



**SmartM2M;
Smart Appliances Ontology and Communication
Framework Testing;
Part 4: Abstract Test Suite (ATS) and Protocol Implementation
eXtra Information for Testing (PIXIT)**

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Smart Machine-to-Machine communications (SmartM2M).

The present document is part 4 of a multi-part deliverable covering Conformance test specifications for Smart Appliances Ontology and Communication Framework Testing, as identified below:

- Part 1: "Testing methodology";
- Part 2: "Protocol Implementation Conformance Statement (PICS) pro forma";
- Part 3: "Test Suite Structure and Test Purposes (TSS & TP)";
- Part 4: "Abstract Test Suite (ATS) and Protocol Implementation eXtra Information for Testing (PIXIT)".**

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).

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1 Scope

The present document contains the Abstract Test Suite (ATS) for SmartAppliances as defined in ETSI TS 103 264 [1] and ETSI TS 103 267 [2] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [6].

The objective of the present document is to provide a basis for conformance tests for SmartAppliances equipment giving a high probability of inter-operability between different manufacturer's equipment.

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [9] and ISO/IEC 9646-2 [10]) as well as the ETSI rules for conformance testing (ETSI ETS 300 406 [11]) and the oneM2M Testing methodology ETSI TS 118 115 [5] 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 <http://docbox.etsi.org/Reference>.

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

- [1] ETSI TS 103 264: "SmartM2M; Smart Appliances; Reference Ontology and oneM2M Mapping".
- [2] ETSI TS 103 267: "SmartM2M; Smart Appliances; Communication Framework".
- [3] ETSI TS 118 104: "oneM2M; Service Layer Core Protocol Specification (oneM2M TS-0004)".
- [4] ETSI TS 118 112: "oneM2M; Base Ontology (oneM2M TS-0012)".
- [5] ETSI TS 118 115: "oneM2M; Testing Framework (oneM2M TS-0015)".
- [6] ISO/IEC 9646-7: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".
- [7] ISO/IEC 9646-6 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol profile test specification".
- [8] 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".
- [9] ISO/IEC 9646-1 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 1: General concepts".
- [10] ISO/IEC 9646-2 (1994): "Information technology -- Open Systems Interconnection -- Conformance testing methodology and framework -- Part 2: Abstract Test Suite specification".
- [11] ETSI ETS 300 406 (1995): "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".
- [12] ETSI TS 103 268-2: "SmartM2M; Smart Appliances Ontology and Communication Framework Testing; Part 2: Protocol Implementation Conformance Statement (PICS) proforma".

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.

Not applicable.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI TS 118 115 [5], in ETSI TS 118 112 [4] and in ISO/IEC 9646-7 [6] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI TS 118 115 [5], ETSI TS 103 264 [1], ETSI TS 118 112 [4] and the following apply:

AE	Application entity
APT	Abstract Protocol Tester
ATM	Abstract Test Method
ATS	Abstract Test Suite
BI	Invalid behaviour
BV	Valid behaviour
CoAP	Constrained Application Protocol
CSE	Common Service Entity
HTTP	Hypertext Transfer Protocol
IP	Internet Protocol
IPv6	Internet Protocol version 6
IUT	Implementation Under Test
MQTT	Message Queuing Telemetry Transport
MTC	Main Test Component
PA	Platform Adapter
PCTR	Protocol Conformance Test Report
PICS	Protocol Implementation Conformance Statement
PIXIT	Partial Protocol Implementation Extra Information for Testing
PTC	Parallel Test Component
PX	PiXit
SA	System Adapter
SAP	Service Access Point
SUT	System Under Test
TC	Test Case
TP	Test Purposes
TSS	Test Suite Structure
TTCN	Tree and Tabular Combined Notation
UT	Upper Tester

4 Prerequisites and Test Configurations

4.1 Test Configurations

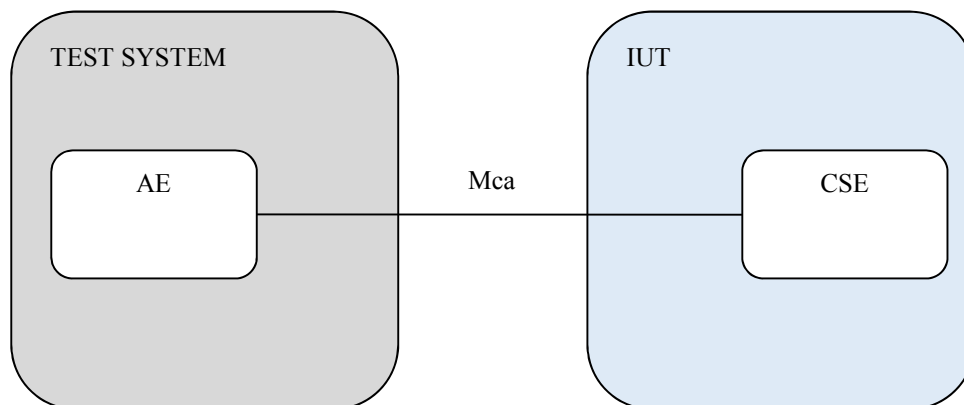


Figure 4.1-1: Test configuration 1 (CF01)

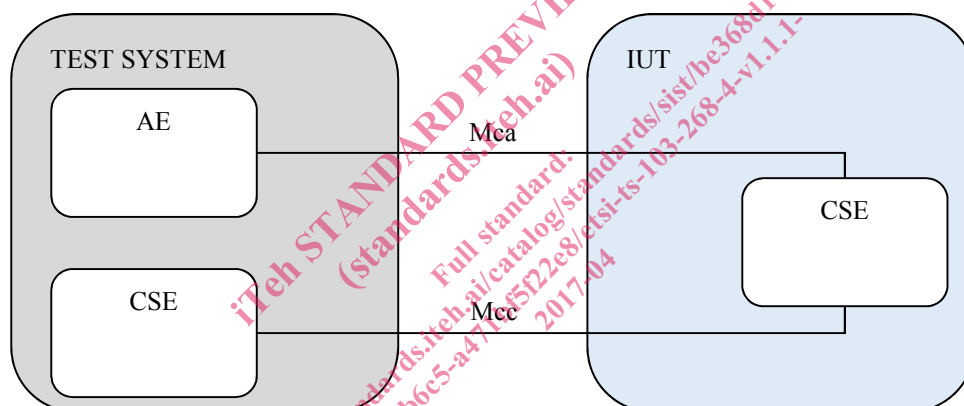


Figure 4.1-2: Test configuration 2 (CF02)

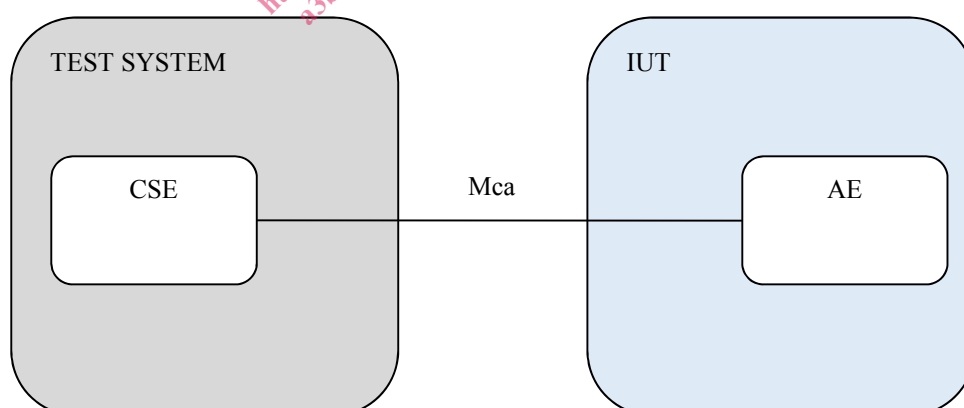


Figure 4.1-3: Test configuration 3 (CF03)

5 Abstract Test Method (ATM)

5.1 Abstract protocol tester

An abstract protocol tester (APT) is a process that provides behaviours for testing an IUT by emulating a peer IUT at the same layer, and enabling to address a single test objective.

APTs used by the SmartAppliances test suite are described in figure 5.1-1. The test system will simulate valid and invalid protocol behaviour, and will analyse the reaction of the IUT.

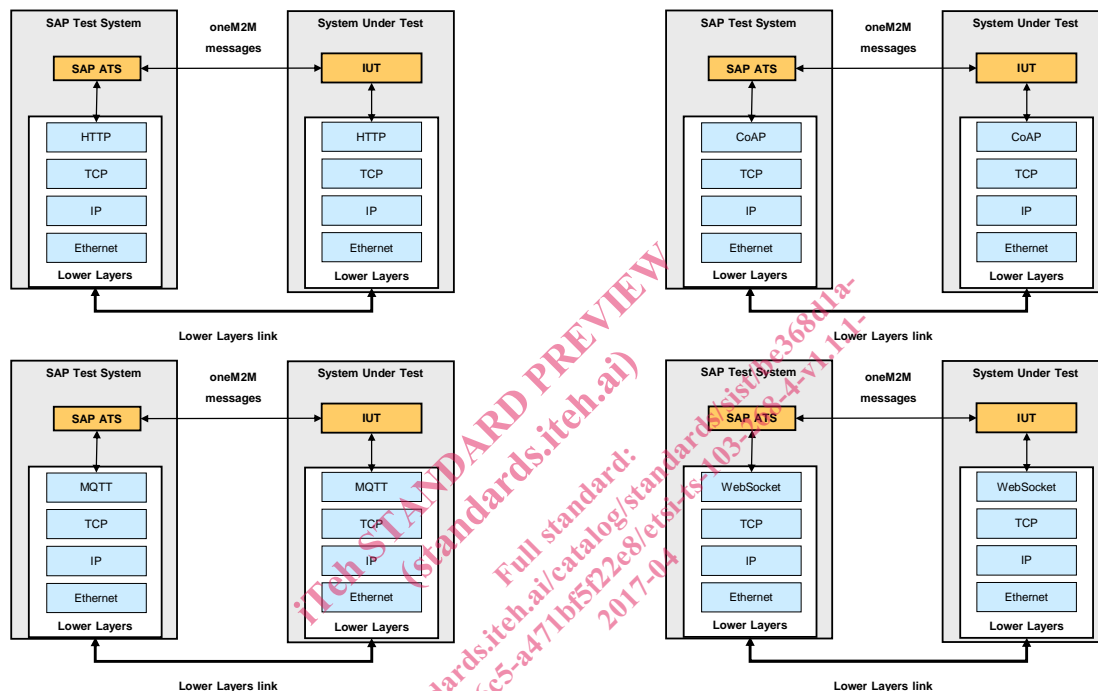


Figure 5.1-1: Abstract protocol testers – SmartAppliances

As figure 5.1-1 illustrates, the corresponding ATS needs to use lower layers to establish a proper connection to the system under test (SUT) over a physical link (Lower layers link). Three different lower layers have been specified corresponding to the binding protocols considered in oneM2M: HTTP, CoAP, MQTT or WebSocket.

5.2 Test Configuration

This test suite uses a unique test configuration in order to cover the different test scenarios. In this configuration, the tester simulates a CSE on Mca interface as defined in Test configuration 3 (CF03) in Figure 4.1-3.

5.3 Test architecture

The approach for the implementation of an Abstract Protocol Tester selected in SmartAppliances follows the recommendation of the oneM2M Testing Framework defined in ETSI TS 118 115 [5] where the TTCN-3 language and its architecture are recommended.

Following this recommendation the SmartAppliances tester architecture comprises a non-platform dependent Test Suite, and a platform dependent part.

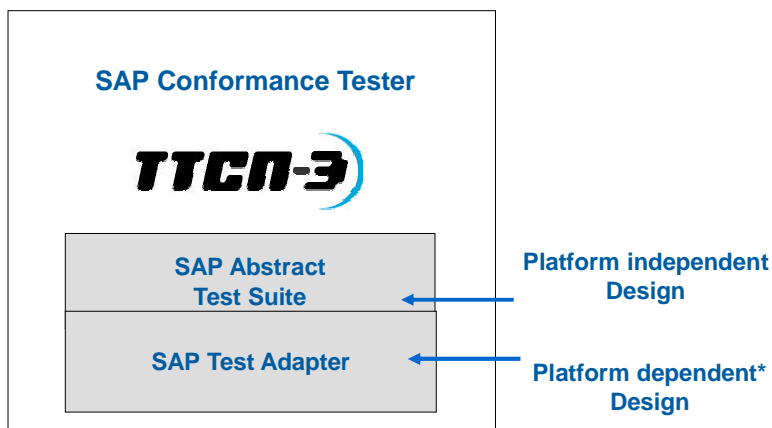


Figure 5.3-1: High level SmartAppliances Test Architecture

- **SmartAppliances TTCN-3 Abstract Test Suite:** the test suite is platform independent, and it is the cornerstone of the architecture. It allows a complete decoupling between the test suite and the rest of the test system. The test suite is composed of a complete set of test cases covering SmartAppliances requirements specified by ETSI TS 103 264 [1] and ETSI TS 103 267 [2].
- **SmartAppliances System Adapter:** this is the platform dependent part that includes adapters and codecs (out of the scope of the present document). This part of the architecture definition depends on the specific platform, operating system and test tool on which the tester is going to run.

However, it can be implemented in a semi-independent manner, which will minimize the dependency to those elements.

Figure 5.3-2 shows the SmartAppliances TTCN-3 test architecture design used for the SmartAppliances ATS. The Test Suite needs to interact with the System Adapter to implement the collection of TTCN-3 test cases that are intended to be used to test the SmartAppliances IUTs.

The SmartAppliances TTCN-3 test cases implement the test algorithms specified in the TSS & TP document ETSI ES 201 873-1 [8], including verdict logic that allows pass/fail diagnosis.

The test algorithms use the interfaces defined in ETSI TS 103 264 [1] and ETSI TS 103 267 [2] (mca, mcc) in order to:

- 1) control the test event to be sent towards the IUT; and
- 2) observe the test events received from the IUT.

In TTCN-3 these two interfaces have been implemented through a logical TTCN-3 concept called port (mcaPort and mccPort respectively) which allows oneM2M message primitives exchange with the IUT.