



**Intelligent Transport Systems (ITS);
RTTT;
Test specifications for High Data Rate (HDR) data
transmission equipment operating in the 5,8 GHz ISM band;
Part 2: Application Layer;
Sub-part 3: Abstract Test Suite (ATS)
and partial PIXIT pro forma**

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TTCN**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
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Foreword

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

The present document is part 2-3 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 2-1 [2].

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) and partial PIXIT pro forma to test the Application layer of ETSI ES 200 674-1 [1].

The objective of the present document is to provide test scripts for testing conformance of DSRC-HDR equipment specified in ETSI ES 200 674-1 [1] giving a high probability of inter-operability between different manufacturer's equipment.

All formal test scripts provided in the present document are based on ETSI TS 102 708-2-2 [3].

The ISO standard for the methodology of conformance testing (ISO/IEC 9646-1 [4], ISO/IEC 9646-2 [5] and ISO/IEC 9646-5 [6]), ETSI ETS 300 406 [7] and ETSI ES 201 873-1 [8] specifying the TTCN-3 core language 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.

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

- [1] ETSI ES 200 674-1: "Intelligent Transport Systems (ITS); Road Transport and Traffic Telematics (RTTT); Dedicated Short Range Communications (DSRC); 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 102 708-2-1: "Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 2: Application Layer; Sub-Part 1: Protocol Implementation Conformance Statement (PICS) proforma specification".
- [3] ETSI TS 102 708-2-2: "Intelligent Transport Systems (ITS); RTTT; Test specifications for High Data Rate (HDR) data transmission equipment operating in the 5,8 GHz ISM band; Part 2: Application Layer; Sub-Part 2: Test Suite Structure and Test Purposes (TSS&TP)".
- [4] ISO/IEC 9646-1 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".
- [5] ISO/IEC 9646-2 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite specification".
- [6] ISO/IEC 9646-5 (1994): "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 5: Requirements on test laboratories and clients for the conformance assessment process".
- [7] ETSI ETS 300 406: "Methods for testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".
- [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] 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)".
- [10] 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)".

2.2 Informative 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.

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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 TS 102 708-1-3: "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 3: Abstract Test Suite (ATS) and partial PIXIT proforma".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in ETSI ES 200 674-1 [1], ISO/IEC 9646-1 [4], ISO/IEC 9646-2 [5], ETSI ES 201 873-1 [8] and the following apply:

Abstract test case: Refer to ISO/IEC 9646-1 [4].

Abstract Test Method (ATM): Refer to ISO/IEC 9646-1 [4].

Abstract Test Suite (ATS): Refer to ISO/IEC 9646-1 [4].

Implementation Under Test (IUT): Refer to ISO/IEC 9646-1 [4].

Lower Tester (LT): Refer to ISO/IEC 9646-1 [4].

Test Purpose (TP): Refer to ISO/IEC 9646-1 [4].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ETSI ES 200 674-1 [1], ISO/IEC 9646-1 [4], ISO/IEC 9646-2 [5], ETSI ES 201 873-1 [8] and the following apply:

AL	Application Layer
APDU	Application Protocol data Unit
ASN.1	Abstract Syntax Notation 1
ATS	Abstract Test Suite
DLL	Data Link Layer
FCS	Frame Check Sequence
IUT	Implementation Under Test
LLC	Link Layer Control
LPDU	Link Protocol data Unit
LSB	Least Significant Bit
MSB	Most Significant Bit
OBU	On Board Unit
PDU	Protocol Data Unit

PHY	PHYSical (layer)
PICS	Protocol Implementation Conformance Statement
PIXIT	Partial Protocol Implementation Extra Information for Testing
RSU	Road Side Unit
SUT	System under Test
TC	Test Case
TP	Test Purpose
TS	Test System
TSS	Test Suite Structure
TTCN	Testing and Test Control Notation
TTCN-3	Testing and Test Control Notation version 3

4 Abstract Test Method (ATM)

4.0 Introduction

Clause 4 describes the Abstract Test Method used to test ETSI TS 102 708-2-2 [3].

4.1 Protocol layer architecture

The implementation under test is the Application layer of ETSI ES 200 674-1 [1]. The System under test includes also the PHY layer and the LLC layer, which are necessary to perform the IUT tests.

The tester executes the TTCN-3 scripts of the present document, running on an emulated PHY layer.

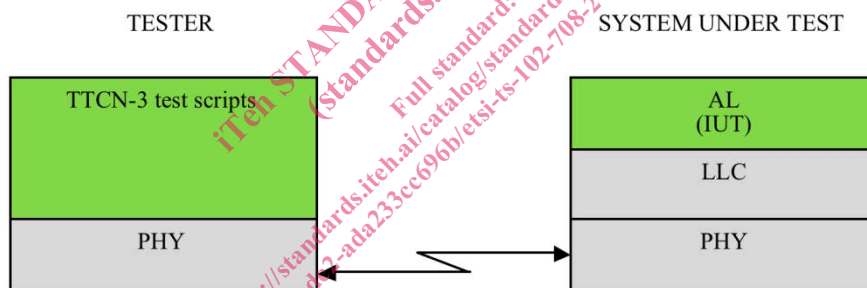


Figure 1: Protocol layer architecture

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

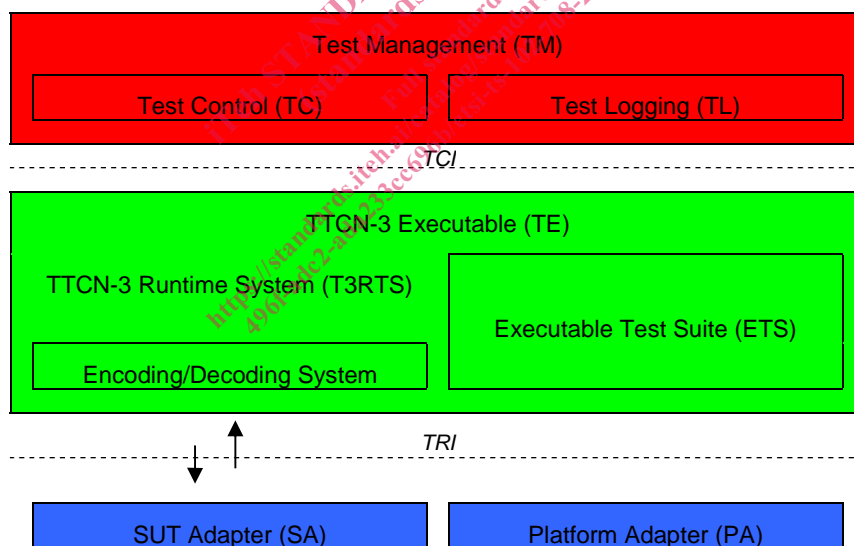
Table 1: Test suite structure for DSRC-HDR application layer

Group	Type of system under test (SUT)	Behaviour
Kernel unit	On Board Unit	Valid behaviour
		Invalid behaviour
Read access	Road Side Unit	Valid behaviour
	On Board Unit	Valid behaviour
Write access	Road Side Unit	Valid behaviour
	On Board Unit	Valid behaviour
Optional functionality	Road Side Unit	Valid behaviour
	On Board Unit	Valid behaviour
Security	Road Side Unit	Valid behaviour
	On Board Unit	Valid behaviour
Integrity constraints	Road Side Unit	Valid behaviour
	On Board Unit	Invalid behaviour

4.2 Test system architecture

4.2.1 The TTCN-3 test architecture

An abstract architecture for a test system (TS) implementing a TTCN-3 ATS is displayed in figure 2 and also stated in ETSI ES 201 873-5 [9].

**Figure 2: The TTCN-3 Abstract Test System Architecture**

A TS has two interfaces, the TTCN-3 Control Interface (TCI) and the TTCN-3 Runtime Interface (TRI), which specify the interface between Test Management (TM) and TTCN-3 Executable (TE) entities, and TE, SUT Adapter (SA) and Platform Adapter (PA) entities, respectively. Out of these two interfaces the TRI has been standardized in ETSI ES 201 873-5 [9], whereas the specification and implementation of the TCI is in ETSI ES 201 873-6 [10].

The part of TS that deals with interpretation and execution of TTCN-3 modules, i.e. the Executable Test Suite (ETS), is shown as part of the TTCN-3 Executable (TE). This ETS corresponds either to the executable code produced by a TTCN-3 compiler or a TTCN-3 interpreter from the TTCN-3 ATS in a TS implementation. The remaining part of the TS, which deals with any aspects that cannot be concluded from information being present in the TTCN-3 ATS alone, can be decomposed into Test Management (TM), SUT Adapter (SA) and Platform Adapter (PA) entities. In general, these entities cover a TS user interface, test execution control, test event logging, communication of test data with the SUT, and timer implementation.

4.2.2 The HDR Application Layer test architecture

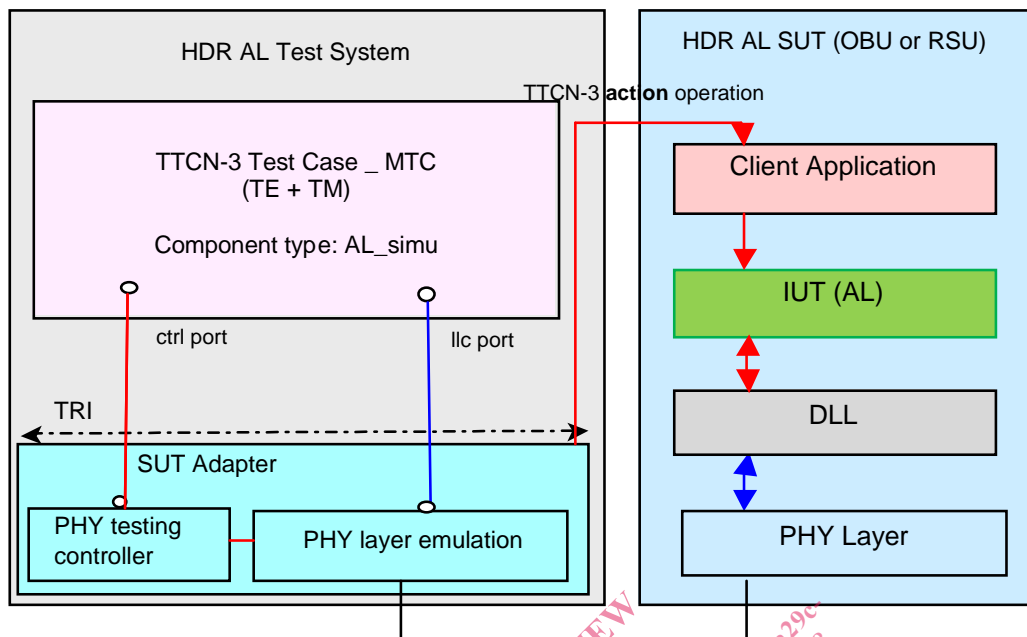


Figure 3: The HDR Application Layer Test System Architecture

The HDR AL Test System Architecture, as described in figure 3, shows the interaction between the test case execution (TE) and the test adapter, as required to cover the test purpose requirements.

LLC frames, sent to the SUT and received from the SUT are handled by the SA in order to fit the TTCN-3 types (see port mapping in the clause 4.2.3). Actually, the application layer (AL) requires changing the LLC address field, so that the TE needs to handle the complete LLC frame as in LLC testing, and not only the Information field where the AL messages are included. As consequence, the TE uses the same port type as the DLL ATS: the llc port.

As in the DLL ATS the TTCN-3 does not manage the values of some fields of the frames, which require dynamic bitwise computation, like for instance the frame flags and the Frame Check Sequence fields. As consequence, the llc port does only manage frames without flags and FCS.

Flags and FCS shall be autonomously and correctly managed by the "PHY layer emulation".

Some test cases require to trigger some actions in the IUT, which result in sending the expected frames to the tester. Triggering these action is realized in TTCN-3 by using the **action** operation (see in ETSI ES 201 873-1 [8]). According to the TTCN-3 standards, the **action** operation can result in different types of behaviour. For the best automatization of the test system, it is recommended to use the **action** operation to trigger the IUT for sending the required frames. At a minimum, the TTCN-3 test system shall generate text windows to invite the test operator to activate the necessary procedures in the IUT for sending the required frames.

4.2.3 Port mapping

4.2.3.1 Mapping rules for the llc port

Only one TTCN-3 types is sent and received over the llc port:

- the Lpdu type.