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Technical Specification

Intelligent Transport Systems (ITS);
Road Transport and Traffic Telematics (RTTT);
Test specifications for Dedicated Short Range Communication (DSRC) transmission equipment;
Part 2: DSRC application layer;
Sub-Part 2: Test Suite Structure and Test Purposes (TSS&TP)

Reference

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Foreword

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

The present document is part 2, sub-part 2 of a multi-part deliverable covering Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Test specifications for Dedicated ShortRange Communication (DSRC) transmission equipment as identified below:

Part 1: "DSRC data link layer: medium access and logical link control";

Part 2: "DSRC application layer";

Sub-part 1: "Protocol Implementation Conformance Statement (PICS) proforma specification";

Sub-part 2: "Test Suite Structure and Test Purposes (TSS&TP)";

Sub-part 3: "Abstract Test Suite (ATS) and partial PIXIT proforma".

1 Scope

The present document contains the Test Suite Structure (TSS) and Test Purposes (TP) to test the Dedicated Short Range Communication (DSRC); Application layer.

The objective of this test specification is to provide a basis for conformance tests for DSRC 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 [5] and ISO/IEC 9646-2 [6]) as well as the ETSI rules for conformance testing (ETS 300 406 [4]) are used as a basis for the test methodology.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
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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.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

[1] CEN EN 12834 (2003): "Road transport and traffic telematics - Dedicated Short Range Communication (DSRC) - DSRC application layer".

[2] CEN EN 12253 (2003): "Road transport and traffic telematics - Dedicated short-range communication - Physical layer using microwave at 5,8 GHz".

[3] CEN EN 13372 (2003): "Road transport and traffic telematics (RTTT) - Dedicated short-range communication - Profiles for RTTT".

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

[5] ISO/IEC 9646-1 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

[6] ISO/IEC 9646-2 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification".

[7] ISO/IEC 9646-6 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol profile test specification".

[8] ISO/IEC 9646-7 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statement".

2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area**.** For non-specific references, the latest version of the referenced document (including any amendments) applies.

Not applicable.

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ISO/IEC 9646-7 [8], EN 12253 [2], EN 12834 [1] and EN 13372 [3] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ISO/IEC 9646-1 [5], ISO/IEC 9646-6 [7], ISO/IEC 9646-7 [8] and EN 12834 [1] and the following apply:

PrWRq MAC frame Private Window Request

4 Test Suite Structure (TSS)

4.1 Structure

Figure 1 shows the Application Test Suite Structure (TSS) including its subgroups defined for the conformance testing.

Group	Type of SUT	behaviour
Application Layer - T-Kernel	On Board Unit	Valid behaviour
		Invalid behaviour
	Road Side Unit	Valid behaviour
		Invalid behaviour
Application Layer - I-Kernel	On Board Unit	Valid behaviour
		Invalid behaviour
	Road Side Unit	Valid behaviour
		Invalid behaviour

Figure 1: TSS for DSRC Application

4.2 Test groups

The test groups are organized in three groups. The first is designed for the application T-kernel testing. The second is designed for Application I-kernel testing and the third is designed for Application B-kernel testing.

4.3 Type of SUT test groups

The type of SUT test groups are organized in two groups. The first is designed for the On Board Unit testing and the second is designed for Road Side Unit testing.

4.4 Behaviour test groups

4.4.1 Valid Behaviour (BV) tests

This test sub group shall verify that the IUT reacts in conformity with the EN, after receipt or exchange of a valid Protocol Data Units (PDUs). Valid PDUs means that the exchange of messages and the content of the exchanged messages are considered as valid.

4.4.2 Invalid Behaviour (BI) tests

This test sub group shall verify that the IUT reacts in conformity with the EN, after receipt of a syntactically invalid PDU.

5 Test Purposes (TP)

5.1 Introduction

5.1.1 TP definition conventions

The TPs are defined following particular rules as shown in table 1.

Table 1: TP definition rules

TP Id according to the TP naming conventions	Title
	Reference
	PICS selection
	TC reference
	Initial condition
	Stimulus and Expected Behaviour

TP Id	The TP Id is a unique identifier. It shall be specified according to the TP naming conventions defined in the clause below.
Title	Short description of test purpose objective.
Reference	The reference should contain the references of the subject to be validated by the actual TP (specification reference, clause, paragraph).
PICS selection	Reference to the PICS statement involved for selection of the TP. Contains a Boolean expression. Only those PICS statements are shown that are explicitly related to the test.
TC reference	Shows the reference number of the related Test Case in the ATS.
Initial condition	The condition defines in which initial state the IUT has to be to apply the actual TP.
Stimulus and Expected Behaviour	Definition of the events the tester performs, and the events that are expected from the IUT to conform to the base specification.

5.1.2 TP naming conventions

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

Table 2: TP naming convention

Identifier:	**TP/<layer>/<sut>/<x>-<nn>**		
	<layer>	AL-T	Application Layer - T-Kernel
		AL-I	Application Layer - I-Kernel
	<sut> = type of SUT	OBU	On Board Unit
		RSU	Road Side Unit
	x = Type of testing	BV	Valid Behaviour Tests
		BI	Invalid Behaviour Tests
	<nn> = sequential number	(01-99)	Test Purpose Number

5.1.3 Sources of TP definitions

All TPs are specified according to EN 12834 [1].

5.2 Application T-kernel test purposes for On Board Unit

5.2.1 BV test purposes

Test subgroup objective:

- to test the behaviour of the IUT in relation to syntactically and contextual correct behaviour of the test system.

Test purposes:

TP/AL-T/OBU/BV/01	**Verify that the OBU can receive GET.request and manage GET.response, with LID=private**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS selection:	Table A.1/1 AND Table A.8/1 AND Table A.8/2 AND Table A.11/5 AND Table E.2/11 AND Table E.3/9
	TC reference:	TC_AL_T_OBU_BV_01
	Initial condition:	OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends GET.request with FlowControl=7, requesting retrieval of data available in the IUT without late response. 2. Verify IUT provides the data requested in step 1 in a GET-Response with proper ReturnStatus.	

TP/AL-T/OBU/BV/02	**Verify that the OBU can receive SET.request with mode=1 and manage SET.response, with LID=private**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection:	Table A.1/1 AND Table A.8/3 AND Table A.8/4 AND Table A.15/4 AND Table E.2/12 AND Table E.3/10
	TC reference:	TC_AL_T_OBU_BV_02
	Initial condition:	OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends SET.request with mode=1 and FlowControl=7, requesting storage of data=DATA in the IUT. 2. Verify proper ReturnStatus indicated in the SET-Response.	

TP/AL-T/OBU/BV/03	**Verify that the OBU can receive SET.request with mode=1 and GET.request, and manage SET.response and GET.response, with LID=private**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection:	Table A.1/1 AND Table A.8/1 AND Table A.8/2 AND Table A.8/3 AND Table A.8/4 AND Table A.11/5 AND Table A.15/4 AND Table E.2/11 AND Table E.2/12 AND Table E.3/9 AND Table E.3/10
	TC reference:	TC_AL_T_OBU_BV_03
	Initial condition:	OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends SET.request with mode=1 and FlowControl=7, requesting storage of data=DATA1 in the attribute given by EID=EID1 and attributeId=attributeID1 in the IUT. 2. Verify proper ReturnStatus indicated in the SET-Response. 3. Tester sends GET.request in order to retrieve the data sent in step 1. 4. Verify proper ReturnStatus indicated in the GET-Response. 5. Verify that the data retrieved in step 3 is identical to the data sent in step 1. 6. Tester sends SET.request with mode=1 and FlowControl=7, requesting storage of data=DATA2 in the attribute given by EID=EID1 and attributeId=attributeID1 in the IUT. 7. Verify proper ReturnStatus indicated in the SET-Response. 8. Tester sends GET.request in order to retrieve the data sent in step 6. 9. Verify proper ReturnStatus indicated in the GET-Response. 10. Verify that the data retrieved in step 8 is identical to the data sent in step 6.	

TP/AL-T/OBU/BV/04	**Verify that the OBU can receive SET.request with mode=0 and GET.request and GET.response, with LID=private**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection:	Table A.1/1 AND Table A.8/1 AND Table A.8/2 AND Table A.8/3 AND Table E.2/9 AND Table E.2/11 AND Table E.3/6 AND Table E.3/10
	TC reference:	TC_AL_T_OBU_BV_04
	Initial condition:	OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends SET.request with mode=0 and FlowControl=4, requesting storage of DATA1 in the attribute given by EID=EID1 and attributeId=attributeID1 of the IUT. 2. Verify proper operation of IUT by retrieval of EID=EID1, attributeId=attributeID1 using GET.request. 3. Tester sends SET.request with mode=0 and FlowControl=4, requesting storage of DATA2 in the attribute given by EID=EID1 and attributeId=attributeID1 in the IUT. 4. Verify proper operation of IUT by retrieval of EID=EID1, attributeId=attributeID1 using GET.request.	

TP/AL-T/OBU/BV/05	**Verify that the OBU can receive SET.request with mode=0 and GET.request and GET.response, with LID=private**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection:	Table A.1/1 AND Table A.8/1 AND Table A.8/2 AND Table A.8/3 AND Table E.3/6 AND Table E.2/11 AND Table E.3/9
	TC reference:	TC_AL_T_OBU_BV_05
	Initial condition:	OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends SET.request with mode=0 and FlowControl=1, requesting storage of DATA1 in the data element given by EID=EID1 and attributeId=attributeID1 of the IUT. 2. Verify proper operation of IUT by retrieval of EID=EID1, attributeId=attributeID1 using GET.request. 3. Tester sends SET.request with mode=0 and FlowControl=1, requesting storage of DATA2 in the data element given by EID=EID1 and attributeId=attributeID1 in the IUT. 4. Verify proper operation of IUT by retrieval of EID=EID1, attributeId=attributeID1 using GET.request.	

TP/AL-T/OBU/BV/06	**Verify that the OBU can receive SET.request with mode=0 and with LID=broadcast after initialization,and GET.request and manage GET.response, with private LID**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection:	Table A.1/1 AND Table A.8/1 AND Table A.8/2 AND Table A.8/3 AND Table E.3/4 AND Table E.2/11 AND Table E.3/9
	TC reference:	TC_AL_T_OBU_BV_06
	Initial condition:	OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends SET.request with mode=0, FlowControl=1 and LID=broadcast, requesting storage of data=DATA1 in the IUT. 2. Tester sends GET.request in order to retrieve the data sent in step 1. 3. Verify that the data retrieved in step 2 is identical to the data sent in step 1. 4. Tester sends SET.request with mode=0 and FlowControl=1 and LID=broadcast, requesting storage of data=DATA2 in the IUT. 5. Tester sends GET.request in order to retrieve the data sent in step 4. 6. Verify that the data retrieved in step 5 is identical to the data sent in step 4.	

TP/AL-T/OBU/BV/07	**Verify that the OBU can receive SET.request with mode=0 and with LID=broadcast without initialization, and GET.request and manage GET.response, with private LID**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection:	Table A.1/1 AND Table A.2/5 AND Table A.3/3 AND Table A.8/1 AND Table A.8/2 AND Table A.8/3 AND Table C.4/7 AND Table E.3/4 AND Table E.2/11 AND Table E.3/9
	TC reference:	TC_AL_T_OBU_BV_07
	Initial condition:	OBU not in sleep mode and not yet initialized.
	Stimulus and Expected Behaviour: 1. Tester sends SET.request with mode=0, FlowControl=1 and LID=broadcast, requesting storage of data=DATA1 in the IUT. 2. Perform initialization with the IUT. 3. Tester sends GET.request in order to retrieve the data sent in step 1. 4. Verify that the data retrieved in step 2 is identical to the data sent in step 1. 5. Tester sends RELEASE command. 6. Tester immediately, i.e. before beacon time-out,sends SET.request with mode=0, FlowControl=1 and LID=broadcast, requesting storage of data=DATA2 in the IUT. 7. Repeat step 2 after beacon time-out. 8. Tester sends GET.request in order to retrieve the data sent in step 6. 9. Verify that the data retrieved in step 8 is identical to the data sent in step 6.	

TP/AL-T/OBU/BV/08	**Verify that the OBU can receive ACTION.request with mode=1 and manage ACTION.response, with LID=private**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection:	Table A.1/1 AND Table A.8/5 AND Table A.8/6 AND Table E.2/13 AND Table E.3/11
	TC reference:	TC_AL_T_OBU_BV_08
	Initial condition:	OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends ACTION.request with mode=1 and FlowControl=7. 2. Verify proper operation of IUT by checking the ACTION.response.	

TP/AL-T/OBU/BV/09	**Verify that the OBU can receive ACTION.request with mode=0 and LID=private**	
	Reference:	EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection:	Table A.1/1 AND Table A.8/5 AND Table E.2/10
	TC reference:	TC_AL_T_OBU_BV_09
	Initial condition:	OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends ACTION.request with mode=0 and FlowControl=4. 2. Verify proper operation of IUT by human observation of IUT behaviour.	
NOTE: The applicant shall declare the SET_MMI ACTION type if possible, that allows human observation of command execution.		

TP/AL-T/OBU/BV/10	**Verify that the OBU can receive ACTION.request with mode=0 and LID=private**
	Reference: EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection: Table A.1/1 AND Table A.8/5 AND Table E.2/7
	TC reference: TC_AL_T_OBU_BV_10
	Initial condition: OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends ACTION.request with mode=0 and FlowControl=1. 2. Verify proper operation of IUT by human observation of IUT behaviour.
NOTE: The applicant shall declare the SET_MMI ACTION type if possible, that allows human observation of command execution.	

TP/AL-T/OBU/BV/11	**Verify that the OBU can receive ACTION.request with mode=0 with LID=broadcast after initialization**
	Reference: EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection: Table A.1/1 AND Table A.8/5 AND Table E.2/5
	TC reference: TC_AL_T_OBU_BV_11
	Initial condition: OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends ACTION.request with mode=0, FlowControl=1 and LID=broadcast. 2. Verify proper operation of IUT by human observation of IUT behaviour.
NOTE: The applicant shall declare the SET_MMI ACTION type if possible, that allows human observation of command execution.	

TP/AL-T/OBU/BV/12	**Verify that the OBU can receive and manage ACTION.request with mode=0 and with LID=broadcast without initialization**
	Reference: EN 12834 [1] clauses 6.2 and Annex A
	PICS Selection: Table A.8/5 ANDTable E.2/5
	TC reference: TC_AL_T_OBU_BV_12
	Initial condition: OBU not in sleep mode and not yet initialized.
	Stimulus and Expected Behaviour: 1. Tester sends ACTION.request with mode=0, FlowControl=1 and LID=broadcast. 2. Verify proper operation of IUT by human observation of IUT behaviour.
NOTE: The applicant shall declare the SET_MMI ACTION type if possible, that allows human observation of command execution.	

TP/AL-T/OBU/BV/13	**Verify that the OBU can receive and manage non-fragmented APDUs with random PDU number**
	Reference: EN 12834 [1] clauses 6.3.3
	PICS Selection: Table A.1/1 AND ((Table E.2/11 AND Table E.3/9) OR (Table E.2/12 AND Table E.3/10) OR (Table E.2/13 AND Table E.3/11))
	TC reference: TC_AL_T_OBU_BV_13
	Initial condition: OBU already initialized, waiting to be served by tester.
	Stimulus and Expected Behaviour: 1. Tester sends SERVICE.request with mode=1 and FlowControl=7 with a random choice of PDU number in the allowed range of 2 through 31. 2. Verify IUT correctly replies with SERVICE.response. 3. Repeat steps 1 and 2 until all allowed values of the PDU number field are tested.
NOTE: SERVICE shall be out of GET, SET, ACTION, as declared by the applicant.	