



**Intelligent Transport Systems (ITS);
Testing;
Conformance test specifications for ITS Security;
Part 3: Abstract Test Suite (ATS) and
Protocol Implementation eXtra Information for Testing (PIXIT);
Release 2**

ETSI TS 103 096-3 V2.1.1 (2024-08)

<https://standards.iteh.ai/catalog/standards/etsi/df7f6f05-5dcd-4022-9884-ff184a9dd522/etsi-ts-103-096-3-v2-1-1-2024-08>

ReferenceRTS/ITS-005120

KeywordsATS, ITS, security, testing

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from the
ETSI [Search & Browse Standards application](#).

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format on [ETSI deliver](#).

Users should be aware that the present document may be revised or have its status changed,
this information is available in the [Milestones listing](#).

If you find errors in the present document, please send your comments to
the relevant service listed under [Committee Support Staff](#).

If you find a security vulnerability in the present document, please report it through our
[Coordinated Vulnerability Disclosure \(CVD\)](#) program.

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2024.
All rights reserved.

Contents

Intellectual Property Rights	5
Foreword.....	5
Modal verbs terminology.....	5
1 Scope	6
2 References	6
2.1 Normative references	6
2.2 Informative references.....	6
3 Definition of terms, symbols and abbreviations.....	7
3.1 Terms.....	7
3.2 Symbols.....	7
3.3 Abbreviations	7
4 Contents of the ITS Security Test Suite	8
5 Abstract Test Method	8
5.1 Introduction	8
5.2 Abstract protocol tester	8
5.3 Test Configuration.....	9
5.3.1 Introduction.....	9
5.3.2 PKI infrastructure	9
5.3.2.1 Overview	9
5.3.2.2 PKI certificate hierarchy	9
5.3.2.3 Test system settings.....	11
5.3.2.3.1 Test adapter settings	11
5.3.2.3.2 Test Suite Parameters	11
5.3.2.4 Certificate profiles.....	12
5.3.2.5 Certificate generation	13
5.3.2.6 Certificate installation	13
5.4 Test architecture	15
5.5 Ports and ASPs	15
5.5.1 Introduction.....	15
5.5.2 Primitives of the geoNetworkingPort	15
5.5.3 Primitives of the utPort	15
6 External functions	15
7 ATS conventions	17
7.1 Introduction	17
7.2 Testing conventions.....	17
7.2.1 Testing states	17
7.2.1.1 Initial states	17
7.2.1.2 Final state	17
7.3 Naming conventions.....	17
7.3.1 Introduction.....	17
7.3.2 General guidelines	17
7.3.3 ITS specific TTCN-3 naming conventions	18
7.3.4 Usage of Log statements.....	19
7.3.5 Test Case (TC) identifier	19
7.4 On line documentation	20
Annex A (informative): ATS in TTCN-3.....	21
A.1 TTCN-3 files and other related modules	21
Annex B (normative): Partial PIXIT pro forma for Security.....	22
B.1 The right to copy	22

B.2	Introduction	22
B.3	Identification summary.....	22
B.4	ATS summary	22
B.5	Test laboratory.....	23
B.6	Client identification.....	23
B.7	SUT	23
B.8	Protocol layer information.....	24
B.8.1	Protocol identification	24
B.8.2	IUT information	24
Annex C (normative): PCTR pro forma for Security		26
C.1	The right to copy	26
C.2	Introduction	26
C.3	Identification summary.....	26
C.3.1	Protocol conformance test report.....	26
C.3.2	IUT identification	26
C.3.3	Testing environment.....	27
C.3.4	Limits and reservation	27
C.3.5	Comments.....	27
C.4	IUT Conformance status	27
C.5	Static conformance summary	28
C.6	Dynamic conformance summary.....	28
C.7	Static conformance review report.....	28
C.8	Test campaign report.....	28
C.9	Observations.....	28
History		29

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Intelligent Transport Systems (ITS).

The present document is part 3 of a multi-part deliverable. Full details of the entire series can be found in part 1 [4].

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document provides parts of the Abstract Test Suite (ATS) for Security as defined in ETSI TS 103 097 [1] in accordance with the relevant guidance given in ISO/IEC 9646-7 [i.6]. The objective of the present document is to provide a basis for conformance tests for security communication over GeoNetworking equipment in order to guarantee interoperability between different manufacturers' equipment.

The ISO standards for the methodology of conformance testing (ISO/IEC 9646-1 [i.3] and ISO/IEC 9646-2 [i.4]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [i.7]) are used as a basis for the test methodology.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] [ETSI TS 103 097 \(V2.1.1\)](#): "Intelligent Transport Systems (ITS); Security; Security header and certificate formats; Release 2".
- [2] [ETSI TS 102 871-2 \(V1.5.1\)](#): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking; Part 2: Test Suite Structure and Test Purposes (TSS & TP)".
- [3] [ETSI TS 102 871-3 \(V1.5.1\)](#): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking; Part 3: Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".
- [4] [ETSI TS 103 096-1 \(V2.1.1\)](#): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for ITS Security; Part 1: Protocol Implementation Conformance Statement (PICS); Release 2".
- [5] [ETSI TS 103 096-2 \(V2.1.1\)](#): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for ITS Security; Part 2: Test Suite Structure and Test Purposes (TSS & TP); Release 2".
- [6] [ETSI TS 102 941 \(V2.2.1\)](#): "Intelligent Transport Systems (ITS); Security; Trust and Privacy Management; Release 2".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] ETSI EG 202 798: "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".
- [i.2] ETSI TR 103 099 (V1.5.1): "Intelligent Transport Systems (ITS); Architecture of conformance validation framework".
- [i.3] ISO/IEC 9646-1 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 1: General concepts".
- [i.4] ISO/IEC 9646-2 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 2: Abstract Test Suite specification".
- [i.5] ISO/IEC 9646-6 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 6: Protocol profile test specification".
- [i.6] ISO/IEC 9646-7 (1995): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 7: Implementation Conformance Statements".
- [i.7] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".
- [i.8] [OpenSSL](#) Project Toolkit Library V1.1.1.
- [i.9] ETSI ES 201 873-1: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI TS 103 097 [1], ETSI TS 102 871-2 [2], ETSI TS 102 871-3 [3], ISO/IEC 9646-6 [i.5] and ISO/IEC 9646-7 [i.6] apply.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AA	Authorization Authority
AID	Application ID
ASN.1	Abstract Syntax Notation One
AT	Authorization Ticket
ATM	Abstract Test Method
ATS	Abstract Test Suite
BO	Exceptionnal Behaviour
BV	Valid Behaviour
CAM	Cooperative Awareness Message
DEN	Decentralized Environmental Notification
DENM	Decentralized Environmental Notification Message
EN	European Norm
ES	ETSI Standard
GN	GeoNetworking
HSM	Hardware Security Module
HTML	HyperText Markup Language
ISO	International Organization for Standardization

ITS	Intelligent Transport Systems
ITS-S	ITS Station
ITSS	ITS-S data transfer
IUT	Implementation Under Test
NB	Normal Behaviour
OER	Octet Encoding Rules
PCTR	Protocol Conformance Testing Report
PICS	Protocol Implementation Conformance Statement
PIXIT	Partial Protocol Implementation eXtra Information for Testing
PKI	Public Key Infrastructure
PX	PiXit
RCA	Root Certificate Authority
SAP	Service Access Point
SCS	System Conformance Statement
SCTR	Static Conformance Test Report
SSP	Service Specific Permissions
SUT	System Under Test
TC	Test Case
TP	Test Purposes
TR	Technical Report
TS	Test System
TSS	Test Suite Structure
TTCN	Testing and Test Control Notation
UT	Upper Tester
XML	eXtensible Markup Language
XSLT	eXtensible Stylesheet Language Transformations

4 Contents of the ITS Security Test Suite

The ITS Security test suite contains:

- test implemented in TTCN-3 code
- certificate profiles and certificate generation tool

To execute the ITS Security Test Suite a Test Adapter implementation and a TTCN-3 compiler is required. The reference Test Adapter implementation can be found at https://forge.etsi.org/rep/ITS/ttcn/ats_sec_ts103096-3.git. TTCN-3 compilers can be acquired at <http://www.ttcn-3.org/>.

5 Abstract Test Method

5.1 Introduction

Clause 5 describes the ATM used to test the ITS-Security framework.

5.2 Abstract protocol tester

The abstract protocol tester used by the ITS-Security test suite is described in figure 1. The Test System simulates valid and invalid protocol behaviour, and analyses the reaction of the IUT.

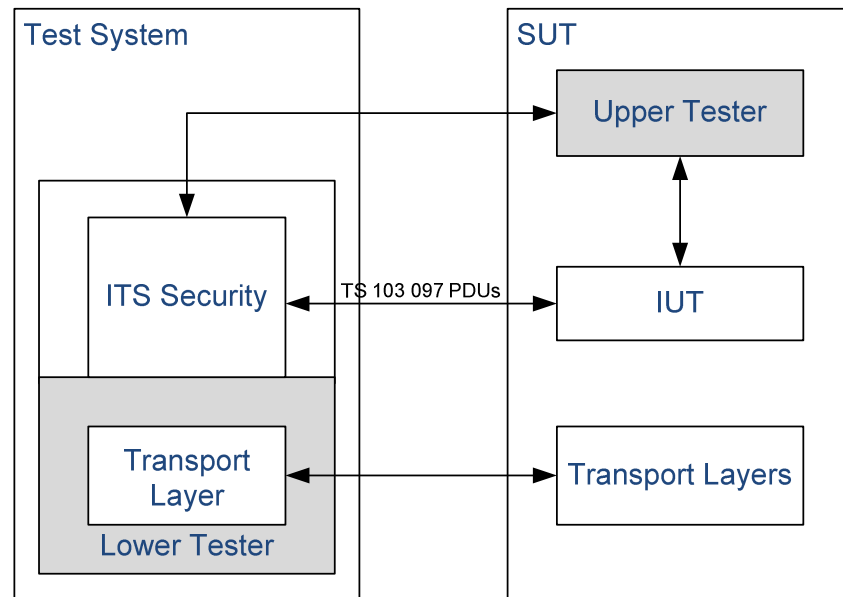


Figure 1: Abstract protocol tester - Security

5.3 Test Configuration

5.3.1 Introduction

This test suite uses test configurations defined in ETSI TS 102 871-3 [3], i.e. the tester simulates the ITS station implementing the ITS Security framework over GeoNetworking protocol.

5.3.2 PKI infrastructure

5.3.2.1 Overview

ETSI TS 103 096-3 V2.1.1 (2024-08)

Before executing tests:

- security certificates need to be generated, see clause 5.3.2.5;
- security certificates need to be installed onto the IUT, see clause 5.3.2.6;
- and some Test System settings need to be configured, see clause 5.3.2.3.

5.3.2.2 PKI certificate hierarchy

The required PKI certificate hierarchy of the test infrastructure is presented in figure 2.

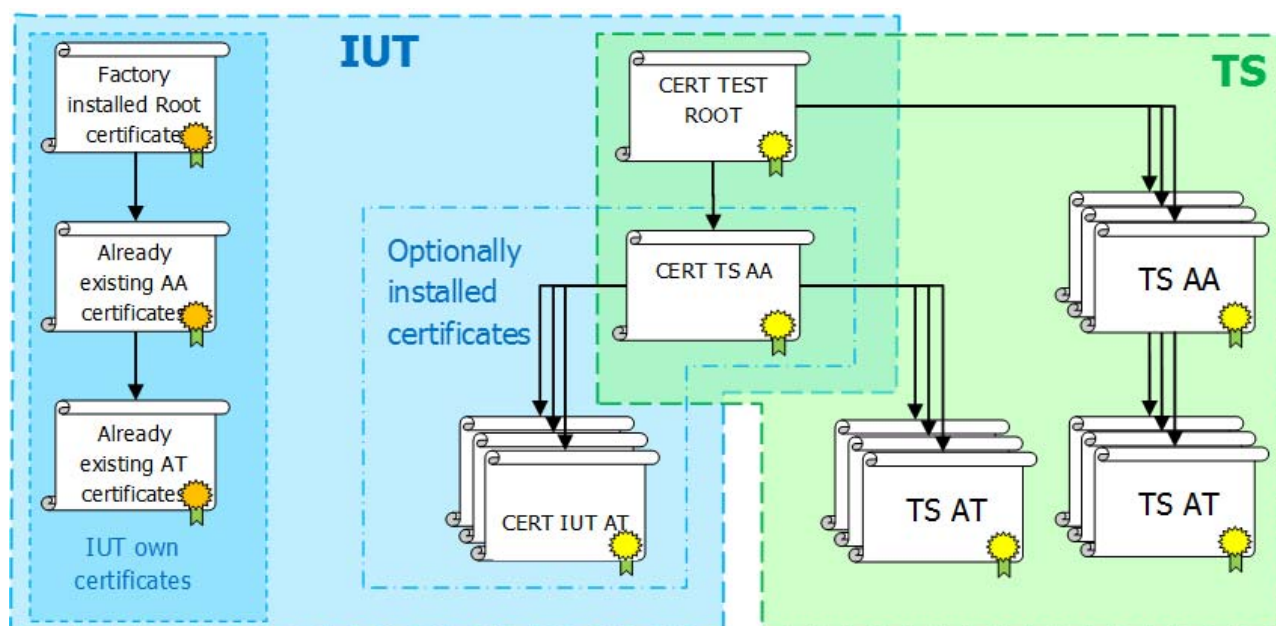


Figure 2: Required PKI certificate hierarchy

The following certificates are required for the test execution:

- 1) The set of the custom user-generated root certificates, referred as CERT_*_RCA, which are used to sign AA certificates used by the Test System and by the IUT to verify the Test System certificates. For the generation procedure see clause 5.3.2.5. The IUT shall install these *_RCA certificates and consider them as trusted. In the case where the IUT cannot install and trust root certificates, no tests can be executed.
- 2) Further certificates to be installed on the IUT:
 - Option 1: Certificates can be installed onto the IUT. Refer to clause 5.3.2.6 for further details on certificate installation.

If the IUT supports certificate selection using the UtInitialize Upper Tester command, then all mandatory tests can be executed and PICS_CERTIFICATE_SELECTION shall be set to true.

- Option 2: The IUT can only use its own pre-installed certificates. In this case only a subset of mandatory tests can be executed and PICS_CERTIFICATE_SELECTION shall be set to false.

In both cases it is necessary to copy these certificates to the subfolder of the location defined in PX_CERTIFICATE_POOL_PATH. The name of the subfolder shall be provided in PX_IUT_SEC_CONFIG_NAME.

It is not necessary to install IUT_ROOT and AA certificates onto the Test System when IUT and TS are using different PKIs. The TS trusts any root and AA certificate from the IUT.

A set of certificates and private keys to be used on the Test System side to sign various messages and other Test System certificates. These files are generated by the generation script (see clause 5.3.2.5).

All certificates and private keys shall be stored as binary streams.

The TS selects certificate using its file name. Table 1 describes file extensions to be used to store certificates and private keys.

Table 1: PKI file extensions

File extension	File role
.oer	OER encoder certificate
.vkey	Verification private key
.ekey	Encryption private key