ETSI TS 103 255 V1.5.1 (2020-02)

TECHNICAL SPECIFICATION

**Methods for Testing and Specification (MTS);
TTCN-3 Conformance Test Suite
for use of XML and JSON schema;
Abstract Test Suite & IXIT**

Reference
RTS/MTS-103255ed151

Keywords
ATS, IXIT, JSON, testing, TTCN, XML

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Methods for Testing and Specification (MTS).

Modal verbs terminology

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1 Scope

The present document specifies the Abstract Test Suite (ATS) for the conformance test suite for using XML Schema with TTCN-3, as defined in ETSI ES 201 873-9 [1].

The objective of the present document is to provide a basis for conformance tests for TTCN-3 tools supporting "Using XML Schema with TTCN-3" extension [1] and "Using JSON with TTCN-3" extension [10]. The conformance test suite should give a high probability of standard conformance with respect to TTCN-3 tools from different vendors. In the present document only using XML and JSON Schema with TTCN-3, specified in ETSI ES 201 873-9 [1] and ETSI ES 201 873-11 [10] have been considered but not the core language [9], tool implementation (see ETSI ES 201 873-5 [i.1] and ETSI ES 201 873-6 [i.2]), language mapping (see ETSI ES 201 873-7 [i.3] and ETSI ES 201 873-8 [i.4]) and language extension (see e.g. ETSI ES 202 781 [i.5], ETSI ES 202 784 [i.6] and ETSI ES 202 785 [i.7]) aspects. The test notation used in the ATS attached in a zipped file is in TTCN-3 and it is part of the present document.

Annex A provides the Tree and Tabular Combined Notation (TTCN-3) part of the ATS.

Annex B provides the Partial Implementation Extra Information for Testing (PIXIT) pro forma of the ATS.

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/.

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

[1] ETSI ES 201 873-9 (V4.10.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 9: Using XML schema with TTCN-3".

[2] ETSI ES 201 873-10 (V4.5.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 10: TTCN-3 Documentation Comment Specification".

[3] ETSI TS 102 351: "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); IPv6 Testing: Methodology and Framework".

[4] ISO/IEC 9646-1 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

[5] ISO/IEC 9646-4: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 4: Test realization".

[6] ISO/IEC 9646-5: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 5: Requirements on test laboratories and clients for the conformance assessment process".

[7] ISO/IEC 9646-7 (1995): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".

[8] ETSI TS 103 253: "Methods for Testing and Specification (MTS); TTCN-3 Conformance Test Suite for use of XML schema; Implementation Conformance Statement".

[9]   ETSI ES 201 873-1 (V4.11.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".

[10]   ETSI ES 201 873-11 (V4.7.1): "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 11: Using JSON with TTCN-3".

[11]   W3C XML Schema.

NOTE: Available at http://www.w3.org/2001/XMLSchema.

2.2   Informative references

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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 ES 201 873-5: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 5: TTCN-3 Runtime Interface (TRI)".

[i.2]   ETSI ES 201 873-6: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 6: TTCN-3 Control Interface (TCI)".

[i.3]   ETSI ES 201 873-7: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 7: Using ASN.1 with TTCN-3".

[i.4]   ETSI ES 201 873-8: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 8: The IDL to TTCN-3 Mapping".

[i.5]   ETSI ES 202 781: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; TTCN-3 Language Extensions: Configuration and Deployment Support".

[i.6]   ETSI ES 202 784: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; TTCN-3 Language Extensions: Advanced Parameterization".

[i.7]   ETSI ES 202 785: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; TTCN-3 Language Extensions: Behaviour Types".

3   Definition of terms, symbols and abbreviations

3.1   Terms

For the purposes of the present document, the terms given in ISO/IEC 9646-1 [4], ISO/IEC 9646-7 [7], ETSI ES 201 873-1 [9] (TTCN-3) and the following apply:

Abstract Test Method (ATM): description of how an IUT is to be tested, given at an appropriate level of abstraction to make the description independent of any particular realization of a Means of Testing, but with enough detail to enable abstract test cases to be specified for this method

Abstract Test Suite (ATS): test suite composed of abstract test cases

ICS pro forma: document, in the form of a questionnaire, which when completed for an implementation or system becomes an ICS

Implementation Conformance Statement (ICS): statement made by the supplier of an implementation claimed to conform to a given specification, stating which capabilities have been implemented

Implementation eXtra Information for Testing (IXIT): statement made by a supplier or implementor of an IUT which contains or references all of the information related to the IUT and its testing environment, which will enable the test laboratory to run an appropriate test suite against the IUT

Implementation Under Test (IUT): implementation of one or more OSI protocols in an adjacent user/provider relationship, being part of a real open system which is to be studied by testing

IXIT pro forma: document, in the form of a questionnaire, which when completed for the IUT becomes the IXIT

Means Of Testing (MOT): combination of equipment and procedures that can perform the derivation, selection, parameterization and execution of test cases, in conformance with a reference standardized ATS and can produce a conformance log

3.2 Symbols

Void.

3.3 Abbreviations

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

ASCII	American Standard Code for Information Interchange
ATM	Abstract Test Method
ATS	Abstract Test Suite
ETS	Executable Test Suite
ICS	Implementation Conformance Statement
IUT	Implementation Under Test
IXIT	Implementation eXtra Information for Testing
JSON	JavaScript Object Notation
MOT	Means Of Testing
TC	Test Case
TCI	TTCN-3 Control Interface
TP	Test Purpose
TRI	TTCN-3 Runtime Interface
TS	Test System
TSS	Test Suite Structure
TSS&TP	Test Suite Structure and Test Purposes
TTCN-3	Testing and Test Control Notation edition 3
UTF	Unicode Transformation Format
XML	eXtensible Markup Language
XSD	XML Schema Definition

4 Abstract Test Method (ATM)

This clause describes the ATM used to test the conformance of TTCN-3 tool implementations as described in ETSI ES 201 873-9 [1] and ETSI ES 201 873-11 [10]. Hereafter the TTCN-3 extension "Using XML Schema with TTCN-3" will be referred to as TTCN-XML. Hereafter the TTCN-3 extension "Using JSON with TTCN-3" will be referred to as TTCN-JSON.

In the ATM, the work is performed on two levels:

- The TTCN-3 tool level. In TTCN-XML and TTCN-JSON conformance tests, it is the TTCN-3 tool which is under test, i.e. the IUT. However, unlike in protocol conformance testing, it is not standardized how test inputs, i.e. TTCN-3 modules and XML and JSON Schema, are provided. Neither are there any standardized interfaces to monitor the reaction of the TTCN-3 tool to the test input. Outputs can only be observed indirectly by monitoring tool outputs such as tool specific command line information, graphical user interfaces, or test execution logs. The tool output is processed further in the tool output evaluation level in order to derive the tool conformance verdicts.

- The TTCN-3 tool output evaluation level. Here, the output of a TTCN-3 tool is indirectly observed, e.g. rejection of TTCN-3 code due to a compile-time error in a command line notification, logging of one or multiple test verdicts in a tool specific window or an execution trace. The observation is evaluated to assess the tool conformance as a result of stimulating the tool with the TTCN-3 modules. Compliance or support of the logging interface specified as part of the TTCN-3 Control Interface standard (TCI) is not required.

NOTE: The loading of the TTCN-3 modules and presentation of the output by the TTCN-3 tools is beyond the scope of the present document.

The ATS document contains the test inputs, i.e. TTCN-3 modules and XML and JSON Schemas, for TTCN-3 tools do not automate the execution of TTCN-3 tool conformance tests. TTCN-3 tool conformance test decisions shall be made on the basis of expected outputs as specified in the test purposes provided in the documentation and as part of the documentation of TTCN-3 tests in the ATS. Three different tool output classifications for TTCN-3 inputs exist:

- Rejection as invalid, i.e. the TTCN-3 input is declared syntactically or semantically incorrect by the tool. This can either happen at compile-time or at runtime.

- Rejection to execute, i.e. an ETS is produced from the test input, but an execution does not take place.

- Execution with results, i.e. the compiled or interpreted TTCN-3 code is executed and different kinds of outputs are produced that can be subject of an evaluation, for example, a logged TTCN-3 test verdict in a test execution trace (none, pass, fail, inconc) in a file or the console output. The respective tool outputs shall specify the expected execution results in order to be able to evaluate whether the conformance test is successful.

A conformance test for XML-supporting and JSON-supporting TTCN-3 tool can attempt to trigger every kind of such outputs in a controlled way, i.e. a test input that is rejected as invalid does not imply a failing conformance test verdict, but instead results in a pass verdict for the conformance test if the test is designed to trigger the rejection. More generally: a TTCN-3 tool conformance test passes if the tool output corresponds to the expected output. The range of expected outputs is described by the tool output classification above.

For a detailed description on how test verdict and test purposes are encoded and how they shall be evaluated with the ATS of annex A, please refer to clause 5.3.1.3 and the descriptions for the document tags @verdict and @purpose.

5 The ATS development process

5.1 Requirements and test purposes

For each test purpose there is a table defined in clause A.2 of ETSI TS 103 253 [8]. The requirements applicable to this TP are given by a reference to ETSI ES 201 873-9 [1]. There are no explicit formulations of requirements.

5.2 ATS structure

5.2.0 Introduction

The ATS is split into folders, where each folder represents a clause in ETSI ES 201 873-9 [1]. Clauses on a lower scope or hierarchy are mapped into subfolders. The names of the folders are derived from the clause names in the following way:

1) All clause and subclause numbers are converted to a two digit format: if the number consists of a single digit, it is prefixed with zero.

2) All spaces and dots in the clause number are removed and all digits are concatenated.

3) The clause name is transformed by converting all upper case letters to lower case and replacing spaces with low lines.

4) The transformed clause number and clause name are concatenated with a low line character inserted between them.

5) If a clause contains subclauses and there are also a test case defined for the requirements defined in this clause, a special subfolder is created to accommodate these test cases. The folder name consists of a transformed clause number according to the above specified rules and the string "_top_level".

EXAMPLE: Clause 5 "Mapping XML schemas" of ETSI ES 201 873-9 [1] contains clauses 5.1 "Namespaces and document references" and 5.2 "Name conversion". It is mapped to the following folder structure:

+ 05_mapping_xml_schemas

+ 05_top_level

+ 0501_namespaces_and_document_references

+ 0502_name_conversion

etc.

5.2.1 Test case grouping

A test case typically checks a single requirement specified in ETSI ES 201 873-9 [1]. However, tests for multiple requirements are possible, especially in cases when the requirements are interconnected and testing them individually would not be feasible.

Test cases consist of several files that are wrapped into folders in the lowest scope of the ATS hierarchy. The test case folders are created in the location that corresponds to their position in ETSI ES 201 873-9 [1]. A folder containing test cases cannot contain folders for subclauses; top_level folders are created for testing requirements of clauses that include numbered subclauses.

Test case folder name is derived from the clause folder name in the following way:

1) The clause name is prefixed with "Pos_" in case of test cases that shall compile successfully and execute without runtime errors. These test cases are called positive test cases.

   Positive semantic tests shall be correct with respect to the TTCN-3BNF, the static semantics of TTCN-3, should include correct XML or JSON schema inputs, and meet the respective text clauses of ETSI ES 201 873-9 [1] and ETSI ES 201 873-11 [10]. They shall produce an ETS. If an ETS is produced and if it contains a control-part or a test case, it should be executed.

2) The clause name is prefixed with "Neg_" in case of test cases that either shall produce compilation errors or whose execution shall lead to a runtime error. These test cases are called negative test cases.

   Negative tests shall be correct with respect to the TTCN-3BNF and the static semantics of TTCN-3, and should include correct XML or JSON schema inputs, but violate the semantics one specific text clause of ETSI ES 201 873-9 [1] or ETSI ES 201 873-11 [10]. They may produce an ETS. If an ETS is produced and if it contains a control-part or a test case, it should be executed.

3) The clause name shall be suffixed with the low line character followed by a three-digit ordinal number of the test case. The ordinal number of the first test case defined inside a (sub)clause folder is 001 and for each following test case it increases by 1 (e.g. the ordinal number of the 4th test case is 004).

4) Positive and negative test cases are numbered separately, so there can be positive and negative test cases with the same ordinal number.

Tables 1 and 2 present test sample test case structure for clause 6.1 "Mapping of facets" of the clause 6 "Basic types" of ETSI ES 201 873-9 [1] and ETSI ES 201 873-11 [10].

The test cases shall conform to the following correctness rules:

- The test case identifiers and their group index do not imply the correct execution order of a TTCN-3 tool conformance test.

- Grouping and subgrouping in the ATS is realized with the help of the ATS directory structure.

Table 1: Example ATS structure of positive tests

Group	Subgroup	Group Index
Mapping of facets Clause 6.1	Length Clause 6.1.1	Pos_060101_length
	Min inclusive Clause 6.1.7	Pos_060107_mininclusive
	Max inclusive Clause 6.1.8	Pos_060108_maxinclusive
	Max exclusive Clause 6.1.10	Pos_060110_maxexclusive

Table 2: Example ATS structure of negative tests

Group	Subgroup	Group Index
Mapping of facets Clause 6.1	Min inclusive Clause 6.1.1	Neg_060101_length_001
	Max exclusive Clause 6.1.10	Neg_060110_maxexclusive_001

Test case folders contain several files with the testing code. Two of these files are mandatory:

- XSD file: specifies the schema with declarations that are the subject of testing.

- TTCN-3 file: contains test description, expected result declaration and TTCN-3 module used for validation of the imported XSD declarations.

Depending on a test case type, additional files can be present as well:

- XML file: used for validation of messages generated from XSD declarations; it contains the expected encoding result and it is mandatory for positive test cases.

- JSON file: used for validation of messages generated from JSON schema declarations; it contains the expected encoding result and it is mandatory for positive test cases.

- Additional XSD files: used in case of various import scenarios and namespace tests.

TTCN-3 and XML and JSON file names and names of the mandatory XSD file consist of the name of the enclosing test case folder and a mandatory extension:

- <TC_folder_name>.ttcn (for TTCN-3 files)

- <TC_folder_name>.xml (for XML files)

- <TC_folder_name>.xsd (for XSD files)

- <TC_folder_name>.json (for JSON files)

In case of additional XSD files, the file name is derived from the name of the main XSD file, with low line and an additional single-digit ordinal number inserted between the test case name and the file extension:

- <TC_folder_name>_1.xml (for extra XML file)

- <TC_folder_name>_1.xsd (for extra XSD file)