relevant to this document. The test parameters for pre-tests are referenced from sources other than this document. The specific test parameters that are ultimately deemed relevant for a specific EFC system shall be identified and listed in the test plan according to [5.3](#). The individual test plan for type approval or acceptance testing shall take into account those pre-tests that have already been passed, i.e. for EMC, DSRC, and environment.

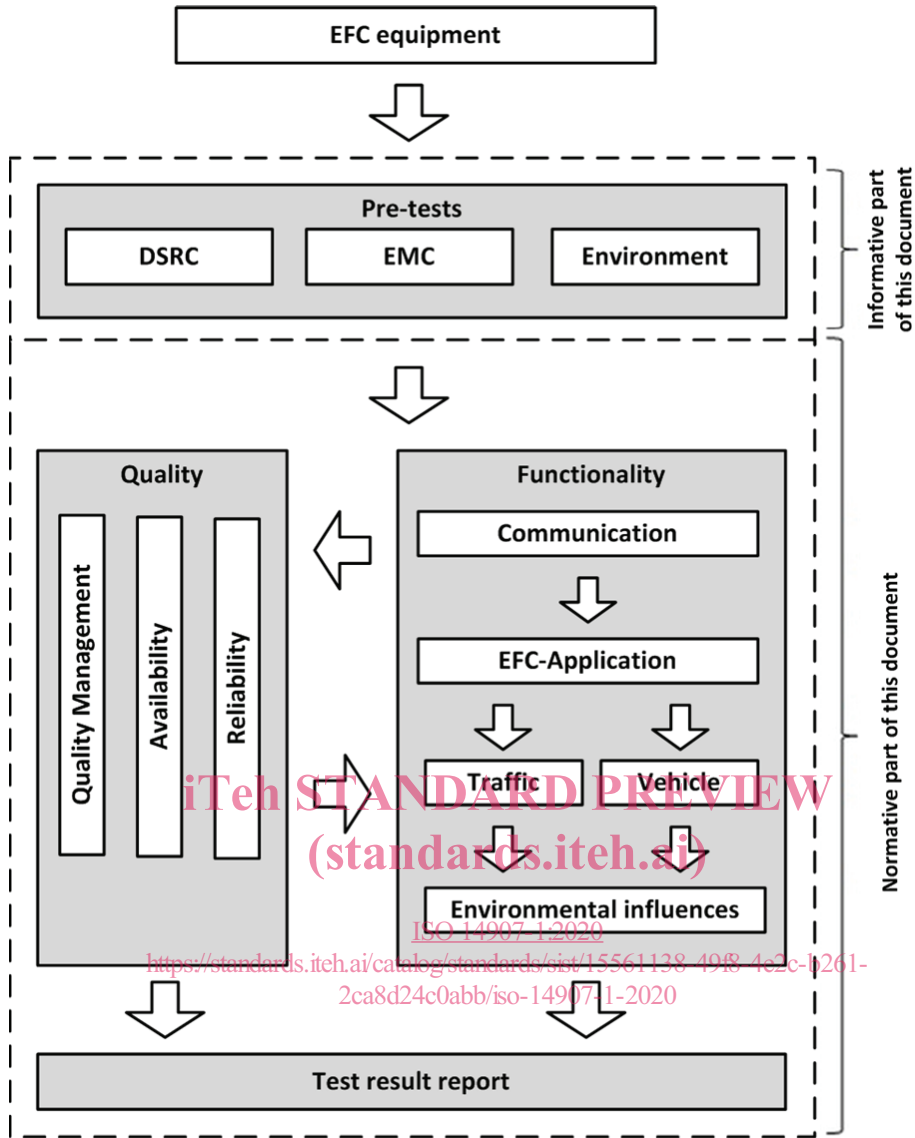


Figure 3 — Test plan — Interdependencies

5.1.2 Functionality tests

The first category of tests is related to test procedures which aim to verify the functionality of the EFC equipment.

The functionality tests are related to the essential test parameters that need to be applied to verify the performance and capability of EFC equipment of different vendors and system operators.

The following parameters shall be tested:

- communication;
- EFC application;
- influence of vehicle characteristics;
- influence of traffic characteristics;
- environmental influences.

Communication and EFC application tests are described in [6.1](#). Tests related to vehicle and traffic characteristics and environmental influences are listed in [Annex B](#).

5.1.3 Quality tests

The second category of tests is related to procedures that aim to determine the quality of the EFC equipment. These are relevant for both operators and users.

The following test parameters shall be tested:

- quality management;
- reliability;
- availability.

For some of these test parameters, there are some existing test procedures available, which are referenced.

These tests are described in [6.2](#) and [Annex C](#).

5.1.4 Referenced pre-tests

The third category of tests is related to test parameters which are fundamental for the performance of EFC equipment. The specific parameters and requirements are not within the scope of this document. The parameters that are relevant can be assigned to the following groups:

- DSRC;
- EMC;
- environment. <https://standards.iteh.ai/catalog/standards/sist/15561138-49f8-4e2c-b261-2ca8d24c0abb/iso-14907-1-2020>

5.2 Parameter overview

[Tables 1](#) to [3](#) provide a comprehensive list of the parameters that are relevant for type approval or acceptance testing of a complete EFC system, as well as components of an EFC system. The tables are divided according to the subjects of [5.1.2](#), [5.1.3](#), and [5.1.4](#), namely functionality, quality, and referenced pre-tests. The subclause in which the tests are described or referenced is shown. An indication as to the nature of these tests (basic or conditional) is provided as not all tests are relevant to all operators and their specific operating situations and environment.

As used in [Tables 1](#) to [3](#),

- “basic” means that the identified tests are highly recommended as part of a foundation for meaningful evaluation, and
- “conditional” means that the test shall be performed if, and only if, it is applicable to a feature identified in the specification of the system or component under evaluation, for example, performing the lane changing test (T6) if the RSE is characterized as multilane.

[Table 1](#) provides an overview of the parameters for which tests are defined in this document to measure the performance and assess the level of conformance of an EFC system or components under test.

[Table 2](#) provides a list of the quality tests.