

ETSI TS 102 708-1-2 V1.1.1 (2010-03)

Technical Specification

**Intelligent Transport Systems (ITS);
RTTT;
Test specifications for High Data Rate (HDR) data
transmission equipment operating in the 5,8 GHz ISM band;
Part 1: Data Link Layer;
Sub-Part 2: Test Suite Structure and Test Purposes (TSS&TP)**

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Reference

DTS/ITS-0020003

Keywords

DSRC, TSS&TP, RTTT, testing

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Sous-Préfecture de Grasse (06) N° 7803/88

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Contents

Intellectual Property Rights	4
Foreword.....	4
1 Scope	5
2 References	5
2.1 Normative references	5
2.2 Informative references.....	5
3 Definitions and abbreviations.....	6
3.1 Definitions	6
3.2 Abbreviations	6
4 Test Suite Structure	6
4.1 Structure	6
4.2 Test groups	6
4.3 Type of SUT.....	6
4.4 Behaviour test groups.....	6
4.4.1 Valid behaviour tests	6
4.4.2 Invalid behaviour tests	6
5 Test purposes.....	7
5.1 Introduction	7
5.1.1 Definition conventions.....	7
5.1.2 Naming conventions	7
5.1.3 Sources of TP definitions.....	7
5.1.4 General reference.....	7
5.1.5 General conditions	8
5.1.6 Default PICS selection.....	8
5.2 Test purposes for on-board units	8
5.2.1 Valid behaviour tests	8
5.2.2 Invalid behaviour tests	9
5.3 Test purposes for road side units.....	10
5.3.1 Valid behaviour tests	10
5.3.2 Invalid behaviour tests	11
Annex A (informative): Test coverage matrix	14
A.1 Introduction	14
A.2 OBU	14
A.3 RSU.....	15
History	17

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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 1, sub-part 2 of a multi-part deliverable covering the test specifications for High Data Rate (HDR) Dedicated Short Range Communication (DSRC).

Full details of the entire series can be found in part 1-1 [2].

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1 Scope

The present document contains the Test Suite Structure (TSS) and Test Purposes (TP) to test the "Dedicated Short Range Communication" (DSRC) "High Data Rate" (HDR) data link layer [1].

The objective of this test specification is to provide a basis for conformance tests for DSRC-HDR equipment specified in [1] 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 [3]) is 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:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
 - for informative references.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

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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] ETSI ES 200 674-1: "Electromagnetic compatibility and Radio spectrum Matters (ERM); Road Transport and Traffic Telematics (RTTT); Part 1: Technical characteristics and test methods for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz Industrial, Scientific and Medical (ISM) band".
- [2] ETSI TS 102 708-1-1: "Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 1: Data Link Layer; Sub-Part 1: Protocol Implementation Conformance Statement (PICS) proforma specification".
- [3] ISO/IEC 9646-1 (1991): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".

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 [1] and [3] apply.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in [1] and [3] apply.

4 Test Suite Structure

4.1 Structure

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

Table 1: Test suite structure for DSRC-HDR data link layer

Group	Type of system under test (SUT)	Behaviour
Data link layer	On Board Unit	Valid behaviour
		Invalid behaviour
	Road Side Unit	Valid behaviour
		Invalid behaviour

4.2 Test groups

There is a single test group for the data link layer of DSRC-HDR.

4.3 Type of SUT

Two types of systems under test (SUT) are distinguished, i.e. on board units (OBUs) and road side units (RSUs).

4.4 Behaviour test groups

4.4.1 Valid behaviour tests

Valid behaviour tests shall verify that the IUT reacts in conformity with the base standard [1], after receipt or exchange of valid protocol data units (PDUs). "Valid PDU" means that the exchange of messages and the content of the exchanged messages are considered as valid, i.e compliant with the base standard.

4.4.2 Invalid behaviour tests

Invalid behaviour tests shall verify that the IUT reacts in conformity with the base standard [1], after receipt of a syntactically invalid protocol data unit (PDU).

5 Test purposes

5.1 Introduction

5.1.1 Definition conventions

Test purposes (TPs) are defined following particular rules as presented in table 2.

Table 2: TP definition rules

TP ID	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 sub-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).
ICS Selection	Reference to the ICS statement involved for selection of the TP. Contains a Boolean expression. Only those ICS 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 Naming conventions

The identifier of the TP is built according to table

Table 3: TP naming convention

Identifier	TP/<sut>/<layer>/<x>/<n>		
	<sut> = Type of SUT	OBU	On Board Unit
		RSU	Road Side Unit
	<layer>	DLL	Data Link Layer
	x = Type of testing	BV	Valid Behaviour Test
		BI	Invalid Behaviour Test
	<n> = sequential number	>0	<n> = sequential number
NOTE: All tests specified in the present document are data link layer tests. The term <layer> in the TP identifier is used to have a consistent TP reference covering also the tests on the application layer provided in a separate part of this multi-part deliverable.			

5.1.3 Sources of TP definitions

All TPs are specified according to the base standard ES 200 674-1 [1].

5.1.4 General reference

All references in the test purposes, if not stated differently, are indicating clauses of the base standard ES 200 674-1 [1].

All references to PICS are indicating tables in TS 102 708-1-1 [2].

5.1.5 General conditions

For all TPs related to OBUs the following pre-conditions shall apply, if not defined differently for a specific TP:

- The OBU shall be ready for communication, i.e. it shall not be in sleep mode and all boot processes shall be finalized.

Additional pre-conditions may apply for specific TPs.

5.1.6 Default PICS selection

For all TPs related to OBUs the following PICS selections shall apply in addition to those specified for a specific TP:

- Tables A.1/1, A.4/3 and A.4/9 of the PICS [2] is implicitly selected for all TPs.

For all TPs related to RSUs the following PICS selections shall apply in addition to those specified for a specific TP:

- Tables A.1/2, A.4/2, A.4/8 and A.5/1 of the PICS [2] is implicitly selected for all TPs.

Further PICS selections may apply as specified for a specific TP. These only give hints on the major properties to be tested, as the base standard [1] does not contain selectable options.

5.2 Test purposes for on-board units

5.2.1 Valid behaviour tests

TP/OBU/DLL/BV/01	Verify that the IUT can reply to requests providing proper values in the LLC address field
	Reference: Clauses 10.9.1, 10.4.1 and 10.4.2
	PICS Selection: Table A.3/1
	TC reference:
	Initial condition:
Stimulus and Expected Behaviour:	
<ol style="list-style-type: none"> 1) Tester sends a frame to the IUT upon which a reply is expected. 2) Verify that the tester receives the expected reply with the LLC address field of the received frame containing the same value as the LLC address field transmitted in step 1). 	

TP/OBU/DLL/BV/02	Verify that the IUT can receive downlink frames of maximum allowed length as defined by N2
	Reference: Clause 10.2.2.4
	PICS Selection: Table A.5/4
	TC reference:
	Initial condition:
Stimulus and Expected Behaviour:	
<ol style="list-style-type: none"> 1) Tester sends downlink frame containing any sequence of PDUs in such a way that the number of octets in the frame equals the maximum number as defined by N2. 2) Verify IUT properly confirms the requests send in step 1) by a corresponding uplink frame. 	

TP/OBU/DLL/BV/03	Verify that the IUT implements correctly the timing constraint T_{umax} for uplink windows
	Reference: Clause 10.9.2
	PICS Selection: Table A.5/3
	TC reference:
	Initial condition:
Stimulus and Expected Behaviour:	
<ol style="list-style-type: none"> 1) Tester sends a frame to the IUT containing a valid request upon which reception of a frame of maximum length from the IUT is expected. 2) Verify that the tester receives the expected reply from the IUT. Tester records time T_{umax} from the end of the last bit of the closing flag of the frame containing the request from the tester until the end of the last bit of the end flag of the frame containing the response. 3) Verify that T_{umax} does not exceed the allowed limit. 	

TP/OBU/DLL/BV/04	Verify that the IUT manages duplicate reception of requests
	Reference: Clause 10.9.3
	PICS Selection: Table A.4/9
	TC reference:
Initial condition:	
Stimulus and Expected Behaviour:	
<ol style="list-style-type: none"> 1) Tester sends a frame containing valid PDUs. 2) Tester records the response (if any) sent by the IUT. 3) After time T_1, repeat step 1). 4) Verify reception of the same response as in step 2). 	

TP/OBU/DLL/BV/05	Verify that the IUT correctly handles the abort sequence
	Reference: Clause 10.2.2.3
	PICS Selection: Table A.4/1 AND Table A.4/10
	TC reference:
Initial condition:	
Stimulus and Expected Behaviour:	
<ol style="list-style-type: none"> 1) Tester sends downlink frame containing a valid sequence of PDUs upon which replies are expected, but replaces the closing flag by the abort sequence. 2) Verify that the IUT does not reply to the frame sent in step 1). 	

5.2.2 Invalid behaviour tests

TP/OBU/DLL/BI/01	Verify that the IUT ignores downlink frames with a length exceeding the maximum allowed length as defined by N2
	Reference: Clauses 10.2.2.1 and 10.2.2.4
	PICS Selection: Table A.4/1 AND Table A.5/4
	TC reference:
Initial condition:	
Stimulus and Expected Behaviour:	
<ol style="list-style-type: none"> 1) Tester sends downlink frame containing any sequence of PDUs upon which replies are expected, in such a way that the number of octets in the frame exceeds the maximum number as defined by N2. 2) Verify that the IUT does not reply to the frame sent in step 1). 	

TP/OBU/DLL/BI/02	Verify that the IUT ignores downlink frames with no closing flag
	Reference: Clauses 10.2.2.1 and 10.3
	PICS Selection: Tables A.2/2 AND A.4/1 AND A.4/10
	TC reference:
Initial condition:	
Stimulus and Expected Behaviour:	
<ol style="list-style-type: none"> 1) Tester sends downlink frame containing a valid sequence of PDUs upon which replies are expected, but suppresses transmission of the closing flag. 2) Verify that the IUT does not reply to the frame sent in step 1). 	

TP/OBU/DLL/BI/03	Verify that the IUT ignores downlink frames with no opening flag
	Reference: Clauses 10.2.2.1 and 10.3
	PICS Selection: Tables A.2/2 AND A.4/1 AND A.4/10
	TC reference:
Initial condition:	
Stimulus and Expected Behaviour:	
<ol style="list-style-type: none"> 1) Tester sends downlink frame containing a valid sequence of PDUs upon which replies are expected, but suppresses transmission of the opening flag. 2) Verify that the IUT does not reply to the frame sent in step 1). 	