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Part 2: Test Suite Structure and Test Purposes (TSS & TP)

**Technical Specification**

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# Foreword

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

The present document is part 2 of a multi-part deliverable covering Conformance test specification for ITS Security, as identified below:

Part 1: "Protocol Implementation Conformance Statement (PICS)";

**Part 2: "Test Suite Structure and Test Purposes (TSS & TP)";**

Part 3: "Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".

# Modal verbs terminology

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# 1 Scope

The present document provides the Test Suite Structure and Test Purposes (TSS & TP) for Security as defined in ETSI TS 103 097 [1] in accordance with the relevant guidance given in ISO/IEC 9646‑7 [i.6i.6].

The ISO standard for the methodology of conformance testing (ISO/IEC 9646‑1 [i.3i.3] and ISO/IEC 9646‑2 [i.4i.4]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [i.7i.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 (V1.3.1): "Intelligent Transport Systems (ITS); Security; Security header and certificate formats".

[2] IEEE Std 1609.2™-2016: "IEEE Standard for Wireless Access in Vehicular Environments –Security Services for Applications and Management Messages", as amended by IEEE Std 1609.2a™-2017: "Standard for Wireless Access In Vehicular Environments – Security Services for Applications and Management Messages Amendment 1".

[3] ETSI TS 103 096-1 (V1.4.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for ITS Security; Part 1: Protocol Implementation Conformance Statement (PICS)".

[4] ETSI TS 102 871-1 (V1.3.1): "Intelligent Transport Systems (ITS); Testing; Conformance test specifications for GeoNetworking ITS-G5; Part 1: Test requirements and Protocol Implementation Conformance Statement (PICS) pro forma".

[5] ISO 3166-1: "Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes".

[6] United Nations, Statistics Division (1996): "Standard Country or Area Codes for Statistical Use (Rev. 3), Series M: Miscellaneous Statistical Papers, No. 49", New York: United Nations.

## 2.2 Informative references

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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 (V1.1.1): "Intelligent Transport Systems (ITS); Testing; Framework for conformance and interoperability testing".

[i.2] ETSI TS 102 965 (V1.3.1): "Intelligent Transport Systems (ITS); Application Object Identifier (ITS-AID); Registration".

[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".

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI TS 103 097 [1], ETSI TS 102 965 [i.2i.2], ISO/IEC 9646‑6 [i.5i.5] and ISO/IEC 9646‑7 [i.6i.6] apply.

## 3.2 Abbreviations

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

AA Authorization Authority

AID Application Identifier

AID\_CAM ITS Application Identifier for CAM

AID\_DENM Application Identifier for DENM

AID\_GN Application Identifier for general GeoNetworking messages

AT Authorization Ticket

ATS Abstract Test Suite

BO Exceptional Behaviour

BV Valid Behaviour

CAM Co-operative Awareness Messages

CAN Controller Area Network

CERT Certificate

DE Data Element

DENM Decentralized Environmental Notification Message

EA Enrolment Authority

ECC Elliptic Curve Cryptography

GN GeoNetworking

ITS Intelligent Transportation Systems

ITS-S Intelligent Transport System - Station

IUT Implementation under Test

MSG Message

PICS Protocol Implementation Conformance Statement

SSP Service Specific Permissions

TP Test Purposes

TSS Test Suite Structure

# 4 Test Suite Structure (TSS)

## 4.1 Structure for Security tests

Table 1 shows the Security Test Suite Structure (TSS) defined for conformance testing.

Table 1: TSS for Security

| Root | Group | Category |
| --- | --- | --- |
| Security | ITS-S data transfer | Valid |
|  | ITS-S - AA authorization | Valid |
|  | ITS-S - EA enrolment | Valid |
|  | Sending behaviour  | Valid |
|  | Receiving behaviour | Valid and Invalid |
|  | Generic messages | Valid |
|  | CAM testing | Valid |
|  | DENM testing | Valid |
|  | Certificate testing | Valid |

# 5 Test Purposes (TP)

## 5.1 Introduction

### 5.1.1 TP definition conventions

The TP definition is built according to ETSI EG 202 798 [i.1].

### 5.1.2 TP Identifier naming conventions

The identifier of the TP is built according to table 2.

Table 2: TP naming convention

| Identifier | TP\_<root>\_<tgt>\_<gr>\_<sgr>\_<rn>\_<sn>\_<x> |  |  |
| --- | --- | --- | --- |
|  | <root> = root | SEC |  |
|  | <tgt> = target | ITSS | ITS-S data transfer |
|  |  | AA | ITS-S - AA authorization |
|  |  | EA | ITS-S - EA enrolment |
|  | <gr> = group | SND | Sending behaviour  |
|  |  | RCV | Receiving behaviour |
|  | <sgr> =sub- group | MSG | Generic messages |
|  |  | CAM | CAM testing |
|  |  | DENM | DENM testing |
|  |  | CERT | Certificate testing |
|  | <sn> = test purpose sequential number |  | 01 to 99 |
|  | <x> = category | BV | Valid Behaviour tests |
|  |  | BO | Invalid Behaviour Tests |

### 5.1.3 Rules for the behaviour description

The description of the TP is built according to ETSI EG 202 798 [i.1].

ETSI TS 103 097 [1] does not use the finite state machine concept. As consequence, the test purposes use a generic "Initial State" that corresponds to a state where the IUT is ready for starting the test execution. Furthermore, the IUT shall be left in this "Initial State", when the test is completed.

Being in the "Initial State" refers to the starting point of the initial device configuration. There are no pending actions, no instantiated buffers or variables, which could disturb the execution of a test.

### 5.1.4 Sources of TP definitions

All TPs have been specified according to ETSI TS 103 097 [1] and IEEE 1609.2™[2]

### 5.1.5 Mnemonics for PICS reference

To avoid an update of all TPs when the PICS document is changed, table 3 introduces mnemonics name and the correspondence with the real PICS item number. The 'PICS item' as defined in IEEE Std 1609.2 [2], ETSI TS 103 096-1 [3] and ETSI TS 102 871‑1 [4] shall be used to determine the test applicability.

Table 3: Mnemonics for PICS reference

|  |  |  |
| --- | --- | --- |
|  | Mnemonic | PICS item |
| 1 | PICS\_GN\_SECURITY | A.2/1 [4] |
| 2 | PICS\_SEC\_CERTIFICATE\_SELECTION | A.7/1 [1] |
| 3 | PICS\_SEC\_CIRCULAR\_REGION | A.2.3.1/S1.2.2.5.1.1 [2] |
| 4 | PICS\_SEC\_RECTANGULAR\_REGION | A.2.3.1/S1.2.2.5.1.2 [2] |
| 5 | PICS\_SEC\_POLYGONAL\_REGION | A.2.3.1/S1.2.2.5.1.3 [2] |
| 6 | PICS\_SEC\_IDENTIFIED\_REGION | A.2.3.1/S1.2.2.5.1.4 [2] |
| 7 | PICS\_SEC\_ITS\_AID\_OTHER | A.6/1 [1] |
| 8 | PICS\_SEC\_SHA256 | A.2.3.1/S1.2.2.1.1 [2] |
| 9 | PICS\_SEC\_SHA384 | A.2.3.1/S1.2.2.1.2 [2] |
| 10 | PICS\_SEC\_BRAINPOOL\_P256R1 | A.2.3.1/S1.2.2.4.1.2 [2] |
| 11 | PICS\_SEC\_BRAINPOOL\_P384R1 | A.2.3.1/S1.2.2.4.2 [2] |

# 5 ITS-S Security

## 5.1 Overview

Void.

## 5.2 Sending behaviour

### 5.2.1 Check the message protocol version

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_MSG\_01\_BV |
| **Summary** | Check that the IUT sends a secured message containing protocol version set to 3 |
| **Reference** | ETSI TS 103 097 [1], clause 5.1 IEEE1609.2[2], clause 6.3.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| **Expected behaviour** |
| with    the IUT being in the 'authorized' stateensure that    when        the IUT is requested to send a secured message    then        the IUT sends a EtsiTs103097Data            containing protocolVersion                 indicating value '3'  |

### 5.2.4 CAM profile

#### 5.2.4.1 Check that secured CAM is signed

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_01\_BV |
| **Summary** | Check that IUT sends the secured CAM using SignedData container |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data containing content             containing signedData |

#### 5.2.4.2 Check secured CAM AID value

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_02\_BV |
| **Summary** | Check that IUT sends the secured CAM containing the HeaderInfo field psid set to 'AID\_CAM' |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing tbsData             containing headerInfo                  containing psid                     indicating 'AID\_CAM'  |

#### 5.2.4.3 Check header fields

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_03\_BV |
| **Summary** | Check that IUT sends the secured CAM with the HeaderInfo containing generationTime and doesn’t containing expiryTime, generationLocation, encryptionKey, p2pcdLearningRequest, missingCrlIdentifier. |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing tbsData             containing headerInfo             containing generationTime             and not containing expiryTime and not containing generationLocation,          and not containing encryptionKey and not containing p2pcdLearningRequest and not containing missingCrlIdentifier |

#### 5.2.4.4 Check signer information

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_04\_BV |
| **Summary** | Check that IUT sends the secured CAM containing signer containing either certificate or digest;Check that signing certificate has permissions to sign CAM messages |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.1IEEE 1609.2 [2], clause 6.3.4 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send a secured CAM    then the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing signer               containing digest               or containing certificate containing toBeSigned containing appPermissions containing the item of type PsidSsp containing psid indicating AID\_CAM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_05\_BV |
| **Summary** | Check that IUT calculate the digest of certificate using proper hash algorithm;Check that IUT canonicalize certificates before hash calculation |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.1IEEE 1609.2 [2], clause 6.3.4 |
| **PICS Selection** | PICS\_GN\_SECURITY AND ***X\_PICS*** |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (***X\_CERTIFICATE***)     and the IUT is configured to send more than one CAM per second    and the IUT having sent a secured CAM containing signer containing certificate indicating ***X\_CERTIFICATE*** containing verifyKeyIndicator containing verificationKey containing ***X\_KEY***ensure that    when        the IUT is requested to send a subsequent secured CAM containing signer containing digest    then the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing signer               containing digest indicating last 8 bytes of the Hash value calculated using ***X\_HASH*** algorithm |
| **Permutation table** |
| **XX** | ***X\_CERTIFICATE*** | ***X\_KEY*** | ***X\_HASH*** | ***X\_PICS*** |
| A | CERT\_IUT\_A\_AT | ecdsaNistP256 | SHA-256 |  |
| AN | CERT\_IUT\_A\_N\_AT | ecdsaNistP256 | SHA-256 |  |
| B | CERT\_IUT\_A\_B\_AT | ecdsaBrainpoolP256r1 | SHA-256 | PICS\_SEC\_BRAINPOOL\_P256R1 |
| BN | CERT\_IUT\_A\_B\_N\_AT | ecdsaBrainpoolP256r1 | SHA-256 | PICS\_SEC\_BRAINPOOL\_P256R1 |
| C | CERT\_IUT\_A\_B3\_AT | ecdsaBrainpoolP384r1 | SHA-384 | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |
| CN | CERT\_IUT\_A\_B3\_N\_AT | ecdsaBrainpoolP384r1 | SHA-384 | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_06\_BV |
| **Summary** | Check that IUT sends the secured CAM containing the signing certificate when over the time of one second no other secured CAM contained the certificate was sent |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)     and the IUT is configured to send more than one CAM per second    and the IUT having sent a secured CAM containing generationTime indicating TIME\_LASTensure that    when        the IUT is sending secured CAM as a message of type EtsiTs103097Data         containing signer           containing certificate    then        this message is       containing headerInfo containing generationTime          indicating TIME (TIME >= TIME\_LAST + 1sec)  |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_07\_BV |
| **Summary** | Check that IUT sends the secured CAM containing the signing certificate when the timeout of one second has been expired after the previous CAM containing the certificate |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)     and the IUT is configured to send more than one CAM per second    and the IUT having sent a secured CAM containing signer  containing certificate     and containing generationTime           indicating TIME\_LASTensure that    when        the IUT is sending a secured CAM as a message of type EtsiTs103097Data   containing generationTime      indicating TIME >= TIME\_LAST + 1sec     then        this message is     containing certificate |

#### 5.2.4.5 Check that IUT sends certificate to unknown ITS-S

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_08\_BV |
| **Summary** | Check that IUT sends the secured CAM containing the signing certificate when the IUT received a CAM from an unknown ITS-S |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)     and the IUT is configured to send more than one CAM per second    and the IUT having already sent secured CAM containing certificate at TIME\_1    and the IUT having received a message of type EtsiTs103097Data        containing signedData     containing signer containing digest indicating HashedId8 value                 referencing an unknown certificate (CERT\_TS\_B\_AT)         at TIME\_2 (TIME\_1 < TIME\_2 < TIME\_1+1sec)ensure that    when        the IUT is requested to send secured CAM                    at TIME\_3 (TIME\_1 < TIME\_2 < TIME\_3 < TIME\_1 + 1sec)    then        the IUT sends a message of type EtsiTs103097Data            containing signedData             containing signer                    containing certificate  |

#### 5.2.4.6 Check that IUT restarts the timer when the certificate has been sent

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_09\_BV |
| **Summary** | Check that IUT restarts the certificate sending timer when the signing certificate was sent |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)     and the IUT is configured to send more than one CAM per second    and the IUT having already sent secured CAM        containing signer            containing certificate at TIME\_1    and the IUT having received a secured CAM        containing signer            containing digest             indicating HashID8 value             referencing an unknown certificate        at TIME\_2 (TIME\_1 + 0.3sec)    and the IUT having sent secured CAM         containing signer            containing certificate at TIME\_3 (TIME\_3 > TIME\_2)ensure that    when        the IUT is sending the next secured CAM     containing signedData         containing signer                 containing certificate at TIME\_4    then        the difference between TIME\_4 and TIME\_3 is about 1sec  |

#### 5.2.4.7 Check sending certificate request for unknown certificate

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_10\_BV |
| **Summary** | Check that the IUT sends certificate request when it receives secured CAM containing digest of unknown certificate as a message signer  |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1IEEE 1609.2 [2], clauses 6.3.9, 8.2.4.1.2 |
| **PICS Selection** | PICS\_GN\_SECURITY, PICS\_SEC\_P2P\_AT\_DISTRIBUTION |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)     and the IUT has receiving a EtsiTs103097Data     containing signer         containing digest             indicating HashedId8 value DIGEST\_A                 referencing an unknown certificate (CERT\_TS\_B\_AT)ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data         containing headerInfo containing inlineP2pcdRequest          containing HashedId3 value                indicating last 3 octets of DIGEST\_A |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_11\_BV***\_XX*** |
| **Summary** | Check that the IUT sends certificate request when it receives secured CAM containing certificate signed by unknown AA certificate |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1IEEE 1609.2 [2], clauses 6.3.9, 8.2.4.1.2 |
| **PICS Selection** | PICS\_GN\_SECURITYAND PICS\_SEC\_P2P\_AA\_DISTRIBUTIONAND ***X\_PICS*** |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)     and the IUT has receiving a message of type EtsiTs103097Data        containing signer            containing certificate             containing issuer containing ***X\_FIELD\_1***                 indicating HashedId8 value DIGEST                 referencing an unknown certificateensure that    when        the IUT is requested to send secured CAM    then        the IUT sends a message of type EtsiTs103097Data            containing signedData             containing tbsData             containing headerInfo containing inlineP2pcdRequest                     containing HashedId3 value                         indicating last 3 octets of DIGEST |
| **Permutation table** |
| **XX** | **X\_FIELD\_1** | **X\_PICS** |
| A | sha256AndDigest |  |
| B | sha384AndDigest | PICS\_SEC\_SHA384 |

#### 5.2.4.8 Check that IUT sends AT certificate when requested

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_12\_BV |
| **Summary** | Check that IUT sends the secured CAM containing the signing certificate when it received a CAM containing a request for unrecognized certificate that matches with the currently used AT certificate ID of the IUT |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1IEEE 1609.2 [2], clauses 6.3.9, 8.2.4.2.3 |
| **PICS Selection** | PICS\_GN\_SECURITYAND PICS\_SEC\_P2P\_AT\_DISTRIBUTION |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)     and the IUT is configured to send more than one CAM per second    and the IUT having already sent secured CAM        containing signer            containing certificate at TIME\_1    and the IUT having received a secured CAM         containing headerInfo containing inlineP2pcdRequest         containing HashedId3 value             indicating last 3 octets of currently used AT certificate at TIME\_2 (TIME\_1 < TIME\_2 < TIME\_1+1sec)ensure that    when        the IUT is requested to send a CAM            at TIME\_3 (TIME\_1 < TIME\_2 < TIME\_3 < TIME\_1+1sec)    then        the IUT sends a SecuredMessage of type EtsiTs103097Data            containing signer                and containing certificate                    referenced by the requested digest  |

#### 5.2.4.9 Check that IUT send AA certificate when requested

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_13\_BV |
| **Summary** | Check that IUT sends the secured CAM containing the AA certificate in the requestedCertificate headerInfo field when it received a CAM containing a request for unrecognized certificate that matches with the currently used AA certificate ID of the IUT |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1IEEE 1609.2 [2], clauses 6.3.9, 8.2.4.2.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_P2P\_AT\_DISTRIBUTION |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)  issued by the AA certificate (CERT\_IUT\_A\_AA)    and the IUT is configured to send more than one CAM per second    and the IUT having already sent a secured CAM        containing signer            containing certificate at TIME\_1    and the IUT having received a secured CAM containing headerInfo containing inlineP2pcdRequest      containing HashedId3 value     indicating last 3 octets of the digest of CERT\_IUT\_A\_AA at TIME\_2 (TIME\_1 < TIME\_2 < TIME\_1+1sec)ensure that    when        the IUT is requested to send a secured CAM            at TIME\_3 (TIME\_1 < TIME\_2 < TIME\_3 < TIME\_1+1sec)    then        the IUT sends a SecuredMessage of type EtsiTs103097Data        containing headerInfo      containing requestedCertificate indicating requested AA certificate CERT\_IUT\_A\_AA |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_14\_BV |
| **Summary** | Check that IUT sends the secured CAM containing the AA certificate in the requestedCertificate headerInfo field when it received a CAM containing a request for unrecognized certificate that matches with the known AA certificate ID which is not currently used by the IUT |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1IEEE 1609.2 [2], clauses 6.3.9, 8.2.4.2.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_P2P\_AA\_DISTRIBUTION |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)     and the IUT is configured to send more than one CAM per second    and the IUT is configured to know the AA certificate (CERT\_TS\_B\_AA)    and the IUT has already sent secured CAM         containing signer                containing certificate at TIME\_1    and the IUT having received a secured CAM        containing headerInfo containing inlineP2pcdRequest          containing HashedId3 value          indicating last 3 octets of the digest of CERT\_TS\_B\_AA which is not an issuer of currently used AT certificate at TIME\_2 (TIME\_1 < TIME\_2 < TIME\_1+1sec)ensure that    when        the IUT is requested to send a secured CAM            at TIME\_3 (TIME\_1 < TIME\_2 < TIME\_3 < TIME\_1+1sec)    then        the IUT sends a SecuredMessage of type EtsiTs103097Data containing headerInfo      containing requestedCertificate indicating requested AA certificate (CERT\_TS\_B\_AA) |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_15\_BV |
| **Summary** | Check that the IUT doesn't send a secured CAM containing the AA certificate in the requestedCertificate headerInfo field when it was previously requested and already received from another ITS-S |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1IEEE 1609.2 [2], clauses 6.3.9, 8.2.4.2.3 |
| **PICS Selection** | PICS\_GN\_SECURITY, PICS\_SEC\_P2P\_AA\_DISTRIBUTION |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)  issued by the AA certificate (CERT\_IUT\_A\_AA)    and the IUT is configured to send more than one CAM per second    and the IUT having already sent secured CAM        containing signer            containing certificate at TIME\_1    and the IUT having received a secured CAM      containing headerInfo containing inlineP2pcdRequest    containing HashedId3 value      indicating last 3 octets of the digest of CERT\_IUT\_A\_AA     at TIME\_2 (TIME\_1 < TIME\_2 < TIME\_1+0.8sec)    and the IUT having received a secured CAM         containing headerInfo     containing requestedCertificate indicating requested AA certificate (CERT\_IUT\_A\_AA) at TIME\_3 (TIME\_2 < TIME\_3 < TIME\_2+0.1sec)ensure that    when        the IUT is requested to send a secured CAM            at TIME\_4 (TIME\_3 < TIME\_4 < TIME\_1+0.9sec)    then        the IUT sends a SecuredMessage of type EtsiTs103097Data         containing headerInfo      does not containing requestedCertificate |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_16\_BV |
| **Summary** | Check that the IUT doesn't send a secured CAM containing the AA certificate in the requestedCertificate headerInfo field when it contains certificate in the signer field |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1IEEE 1609.2 [2], clauses 6.3.9, 8.2.4.2.3 |
| **PICS Selection** | PICS\_GN\_SECURITY, PICS\_SEC\_P2P\_AA\_DISTRIBUTION |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)  issued by the AA certificate (CERT\_IUT\_A\_AA)    and the IUT is configured to send more than one CAM per second    and the IUT having already sent a secured CAM        containing signer            containing certificate at TIME\_1    and the IUT having received a SecuredMessage  containing headerInfo containing inlineP2pcdRequest          containing HashedId3 value      indicating last 3 octets of the digest of CERT\_IUT\_A\_AA at TIME\_2 (TIME2 = TIME\_1+0.9sec)ensure that    when        the IUT is requested to send a secured CAM            at TIME\_3 (TIME\_2 < TIME\_3 < TIME\_1+1sec)    then        the IUT sends a SecuredMessage of type EtsiTs103097Data         containing signer             containing certificate         and containing headerInfo          does not containing requestedCertificate  |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_17\_BV |
| **Summary** | Check that the IUT send a secured CAM containing the AA certificate in the requestedCertificate headerInfo field with the next CAM containing digest as a signer info |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.1IEEE 1609.2 [2], clauses 6.3.9, 8.2.4.2.3 |
| **PICS Selection** | PICS\_GN\_SECURITY, PICS\_SEC\_P2P\_AA\_DISTRIBUTION |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)  issued by the AA certificate (CERT\_IUT\_A\_AA)    and the IUT is configured to send more than one CAM per second    and the IUT having already sent secured CAM        containing signer            containing certificate at TIME\_1    and the IUT having received a SecuredMessage of type EtsiTs103097Data        containing headerInfo containing inlineP2pcdRequest                containing HashedId3 value      indicating last 3 octets of the digest of CERT\_IUT\_A\_AA at TIME\_2 (TIME\_1+0.9sec < TIME2 < TIME\_1+1sec)ensure that    when        the IUT is sending a first subsequent secured CAM         containing signer             containing digest    then        this message         containing headerInfo      containing requestedCertificate  indicating requested AA certificate CERT\_IUT\_A\_AA |

#### 5.2.4.10 Check generation time

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_18\_BV |
| **Summary** | Check that IUT sends the secured CAM containing generation time and this time is inside the validity period of the signing certificate;Check that message generation time value is realistic |
| **Reference** | ETSI TS 103 097 [1], clauses 7.1.1IEEE 1609.2 [2], clauses 5.2.3.2.2, 5.2.4.2.2, 5.2.4.2.3  |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send CAM            containing certificate    then        the IUT sends a SecuredMessage of type EtsiTs103097Data containing headerInfo             containing generationTime          indicating GEN\_TIME (CUR\_TIME - 5min <= GEN\_TIME <= CUR\_TIME + 5min)         and containing signer                containing certificate                 containing toBeSigned                     containing validityPeriod containing start                          indicating value X\_START\_VALIDITY (X\_START\_VALIDITY <= GEN\_TIME)                            and containing duration                                indicating value > GEN\_TIME - X\_START\_VALIDITY  |

#### 5.2.4.11 Check payload

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_19\_BV |
| **Summary** | Check that IUT sends the secured CAM containing the 'data' field in signed data payload, containing the EtsiTs103097Data of type unsecured, contained the CAM payload |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data         contains content         contains signedData             containing tbsData              containing payload             containing data              containing content              containing unsecuredData                 containing not-empty data |

#### 5.2.4.12 Check signing permissions

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_20\_BV |
| **Summary** | Check that the IUT sends the secured CAM signed with the certificate containing appPermisions allowing to sign CA messages |
| **Reference** | ETSI TS 103 097 [1], clauses 7.2.1IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data        containing signer             containing certificate              containing appPermissions              containing an item of type PsidSsp                  containing psid = AID\_CAM  |

#### 5.2.4.13 Check signature

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_21\_BV\_***XX*** |
| **Summary** | Check that IUT sends the secured CAM containing signature;check that the signature is calculated over the right fields and using right hash algorythm by cryptographically verifying the signature |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.1IEEE 1609.2 [2], clauses 5.3.1, 6.3.4, 6.3.29, 6.3.30, 6.3.31 |
| **PICS Selection** | PICS\_GN\_SECURITY AND ***X\_PICS*** |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (***X\_CERTIFICATE***)  containing verifyKeyIndicator containing verificationKey containing ***X\_KEY*** indicating KEYensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data         containing signedData         containing signer containing digest                  referencing the certificate ***X\_CERTIFICATE***                 or containing certificate indicating ***X\_CERTIFICATE***             and containing signature              containing ***X\_SIGNATURE***                 verifiable using KEY  |
| **Permutation table** |
| **XX** | ***X\_CERTIFICATE*** | ***X\_KEY*** | ***X\_SIGNATURE*** | ***X\_PICS*** |
| A | CERT\_IUT\_A\_AT | ecdsaNistP256 | ecdsaNistP256Signature |  |
| B | CERT\_IUT\_A\_B\_AT | ecdsaBrainpoolP256r1 | ecdsaBrainpoolP256r1Signature | PICS\_SEC\_BRAINPOOL\_P256R1 |
| C | CERT\_IUT\_A\_B3\_AT | ecdsaBrainpoolP384r1 | ecdsaBrainpoolP384r1Signature | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_22\_BV |
| **Summary** | Check that IUT sends the secured CAM containing signature containing the ECC point of type set to either compressed\_lsb\_y\_0, compressed\_lsb\_y\_1 or x\_coordinate\_only |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.1IEEE 1609.2 [2], clauses 6.3.30, 6.3.31 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data         containing signedData             containing signature containing one of the ecdsaNistP256Signature or containing ecdsaBrainpoolP256r1Signature or containing ecdsaBrainpoolP384r1Signature containing rSig containing x-only  or containing compressed-y-0 or containing compressed-y-1 |

#### 5.2.4.14 Check certificate consistency conditions

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_23\_BV |
| **Summary** | Check that IUT doesn’t send secured CAMs if IUT is authorized with AT certificate doesn’t allowing sending messages in this location |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_C1\_AT)  containing region indicating rectangular region not containing current IUT position and the IUT has no other installed AT certificatesensure that    when        the IUT is requested to send a secured CAM    then        the IUT doesn’t send CAM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_24\_BV |
| **Summary** | Check that IUT doesn’t send the secured CAM if IUT is configured to use an AT certificate without region validity restriction and generation location is outside of the region of the issuing AA certificate |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_CA3\_AT) not containing region and issued by the AA certificate (CERT\_IUT\_C3\_AA) containing region indicating rectangular region not containing current IUT positionensure that    when        the IUT is requested to send a secured CAM    then        the IUT doesn’t send CAM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_25\_BV |
| **Summary** | Check that IUT doesn’t send secured CAMs if all AT certificates installed on the IUT was expired. |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A1\_AT)  containing validityPeriod indicating start + duration < CURRENT\_TIME and the IUT has no other installed AT certificatesensure that    when        the IUT is requested to send a secured CAM    then        the IUT doesn’t send CAM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_26\_BV |
| **Summary** | Check that IUT doesn’t send secured CAMs if all AT certificates installed on the IUT have the starting time in the future. |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A2\_AT)  containing validityPeriod indicating start > CURRENT\_TIME and the IUT has no other installed AT certificatesensure that    when        the IUT is requested to send a secured CAM    then        the IUT doesn’t send CAM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CAM\_27\_BV |
| **Summary** | Check that IUT doesn’t send secured CAMs if IUT doesn’t possess an AT certificate allowing sending CAM by its appPermissions |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A3\_AT)  containing appPermissions not containing PsidSSP containing psid indicating AID\_CAM and the IUT has no other installed AT certificatesensure that    when        the IUT is requested to send a secured CAM    then        the IUT doesn’t send CAM |

### 5.2.5 DENM profile

#### 5.2.5.1 Check secured DENM is signed

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_01\_BV |
| **Summary** | Check that IUT sends the secured DENM using SignedData container |
| **Reference** | ETSI TS 103 097 [1], clauses 7.1.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a EtsiTs103097Data containing content             containing signedData  |

#### 5.2.5.2 Check secured DENM AID value

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_02\_BV |
| **Summary** | Check that IUT sends the secured DENM containing the HeaderInfo field psid set to 'AID\_DENM' |
| **Reference** | ETSI TS 103 097 [1], clauses 7.1.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a EtsiTs103097Data containing content             containing signedData             containing tbsData             containing headerInfo                  containing psid                     indicating 'AID\_DENM' |

#### 5.2.5.3 Check header fields

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_03\_BV |
| **Summary** | Check that IUT sends the secured DENM with the HeaderInfo containing generationTime and generationLocation and doesn’t containing expiryTime, encryptionKey, p2pcdLearningRequest, missingCrlIdentifier, inlineP2pcdRequest, requestedCertificate. |
| **Reference** | ETSI TS 103 097 [1], clause 5.2, 7.1.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a EtsiTs103097Data containing content             containing signedData             containing tbsData             containing headerInfo             containing generationTime and containing generationLocation,              and not containing expiryTime         and not containing encryptionKey and not containing p2pcdLearningRequest and not containing missingCrlIdentifier and not containing inlineP2pcdRequest and not containing requestedCertificate |

#### 5.2.5.4 Check signer information

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_04\_BV |
| **Summary** | Check that IUT sends the secured DENM containing signer containing certificate |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.2IEEE 1609.2 [2], clause 6.3.4 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured DENM    then the IUT sends a EtsiTs103097Data containing content             containing signedData             containing signer               containing certificate containing toBeSigned containing appPermissions containing the item of type PsidSsp containing psid indicating AID\_DENM |

#### 5.2.5.5 Check generation time

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_05\_BV |
| **Summary** | Check that IUT sends the secured DENM containing generation time and this time is inside the validity period of the signing certificate;Check that message generation time value is realistic |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.2IEEE 1609.2 [2], clauses 5.2.3.2.2, 5.2.4.2.2, 5.2.4.2.3 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationTime          indicating GEN\_TIME (CUR\_TIME - 10min <= GEN\_TIME <= CUR\_TIME + 10min)         and containing signer                containing certificate                 containing toBeSigned                     containing validityPeriod containing start                          indicating value X\_START\_VALIDITY (X\_START\_VALIDITY <= GEN\_TIME)                            and containing duration                                indicating value > GEN\_TIME - X\_START\_VALIDITY  |

#### 5.2.5.6 Check generation location

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_06\_BV |
| **Summary** | Check that IUT sends the secured DENM containing generation location when signing certificate chain doesn’t have any region restriction |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.2IEEE 1609.2 [2], clause 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_CERTIFICATE\_SELECTION |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_A\_AT) containing toBeSigned not containing region and issuied by the certificate AA (CERT\_IUT\_A\_AA) containing toBeSigned not containing region and issuied by the certificate RCA (CERT\_IUT\_A\_RCA) containing toBeSigned not containing regionensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationLocation |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_07\_BV***\_XX*** |
| **Summary** | Check that IUT sends the secured DENM containing generation location which is inside the circular region defined by the validity restriction of the certificate pointed by the message signer |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.2IEEE 1609.2 [2], clause 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_CERTIFICATE\_SELECTION AND ***X\_PICS***  |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (***X\_AT\_CERTIFICATE***) containing toBeSigned containing region containing ***X\_FIELD*** indicating REGIONensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationLocation                    indicating value inside the REGION  |
| **Permutation Table** |
| ***\_XX*** | ***X\_FIELD*** | ***X\_AT\_CERTIFICATE*** | ***X\_PICS*** |
| B | circularRegion | CERT\_IUT\_B\_AT | PICS\_SEC\_CIRCULAR\_REGION |
| C | rectangularRegion | CERT\_IUT\_C\_AT | PICS\_SEC\_RECTANGULAR\_REGION |
| D | polygonalRegion | CERT\_IUT\_D\_AT | PICS\_SEC\_POLYGONAL\_REGION |
| E | identifiedRegion | CERT\_IUT\_E\_AT | PICS\_SEC\_IDENTIFIED\_REGION |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_08\_BV |
| **Summary** | Check that IUT sends the secured DENM containing generation location which is inside the region defined by the validity restriction of the certificate pointed by the message signer |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.2IEEE 1609.2 [2], clause 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY AND NOT PICS\_SEC\_CERTIFICATE\_SELECTION |
| Expected behaviour |
| with    the IUT has been authorized with some AT certificate containing toBeSigned containing regionensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationLocation                    indicating value inside the REGION |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_09\_BV |
| **Summary** | Check that IUT sends the secured DENM containing generation location which is inside the identified region defined by the validity restriction of the AA certificate used to sign the certificate pointed by the message signer doesn’t containing any region restriction |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.2IEEE 1609.2 [2], clause 5.2.3.2.2, 6.4.8 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_CERTIFICATE\_SELECTION |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_CA1\_AT) containing toBeSigned not containing region and issuied by the certificate AA (CERT\_IUT\_CC\_AA) containing toBeSigned containing circularRegion indicating REGION and issuied by the certificate RCA (CERT\_IUT\_C\_RCA) containing toBeSigned containing circularRegion indicating REGIONensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationLocation                    indicating value inside the REGION |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_10\_BV |
| **Summary** | Check that IUT sends the secured DENM containing generation location which is inside the identified region defined by the validity restriction of the root certificate when subordinate AA and AT certificates don’t contain any region restriction |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.2IEEE 1609.2 [2], clause 5.2.3.2.2, 6.4.8 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_CERTIFICATE\_SELECTION |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_CA2\_AT) containing toBeSigned not containing region and issuied by the certificate AA (CERT\_IUT\_CA\_AA) containing toBeSigned not containing region and issuied by the certificate RCA (CERT\_IUT\_C\_RCA) containing toBeSigned containing circularRegion indicating REGIONensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationLocation                    indicating value inside the REGION |

#### 5.2.5.7 Check payload

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_11\_BV |
| **Summary** | Check that IUT sends the secured DENM containing the 'data' field in signed data payload, containing the EtsiTs103097Data of type unsecured, contained the DENM payload |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with        the IUT has been authorized with the AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data         contains content         contains signedData             containing tbsData              containing payload             containing data              containing content              containing unsecuredData                 containing not-empty data |

#### 5.2.5.8 Check signing permissions

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_12\_BV |
| **Summary** | Check that the IUT sends the secured DENM signed with the certificate containing appPermisions allowing to sign DEN messages |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.2IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data        containing signer             containing certificate              containing appPermissions              containing an item of type PsidSsp                  containing psid = AID\_DENM |

#### 5.2.5.9 Check signature

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_13\_BV |
| **Summary** | Check that IUT sends the secured DENM containing signature; check that the signature is calculated over the right fields and using right hash algorythm by cryptographically verifying the signature |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.2IEEE 1609.2 [2], clauses 5.3.1, 6.3.4, 6.3.29, 6.3.30, 6.3.31 |
| **PICS Selection** | PICS\_GN\_SECURITY AND ***X\_PICS*** |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (***X\_CERTIFICATE***)  containing verifyKeyIndicator containing verificationKey containing ***X\_KEY*** indicating KEYensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data         containing signedData         containing signer                 containing certificate indicating ***X\_CERTIFICATE*** containing verifyKeyIndicator containing verificationKey containing ***X\_KEY*** indicating KEY             and containing signature              containing ***X\_SIGNATURE***                 verifiable using KEY  |
| **Permutation table** |
| **XX** | ***X\_CERTIFICATE*** | ***X\_KEY*** | ***X\_SIGNATURE*** | ***X\_PICS*** |
| A | CERT\_IUT\_A\_AT | ecdsaNistP256 | ecdsaNistP256Signature |  |
| B | CERT\_IUT\_A\_B\_AT | ecdsaBrainpoolP256r1 | ecdsaBrainpoolP256r1Signature | PICS\_SEC\_BRAINPOOL\_P256R1 |
| C | CERT\_IUT\_A\_B3\_AT | ecdsaBrainpoolP384r1 | ecdsaBrainpoolP384r1Signature | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |

#### 5.2.5.10 Check certificate consistency conditions

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_14\_BV |
| **Summary** | Check that IUT doesn’t send secured DENMs if IUT doesn’t possess an AT certificate allowing sending messages in this location |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_C1\_AT) containing region indicating rectangular region not containing current IUT positionensure that    when        the IUT is requested to send a secured DENM    then        the IUT doesn’t send DENM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_15\_BV |
| **Summary** | Check that IUT doesn’t send the secured DENM if IUT is configured to use an AT certificate without region validity restriction and generation location is outside of the region of the issuing AA certificate |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_CA3\_AT) not containing region and issued by the AA certificate (CERT\_IUT\_C3\_AA) containing region indicating rectangular region not containing current IUT positionensure that    when        the IUT is requested to send a secured DENM    then        the IUT doesn’t send DENM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_16\_BV |
| **Summary** | Check that IUT doesn’t send secured DENMs if all AT certificates installed on the IUT are expired. |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A1\_AT)  containing validityPeriod indicating start + duration < CURRENT\_TIME and the IUT has no other installed AT certificatesensure that    when        the IUT is requested to send a secured DENM    then        the IUT doesn’t send DENM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_17\_BV |
| **Summary** | Check that IUT doesn’t send secured DENMs if all AT certificates installed on the IUT have the starting time in the future. |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_A2\_AT) containing validityPeriod indicating start > CURRENT\_TIME and IUT has no other certificates installedensure that    when        the IUT is requested to send a secured DENM    then        the IUT doesn’t send DENM |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_DENM\_18\_BV |
| **Summary** | Check that IUT doesn’t send secured DENMs if IUT doesn’t possess an AT certificate allowing sending DENM by its appPermissions |
| **Reference** | IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_A4\_AT) containing appPermissions not containing PsidSSP containing psid indicating AID\_DENM and IUT has no other certificates installedensure that    when        the IUT is requested to send a secured DENM    then        the IUT doesn’t send DENM |

### 5.2.6 Generic signed message profile

#### 5.2.6.1 Check that secured message is signed

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_GENMSG\_01\_BV |
| **Summary** | Check that IUT sends the secured message using signedData container |
| **Reference** | ETSI TS 103 097 [1], clauses 7.1.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ITS\_AID\_OTHER |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured Beacon    then        the IUT sends a message of type EtsiTs103097Data containing content             containing signedData  |

#### 5.2.6.2 Check secured AID value

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_GENMSG\_02\_BV |
| **Summary** | Check that the sent Secured Message contains HeaderField its\_aid that is set to other value then AID\_CAM and AID\_DENM  |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ITS\_AID\_OTHER |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured Beacon    then        the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing tbsData             containing headerInfo                  containing psid                     indicating AID\_GNMGMT |

#### 5.2.6.2 Check header field

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_GENMSG\_03\_BV |
| **Summary** | Check that IUT sends the secured GeoNetworking message with the headerInfo containing generationTime |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ITS\_AID\_OTHER |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured Beacon    then        the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing tbsData             containing headerInfo             containing generationTime and not containing p2pcdLearningRequest and not containing missingCrlIdentifier |

#### 5.2.6.3 Check that signer info is a certificate or digest

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_GENMSG\_04\_BV |
| **Summary** | Check that IUT sends the secured GeoNetworking message containing certificate or digest as a signer |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.3IEEE 1609.2 [2], clause 6.3.4 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ITS\_AID\_OTHER |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT) ensure that    when        the IUT is requested to send a secured Beacon    then the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing signer               containing digest               or containing certificate containing toBeSigned containing appPermissions containing the item of type PsidSsp containing psid indicating AID\_GNMGMT |

#### 5.2.6.4 Check generation time

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_GENMSG\_05\_BV |
| **Summary** | Check that IUT sends the secured GeoNetworking message containing generation time and this time is inside the validity period of the signing certificate;Check that message generation time value is realistic |
| **Reference** | ETSI TS 103 097 [1], clauses 5.4 and 7.1.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ITS\_AID\_OTHER |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured Beacon            containing certificate    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationTime          indicating GEN\_TIME (CUR\_TIME - 10min <= GEN\_TIME <= CUR\_TIME + 10min)         and containing signer                containing certificate                 containing toBeSigned                     containing validityPeriod containing start                          indicating value X\_START\_VALIDITY (X\_START\_VALIDITY <= GEN\_TIME)                            and containing duration                                indicating value > GEN\_TIME - X\_START\_VALIDITY |

#### 5.2.6.6 Check payload

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_GENMSG\_06\_BV |
| **Summary** | Check that IUT sends the secured message using the 'data' field in signed data payload, containing the EtsiTs103097Data of type unsecured, containing the data payload or using the extDataHash field containing the SHA256 hash of data payload |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ITS\_AID\_OTHER |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send a secured Beacon    then        the IUT sends a message of type EtsiTs103097Data         contains content         contains signedData             containing tbsData              containing payload             containing data              containing content              containing unsecuredData                 containing not-empty data |

#### 5.2.5.8 Check signing permissions

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_GENMSG\_07\_BV |
| **Summary** | Check that the IUT sends the secured messages signed with the certificate containing appPermisions allowing to sign these messages |
| **Reference** | ETSI TS 103 097 [1], clause 7.1.3IEEE 1609.2 [2], clauses 5.2.3.2.2 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ITS\_AID\_OTHER |
| Expected behaviour |
| with    the IUT has been authorized with the AT certificate (CERT\_IUT\_A\_AT)ensure that    when        the IUT is requested to send Beacon    then        the IUT sends a message of type EtsiTs103097Data        containing signer             containing certificate              containing appPermissions              containing an item of type PsidSsp                  containing psid = AID\_GNMGMT |

#### 5.2.6.7 Check signature

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_GENMSG\_08\_BV |
| **Summary** | Check that IUT sends the secured GeoNetworking message containing signature;check that the signature is calculated over the right fields and using right hash algorythm by cryptographically verifying the signature |
| **Reference** | ETSI TS 103 097 [1], clauses 5.2, 7.1.3IEEE 1609.2 [2], clauses 5.3.1, 6.3.4, 6.3.29, 6.3.30, 6.3.31 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ITS\_AID\_OTHER AND ***X\_PICS*** |
| Expected behaviour |
| with    the IUT is authorized with AT certificate (***X\_CERTIFICATE***)  containing verifyKeyIndicator containing verificationKey containing ***X\_KEY*** indicating KEYensure that    when        the IUT is requested to send a secured Beacon    then        the IUT sends a message of type EtsiTs103097Data         containing signedData         containing signer containing digest                  referencing the certificate ***X\_CERTIFICATE***                 or containing certificate indicating ***X\_CERTIFICATE***             and containing signature              containing ***X\_SIGNATURE***                 verifiable using KEY |
| **Permutation table** |
| **XX** | ***X\_CERTIFICATE*** | ***X\_KEY*** | ***X\_SIGNATURE*** | ***X\_PICS*** |
| A | CERT\_IUT\_A\_AT | ecdsaNistP256 | ecdsaNistP256Signature |  |
| B | CERT\_IUT\_A\_B\_AT | ecdsaBrainpoolP256r1 | ecdsaBrainpoolP256r1Signature | PICS\_SEC\_BRAINPOOL\_P256R1 |
| C | CERT\_IUT\_A\_B3\_AT | ecdsaBrainpoolP384r1 | ecdsaBrainpoolP384r1Signature | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |

### 5.2.7 Encrypted messages profile

#### 5.2.7.1 Check encrypted message generation

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_ENC\_01\_BV |
| **Summary** | Check that the IUT can generate encrypted message |
| **Reference** | ETSI TS 103 097 [1], clauses 5.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ENCRYPTION\_SUPPORT |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that     when        the IUT is requested to send an encrypted message    then        the IUT sends a message of type EtsiTs103097Data         containing encryptedData |

#### 5.2.7.2 Check recipient information

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_ENC\_02\_BV |
| **Summary** | Check that the encrypted message contains at least one RecipientInfo |
| **Reference** | IEEE 1609.2 [2], clause 6.3.31 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ENCRYPTION\_SUPPORT |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that     when        the IUT is requested to send an encrypted message    then        the IUT sends a message of type EtsiTs103097Data         containing encryptedData containing recipients containing at least one item of type RecipientInfo |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_ENC\_03\_BV\_***XX*** |
| **Summary** | Check that when the certRecipInfo is used to specify the RecipientInfo then the recipientId contains the HashID8 of the receiver's certificate and the encKey contains encrypted symmetric kay that can be used to decrypt cyphertext |
| **Reference** | IEEE 1609.2 [2], clauses 5.3.4, 5.3.5, 6.3.31, 6.3.34 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ENCRYPTION\_SUPPORT AND ***X\_PICS*** |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that     when        the IUT is requested to send an encrypted message to the receipient authorized with the certificate ***X\_REC\_CERT*** containing encryptionKey containing publicKey containing ***X\_REC\_KEY***    then        the IUT sends a message of type EtsiTs103097Data         containing encryptedData containing recipients containing an item of type RecipientInfo containing certRecipInfo containing recipientId indicating HashID8 of the certificate ***X\_REC\_CERT*** and containing encKey containing ***X\_ENC\_KEY*** containing v indicating sender public key and containing c indicating encoded symmetric key ***ENC\_SYM\_KEY*** and containing t indicating the authentication tag and containing ciphertext which can be decrypted using decrypted ***ENC\_SYM\_KEY*** |
| **Permutation table** |
| **XX** | ***X\_REC\_CERT*** | ***X\_REC\_KEY*** | ***X\_ENC\_KEY*** | ***X\_PICS*** |
| A | CERT\_TS\_A\_AA | eciesNistP256 | eciesNistP256 |  |
| B | CERT\_TS\_A\_AA\_B | eciesBrainpoolP256r1 | eciesBrainpoolP256r1 | PICS\_SEC\_BRAINPOOL\_P256R1 |

#### 5.2.7.3 Check encrypted data content

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_ENC\_04\_BV |
| **Summary** | Check that the ciphertext of encrypted message contains encrypted EtsiTs103097Data structure |
| **Reference** | IEEE 1609.2 [2], clauses 6.3.31ETSI TS 103 097 [1], clause 7.1.4 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ENCRYPTION\_SUPPORT |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that     when        the IUT is requested to send an encrypted message    then        the IUT sends a message of type EtsiTs103097Data         containing encryptedData containing ciphertext containing encrypted data containing COER encoded data containing structure of type EtsiTs103097Data |

#### 5.2.7.4 Check encrypted and signed data

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_ENC\_05\_BV |
| **Summary** | Check that when the IUT sends SignedAndEcrypted message then it sends the EtsiTs103097Data-Encrypted message containing the EtsiTs103097Data-Signed structure as the ToBeSignedDataContent |
| **Reference** | IEEE 1609.2 [2], clauses 6.3.31ETSI TS 103 097 [1], clause 7.1.5 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_ENCRYPTION\_SUPPORT |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT)ensure that     when        the IUT is requested to send an encrypted and signed message    then        the IUT sends a message of type EtsiTs103097Data         containing encryptedData containing ciphertext containing encrypted data containing COER encoded data containing structure of type EtsiTs103097Data containing signedData |

### 5.2.8 Profiles for certificates

#### 5.2.8.1 Check that certificate version is 3

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_01\_BV |
| **Summary** | Check that IUT certificate is explicit and has version 3 |
| **Reference** | ETSI TS 103 097 [1], clauses 6IEEE 1609.2 [2], clause 6.4.3 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| ensure that     when        the AA is issued the certificate    then     this certificate is of type EtsiTs103097Certificate      containing version      indicating 3        and containing type         indicating ‘explicit’    and containing toBeSigned containing verifyKeyIndicator containing verificationKey |

#### 5.2.8.2 Check basic certificate conformance to ETSI TS 103 097

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_03\_BV |
| **Summary** | Check that IUT certificate is conformed to ETSI TS 103 097 clause 6. |
| **Reference** | ETSI TS 103 097 [1], clauses 6 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| ensure that     when        the AA is issued the certificate    then     this certificate is of type EtsiTs103097Certificate containing toBeSigned      containing id indicating ‘none’ or indicating ‘name’         and containing cracaId indicating ‘000000'H         and containing crlSeries indicating ‘0'D         and not containing certRequestPermissions         and not containing canRequestRollover         and containing signature |

#### 5.2.8.3 Check the issuer reference of the certificate

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_04\_BV\_***XX*** |
| **Summary** | Check that the certificate issuer of certificates is referenced using digest;check that right digest field is used to reference to the certificate |
| **Reference** | IEEE 1609.2 [2], clause 6.4.3 |
| **PICS Selection** | PICS\_GN\_SECURITY AND ***X\_PICS*** |
| Expected behaviour |
| with  the CA is authorized with certificate C\_ISSUERensure that     when        the CA is issued the certificate    then     this certificate is of type EtsiTs103097Certificate containing issuer containing self or containing ***X\_DIGEST*** indicating last 8 bytes of the hash of the certificate calculated using ***X\_ALGORITHM*** referenced to certificate containing toBeSigned containing verifyKeyIndicator containing verificationKey containing ***X\_KEY*** |
| **cPermutation table** |
| **XX** | ***X\_DIGEST*** | ***X\_ALGORITM*** | ***X\_KEY*** | ***X\_PICS*** |
| A | sha256AndDigest | SHA-256 | ecdsaNistP256 or ecdsaBrainpoolP256r1 | PICS\_SEC\_SHA256 AND PICS\_SEC\_BRAINPOOL\_P256R1 |
| B | sha384AndDigest | SHA-384 | ecdsaBrainpoolP384r1 | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |

#### 5.2.8.4 Check rectangular region validity restriction

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_05\_BV |
| **Summary** | Check that the rectangular certificate validity region of the subordinate certificate is well formed and inside the validity region of the issuing certificate |
| **Reference** | IEEE 1609.2 [2], clause 6.4.20, 6.4.17,5.1.2.4 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_RECTANGULAR\_REGION |
| Expected behaviour |
| with  the CA is authorized with AA certificate  containing toBeSigned containing region indicating REGIONensure that    when        the IUT issued the AT certificate     then     this AT certificate is of type EtsiTs103097Certificate containing toBeSigned containing region containing rectangularRegion containing items of type RectangularRegion containing northwest indicating a point inside the REGION and containing southeast indicating a point on the south from northwest and inside the REGION |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_06\_BV |
| **Summary** | Check that the IUT supports at least 8 entries in the rectangular certificate validity region in the AT certificate |
| **Reference** | IEEE 1609.2 [2], clause 6.4.17 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_RECTANGULAR\_REGION |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_C\_AT\_8) containing toBeSigned containing region containing rectangularRegion containing 8 entries containing one entry (***ENTRY***) containing current IUT positionensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationLocation              indicating position inside the ***ENTRY***  |

#### 5.2.8.5 Check polygonal region validity restriction

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_07\_BV |
| **Summary** | Check that the polygonal certificate validity region contains at least three points;Check that the polygonal certificate validity region does not contain intersections;Check that the polygonal certificate validity region is inside the validity region of the issuing certificate; |
| **Reference** | IEEE 1609.2 [2], clause 6.4.21, 6.4.17,5.1.2.4 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_POLYGONAL\_REGION |
| Expected behaviour |
| with  the CA is authorized with AA certificate  containing toBeSigned containing region indicating REGIONensure that    when        the IUT issued the AT certificate     then     this AT certificate is of type EtsiTs103097Certificate containing toBeSigned containing region containing polygonalRegion containing more then 2 items of type TwoDLocation indicating points inside the REGION and indicating unintercepting segments |

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| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_08\_BV |
| **Summary** | Check that the IUT supports at least 8 points in the polygonal certificate validity region in the AT certificate |
| **Reference** | IEEE 1609.2 [2], clause 6.4.17 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_POLYGONAL\_REGION |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_D\_AT\_8) containing toBeSigned containing region containing polygonalRegion containing 8 entries indicating polygon ***P*** and the IUT’s position is inside the polygon ***P***ensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationLocation              indicating position inside the ***P***  |

#### 5.2.8.6 Check identified region validity restriction

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_09\_BV |
| **Summary** | Check that the identified certificate validity region contains values that correspond to numeric country codes as defined by United Nations Statistics Division [6] in October 2013 |
| **Reference** | IEEE 1609.2 [2], clause 6.4.23 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_IDENTIFIED\_REGION |
| Expected behaviour |
| ensure that    when        the IUT issued the certificate  containing toBeSigned containing region containing identifiedRegion    then     this certificate is of type EtsiTs103097Certificate containing toBeSigned containing region containing identifiedRegion containing 1 entry of type IdentifiedRegion containing countryOnly indicating integer representation of the identifier of country or area or containing countryAndRegions containing countryOnly indicating integer representation of the identifier of country or area or containing countryAndSubregions containing country indicating integer representation of the identifier of country or area |

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| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_10\_BV |
| **Summary** | Check that the IUT supports at least 8 points in the polygonal certificate validity region in the AT certificate |
| **Reference** | IEEE 1609.2 [2], clause 6.4.17 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_IDENTIFIED\_REGION |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_E\_AT\_8) containing toBeSigned containing region containing identifiedRegion containing 8 entries containing one of the items (***I***) containing current IUT positionensure that    when        the IUT is requested to send a secured DENM    then        the IUT sends a message of type EtsiTs103097Data containing headerInfo             containing generationLocation              indicating position inside the ***I***  |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_11\_BV |
| **Summary** | Check that the identified region validity restriction of the subordinate certificate is included in the identified region validity restriction of the issuing certificate  |
| **Reference** | IEEE 1609.2 [2], clause 6.4.17,5.1.2.4 |
| **PICS Selection** | PICS\_GN\_SECURITY AND PICS\_SEC\_IDENTIFIED\_REGION |
| Expected behaviour |
| with the CA is authorized with AA certificate  containing toBeSigned containing region containing identifiedRegion containing countryOnly indicating COUNTRY or containing countryAndRegions containing countryOnly indicating COUNTRY and containing regions indicating REGIONS or containing countryAndSubregions containing country indicating COUNTRY and containing regionAndSubregions indicating REGIONS and SUBREGIONS ensure that    when        the IUT issued the certificate  containing toBeSigned containing region containing identifiedRegion    then     this certificate is of type EtsiTs103097Certificate containing toBeSigned containing region containing identifiedRegion containing countryOnly indicating value = COUNTRY or containing countryAndRegions containing countryOnly indicating value = COUNTRY and containing regions containing region identifiers contained in REGIONS or containing countryAndSubregions containing country indicating value = COUNTRY and containing regionAndSubregions containing region identifiers contained in REGIONS and containing subRegion identifiers contained in SUBREGIONS for every region |

#### 5.2.8.7 Check time validity restriction in the chain

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_12\_BV |
| **Summary** | Check that the validityPeriod of the subordinate certificate is inside the vlidityPeriod of the issuing certificate |
| **Reference** | IEEE 1609.2 [2], clause 5.1.2.4 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with the CA is authorized with AA certificate  containing toBeSigned containing validityPeriod containing start indicating X\_START\_VALIDITY\_AA containing duration indicating X\_START\_DURATION\_AAensure that    when        the IUT issued the certificate     then     this certificate is of type EtsiTs103097Certificate containing toBeSigned containing validityPeriod containing start indicating X\_START\_VALIDITY\_AT ( X\_START\_VALIDITY\_AT >= X\_START\_VALIDITY\_AA ) containing duration indicating value <= X\_START\_VALIDITY\_AT + X\_DURATION\_AT - X\_START\_VALIDITY\_AA |

#### 5.2.8.8 Check ECC point type of the certificate signature

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| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_13\_BV\_***XX*** |
| **Summary** | Check that the certificate signature contains ECC point of type set to either compressed\_lsb\_y\_0, compressed\_lsb\_y\_1 or x\_coordinate\_only  |
| **Reference** | IEEE 1609.2 [2], clause 6.3.29, 6.3.30, 6.3.31 |
| **PICS Selection** | PICS\_GN\_SECURITY AND  ***X\_PICS*** |
| Expected behaviour |
| ensure that    when        the IUT issued the certificate     then     this certificate is of type EtsiTs103097Certificate containing signature             and containing signature              containing ***X\_SIGNATURE*** containing rSig containing x-only or containing compressed-y-0 or containing compressed-y-1 |
| **Permutation table** |
| **XX** | ***X\_SIGNATURE*** | ***X\_PICS*** |
| A | ecdsaNistP256Signature |  |
| B | ecdsaBrainpoolP256r1Signature | PICS\_SEC\_BRAINPOOL\_P256R1 |
| C | ecdsaBrainpoolP384r1Signature | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |

#### 5.2.8.9 Check ECC point type of the certificate public keys

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_14\_BV |
| **Summary** | Check that the certificate verification key contains ECC point of type set to either compressed\_lsb\_y\_0, compressed\_lsb\_y\_1 or uncompressed  |
| **Reference** | IEEE 1609.2 [2], clause 6.4.38 |
| **PICS Selection** | PICS\_GN\_SECURITY AND ***X\_PICS*** |
| Expected behaviour |
| ensure that    when        the IUT issued the certificate     then     this certificate is of type EtsiTs103097Certificate containing toBeSigned containing verifyKeyIndicator containing verificationKey containing ***X\_KEY*** containing uncompressed or containing compressed-y-0 or containing compressed-y-1  |
| **Permutation table** |
| **XX** | ***X\_KEY*** | ***X\_PICS*** |
| A | ecdsaNistP256 |  |
| B | ecdsaBrainpoolP256r1 | PICS\_SEC\_BRAINPOOL\_P256R1 |
| C | ecdsaBrainpoolP384r1 | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_15\_BV |
| **Summary** | Check that the certificate encryption key contains ECC point of type set to either compressed\_lsb\_y\_0, compressed\_lsb\_y\_1 or uncompressed  |
| **Reference** | IEEE 1609.2 [2], clause 6.4.38 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| ensure that    when        the IUT issued the certificate     then     this certificate is of type EtsiTs103097Certificate containing toBeSigned containing encryptionKey containing publicKey containing ***X\_KEY*** containing uncompressed or containing compressed-y-0 or containing compressed-y-1  |
| **Permutation table** |
| **XX** | ***X\_KEY*** | ***X\_PICS*** |
| A | eciesNistP256 |  |
| B | eciesBrainpoolP256r1 | PICS\_SEC\_BRAINPOOL\_P256R1 |

#### 5.2.8.10 Verify certificate signatures

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| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_16\_BV |
| **Summary** | Check the certificate signature  |
| **Reference** | ETSI TS 103 097 [1], clauses 6 |
| **PICS Selection** | PICS\_GN\_SECURITY AND ***X\_PICS*** |
| Expected behaviour |
| With the CA authorized with certificate  containing toBeSigned containing verifyKeyIndicator containing verificationKey containing ***X\_KEY***ensure that    when        the IUT issued the certificate     then     this certificate is of type EtsiTs103097Certificate containing issuer referencing the certificate containing toBeSigned containing verifyKeyIndicator containing verificationKey containing ***X\_KEY*** indicating KEY            and containing signature          containing ***X\_SIGNATURE***         verifiable using KEY |
| **Permutation table** |
| **XX** | ***X\_KEY*** | ***X\_SIGNATURE*** | ***X\_PICS*** |
| A | ecdsaNistP256 | ecdsaNistP256Signature |  |
| B | ecdsaBrainpoolP256r1 | ecdsaBrainpoolP256r1Signature | PICS\_SEC\_BRAINPOOL\_P256R1 |
| C | ecdsaBrainpoolP384r1 | ecdsaBrainpoolP384r1Signature | PICS\_SEC\_SHA384 AND PICS\_SEC\_BRAINPOOL\_P384R1 |

#### 5.2.8.11 Verify certificate permissions

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_17\_BV |
| **Summary** | Check that all PSID entries of the appPermissions component of the certificate are unique; |
| **Reference** | IEEE 1609.2 [2], clause 6.4.28, 5.1.2.4 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| ensure that    when        the CA issued the certificate  containing toBeSigned containing appPermissions    then     this certificate is of type EtsiTs103097Certificate containing toBeSigned containing appPermissions containing items of type PsidSsp containing psid indicating unique values in this sequence |

|  |  |
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| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_18\_BV |
| **Summary** | Check that IUT supports at least 8 items in the appPermissions component of the certificate |
| **Reference** | IEEE 1609.2 [2], clause 6.4.8 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT\_A8) containing toBeSigned containing appPermissions containing 8 entries indicating the last item containing psid indicating the ‘AID\_CAM’ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing tbsData             containing headerInfo                  containing psid                     indicating 'AID\_CAM' |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_19\_BV |
| **Summary** | Check that all PSID entries of the certIssuePermissions component of the certificate are unique; |
| **Reference** | IEEE 1609.2 [2], clause 6.4.28, 5.1.2.4 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| ensure that    when        the IUT issued the certificate  containing toBeSigned containing certIssuePermissions    then     this certificate is of type EtsiTs103097Certificate containing toBeSigned containing certIssuePermissions containing items of type PsidGroupPermissions and containing subjectPermissions containing explicit containing items of type PsidSspRange containing psid indicating unique values in this sequence |

|  |  |
| --- | --- |
| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_20\_BV |
| **Summary** | Check that IUT supports at least 8 items in the certIssuePermissions component of the certificate |
| **Reference** | IEEE 1609.2 [2], clause 6.4.8 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with the IUT is authorized with AT certificate (CERT\_IUT\_A\_AT\_A8) containing appPermissions conformed to the certIssuePermissions issued by AA certificate (CERT\_IUT\_A\_AA\_C8) containing toBeSigned containing certIssuePermissions containing 8 entries indicating the last item containing psid indicating the ‘AID\_CAM’ensure that    when        the IUT is requested to send a secured CAM    then        the IUT sends a message of type EtsiTs103097Data containing content             containing signedData             containing tbsData             containing headerInfo                  containing psid                     indicating 'AID\_CAM' |

|  |  |
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| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_19\_BV |
| **Summary** | Check that all PSID entries of the appPermissions component of the certificate are also contained in the certIssuePermissions component in the issuing certificate; |
| **Reference** | IEEE 1609.2 [2], clause 6.4.28, 5.1.2.4 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| ensure that    when        the IUT issued the certificate  containing toBeSigned containing appPermissions    then     this certificate is of type EtsiTs103097Certificate containing issuer referenced to the certificate containing toBeSigned containing certIssuePermissions containing items of type PsidGroupPermissions containing eeType indicating app(0) and containing subjectPermissions containing explicit containing items of type PsidSspRange indicating X\_PSID\_RANGE\_LIST or containing all containing toBeSigned containing appPermissions containing items of type PsidSsp containing psid contained in the X\_PSID\_RANGE\_LIST as a psid |

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| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_20\_BV |
| **Summary** | Check that SSP field in each entry of the appPermissions component of the AT certificate is equal to or a subset of the SSP Range in the corresponding issung entry |
| **Reference** | IEEE 1609.2 [2], clause 6.4.28, 5.1.2.4 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| ensure that    when        the IUT issued the certificate  containing toBeSigned containing appPermissions    then     this certificate is of type EtsiTs103097Certificate containing issuer referenced to the certificate containing toBeSigned containing certIssuePermissions containing items of type PsidGroupPermissions containing eeType indicating app(0) and containing subjectPermissions containing explicit containing items of type PsidSspRange containing psid indicating X\_PSID\_AA containing sspRange indicating X\_SSP\_AA [ X\_PSID\_AA ] or containing all containing toBeSigned containing appPermissions containing items of type PsidSsp containing psid indicating value equal to X\_PSID\_AA containing ssp indicating value permitted by X\_SSP\_AA [ X\_PSID\_AA ] |

#### 5.2.8.12 AT and AA certificate profiles

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| **TP Id** | TP\_SEC\_ITSS\_SND\_CERT\_AT\_01\_BV |
| **Summary** | Check that the IUT sign messages with Authorization Ticket certificateCheck that AT certificate certificate\_id is set to noneCheck that AT certificate contains appPermissionCheck that AT certificate doesn’t contain certIssuePermissions |
| **Reference** | ETSI TS 103 097 [1], clause 7.2.1 |
| **PICS Selection** | PICS\_GN\_SECURITY |
| Expected behaviour |
| with    the IUT is in ‘authorized’ state    the IUT being requested to include certificate in the next CAMensure that    when        the IUT is requested to send a secured CAM    then the IUT sends a message of type EtsiTs103097Data         containing signer containing certificate containing toBeSigned      containing id indicating ‘none’ and containing appPermissions and not containing certIssuePermissions |

Annex A (informative):
Bibliography

* ETSI TS 102 894-2 (V1.2.1): "Intelligent Transport Systems (ITS); Users and applications requirements; Part 2: Applications and facilities layer common data dictionary".

# History

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