ETSI TS 102 916-3 V1.1.1 (2012-05)

Intelligent Transport Systems (ITS);
Test specifications for the methods to ensure coexistence of Cooperative ITS G5 with RTTT DSRC;
Part 3: Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT)

Reference
DTS/ITS-0040024

Keywords
ATS, DSRC, ITS, PIXIT, radio, RTTT

ETSI

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

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

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

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

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

Foreword

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

The present document is part 3 of a multi-part deliverable covering the test specifications for the methods to ensure coexistence of cooperative ITS G5 with RTTT DSRC 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 partial Protocol Implementation eXtra Information for Testing (PIXIT)".

1 Scope

The present document specifies the Abstract Test Suite (ATS) and partial Protocol Implementation eXtra Information for Testing (PIXIT) proforma for the test specifications for the methods to ensure coexistence of cooperative ITS G5 with RTTT DSRC as specified in TS 102 792 [i.1] and ES 202 663 [1] in compliance with the relevant requirements and in accordance with the relevant guidance given in ISO/IEC 9646-7 [4] and ETS 300 406 [5].

The test notation used in the ATS is TTCN-3 (see ES 201 873-1 [6]).

The following test specification- and design considerations can be found in the body of the present document:

- the overall test suite structure;
- the testing architecture;
- the test methods and port definitions;
- the test configurations;
- TTCN styles and conventions;
- the partial PIXIT proforma;
- the modules containing the TTCN-3 ATS.

Annex A provides the Partial Implementation Extra Information for Testing (PIXIT) Proforma of the ATS.

Annex B provides the Testing and Test Control Notation (TTCN-3) part of the ATS.

2 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 reference 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.

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

2.1 Normative references

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

[1] ETSI ES 202 663: "Intelligent Transport Systems (ITS); European profile standard for the physical and medium access control layer of Intelligent Transport Systems operating in the 5 GHz frequency band".

[2] ETSI TS 102 916-2: "Intelligent Transport Systems (ITS); Test specifications for the methods to ensure coexistence of Cooperative ITS G5 with RTTT DSRC; Part 2: Test Suite Structure and Test Purposes (TSS&TP)".

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

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

[5] ETSI ETS 300 406: "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".

[6] 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".

2.2 Informative references

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 TS 102 792: "Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (RTTT DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ISO/IEC 9646-7 [4], TS 102 792 [i.1] and ES 202 663 [1] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ISO/IEC 9646-1 [3], ISO/IEC 9646-7 [4], TS 102 792 [i.1] and ES 202 663 [1] apply.

4 ATS conventions

Test purposes of the present document address the mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (RTTT DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range.

4.1 Test Architecture

The test architecture defined in figure 1 applies. The communication covered by the test purposes of TS 102 916-2 [2] address the exchange of frames over the physical radio connection between an OBU and an RSU. As the actual frame exchange is only available in the form of recorded trace files the test system has been modelled to cover the frames received from OBU or RSU via the virtual ports named obuPort and rsuPort in two Parallel Test Components (PTC). Synchronization between the two PTC is achieved via the comport; the additional connection commonOBURSUPort is used to allow display of the frame exchange in trace play mode. The verdictPort between PTC rsuType and the Main Test Component (MTC) is used to transport verdict information to the MTC for statistical evaluation of the overall test results.

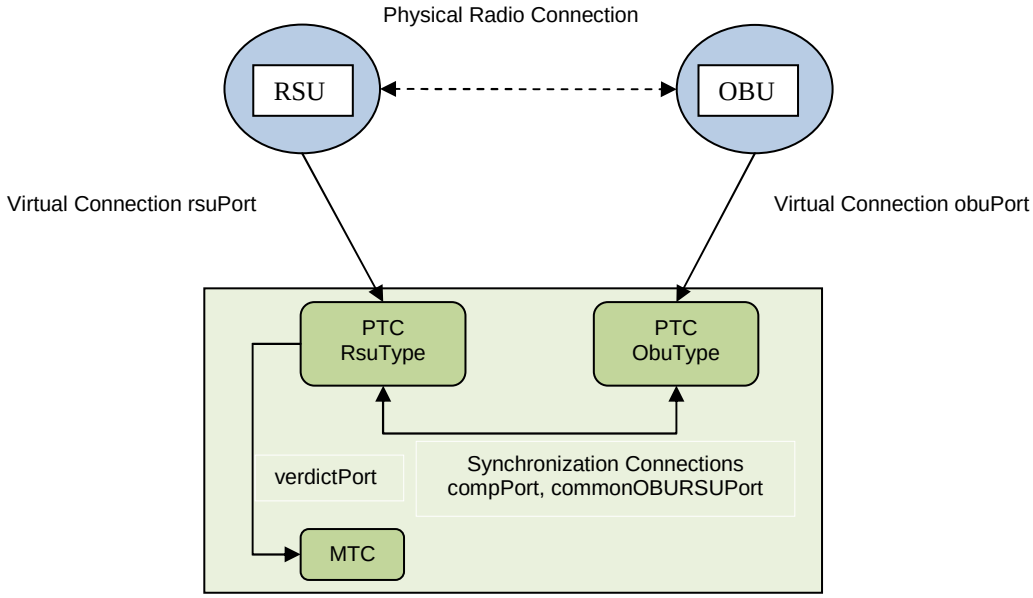

Figure 1: Test architecture

RSU, OBU:	Real equipment exchanging frames via the physical radio connection.
RsuType:	Test component type that "receives" the frames destined to the real RSU via the unidirectional virtual conection rsuPort. The frames are the downlink frames recorded in the trace file.
ObuType:	Test component type that "receives" the frames destined to the real OBU via the unidirectional virtual conection obuPort. The frames are the uplink frames recorded in the trace file.
compPort:	Bi-directional connection between RsuType and ObuType for the exchange of co-ordination messages.
commonOBURSUPort:	Bi-directional connection between RsuType and ObuType for the virtual exchange of all "received" frames for the purpose of creating the trace play representation of the real radio communication between RSU and OBU.
verdictPort:	Unidirectional port to from the RsuType to the MTC for the transport of verdict information.
MTC:	The MTC opens the trace file, counts the number of transactions stored and feeds the recorded downlink and uplink framesinto the rsuPort and the obuPort. The verdict information received via the verdictPort is used to calculate statistics for the totality of transactions stored in one trace file.

4.2 ATS structure

4.2.1 Test case grouping

The ATS structure is based on the Test Purposes for mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (RTTT DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range as defined in TS 102 916-2 [2].

4.2.2 Test case identifiers

The test case names are built up according to the following scheme:

"<TC>"_"<Group index>"_"<TC number>"

NOTE: This naming scheme provides a 1-1 correspondence of TP identifiers as defined in TS 102 916-2 [2] and test case names.
The TP identifier of TC_CAL_01 is TP_CAL_01.

The test cases have been divided according to the functionalities into several groups:

- TC_CAL_xx Calibration Measurements
- TC_COEX_OBU_xx Co-existence Interference Tests OBU
- TC_COEX_RSU_xx Co-existence Interference Tests RSU
- TC_COEX_xx Co-existence Interference Tests Complete System

4.3 Test Result Presentation

The results of one test run, i.e. for one duty cycle measurement point will be stored in one log file. Each log file will typically contain several hundred transactions. The test case granularity is defined to be one test case per transaction in the trace file.

The TTCN-3 test architecture design with the inclusion of the co-ordination port commonOBURSUPort allows for trace play so that the TTCN-3 test operator will have the impression to see a real message exchange between OBU and RSU.

4.3.1 Results per transaction

Per transaction in the file the following result data is recorded:

- Chronological number of the transaction within the trace file (count starts with 0).
- Time length of the transaction in ms.
- Number of empty uplink frames from OBU to RSU.

The TTCN-3 test suite assigns a PASS verdict when the following conditions are fulfilled:

- Transaction is complete.
- Transaction duration < 100 ms (PX_MAX_TRANSACTION_DURATION).
- No other OBU sends except the OBU under test.
- Number of empty uplink frames per transaction < configurable threshold (PX_MAX_NUM_EMPTY_UPLINK_FRAMES).

4.3.2 Results per trace file

For each log file (duty cycle) further evaluation information will be provided:

- Power Level.
- Name of the OBU under test.
- Total number of transactions in the trace file.
- Minimum transaction duration.
- Maximum transaction duration.

- Average transaction duration.
- Number of failed transaction.
- Transaction error rate based on the total amount of transactions in the trace file.

The TTCN-3 test suite assigns a PASS verdict when the following conditions are fulfilled:

- Transaction error rate is below defined threshold (PX_MAX_TRANSACTION_ERROR_RATE).
- Trace file is not empty.

Annex A (normative): Partial PIXIT proforma

A.1 Introduction

This partial PIXIT proforma contained in the present document is provided for completion, when the related Abstract Test Suite is to be used against the Implementation Under Test (IUT).

The completed partial PIXIT will normally be used in conjunction with the completed PICS, as it adds precision to the information provided by the PICS.

A.2 PIXIT items

Each PIXIT item corresponds to a Module Parameter of the ATS.

Table A.1: PIXIT items

Id	Identifier	Type / Description
1	PX_TRACE_PATH	Path to file that holds the trace
2	PX_MAX_NUM_EMPTY_UPLINK_FRAMES	Maximum allowed number of empty uplink frames from the On Board Unit (OBU) within one transaction (integer)
3	PX_MAX_TRANSACTION_DURATION	Maximum allowed transaction time duration (in ms)
4	PX_MAX_TRANSACTION_ERROR_RATE	Maximum allowed transaction error rate (integer)

Annex B (informative): TTCN-3 library modules

B.1 Electronic annex, zip file with TTCN-3 code

The TTCN-3 library modules are contained in archive ts_10291603v010101p0.zip which accompanies the present document.

This ATS has been produced using the Testing and Test Control Notation (TTCN) according to ES 201 873-1 [6].

Annex C (informative): Bibliography

- ETSI TR 102 960: "Intelligent Transport Systems (ITS); Mitigation techniques to avoid interference between European CEN Dedicated Short Range Communication (RTTT DSRC) equipment and Intelligent Transport Systems (ITS) operating in the 5 GHz frequency range; Evaluation of mitigation methods and techniques ".

History

Document history		
V1.1.1	May 2012	Publication