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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 1: DSRC data link layer:
medium access and logical link control;
Sub-Part 3: Abstract Test Suite (ATS) and partial PIXIT proforma**

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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 3 of a multi-part deliverable covering Intelligent Transport Systems (ITS); Dedicated Short Range Communication (DSRC); Data Link Control (DLC) layer as identified below:

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

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".

Part 2: "DSRC application layer".

1 Scope

The present document contains the Abstract Test Suite (ATS) and partial PIXIT proforma to test the Dedicated Short Range Communication (DSRC); Data Link Control (DLC) 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 [4], ISO/IEC 9646-2 [5] and ISO/IEC 9646-3 [6]) as well as the ETSI rules for conformance testing (ETS 300 406 [3]) 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:
 - 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.

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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] CEN EN 12795 (2003): "Road transport and traffic telematics - Dedicated Short Range Communication (DSRC) - DSRC data link layer: medium access and logical link control".
- [2] CEN EN 13372 (2003): "Road transport and traffic telematics (RTTT) - Dedicated short-range communication - Profiles for RTTT applications".
- [3] ETSI ETS 300 406: "Methods for Testing and Specification (MTS); Protocol and profile conformance testing specifications; Standardization methodology".
- [4] ISO/IEC 9646-1: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 1: General concepts".
- [5] ISO/IEC 9646-2: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 2: Abstract Test Suite Specification".
- [6] ISO/IEC 9646-3: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 3: The Tree and Tabular Combined Notation (TTCN)".
- [7] 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".

- [8] ISO/IEC 9646-6: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 6: Protocol Profile Test Specification".
- [9] ISO/IEC 9646-7: "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 9646-1 [4], EN 12795 [1], EN 13372 [2] and the following apply:

blocked signal: signal without clock and bit information, e.g. a very weak signal

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in ISO/IEC 9646-1 [4], ISO/IEC 9646-6 [8], ISO/IEC 9646-7 [9], EN 12795 [1], EN 13372 [2] and the following apply:

ASP	Abstract Service Primitive
ATM	Abstract Test Method
ATS	Abstract Test Suite
BI	Invalid Behaviour
BV	Valid Behaviour
CM	Co-ordination Message
CP	Co-ordination Point
IUT	Implementation Under Test
MTC	Master Test Component
PCO	Point of Control and Observation
PrWA	MAC frame Private Window Allocation
PrWRq	MAC frame Private Window Request
SAP	Service Access Point
SUT	System Under Test
TTCN	Tree and Tabular Combined Notation
UT	Upper Tester

4 Abstract Test Method (ATM)

4.1 DSRC MAC layer Abstract Test Method (ATM) for OBU

This clause describes the ATM used to test the DSRC MAC layer at the OBU side.

4.1.1 Test architecture

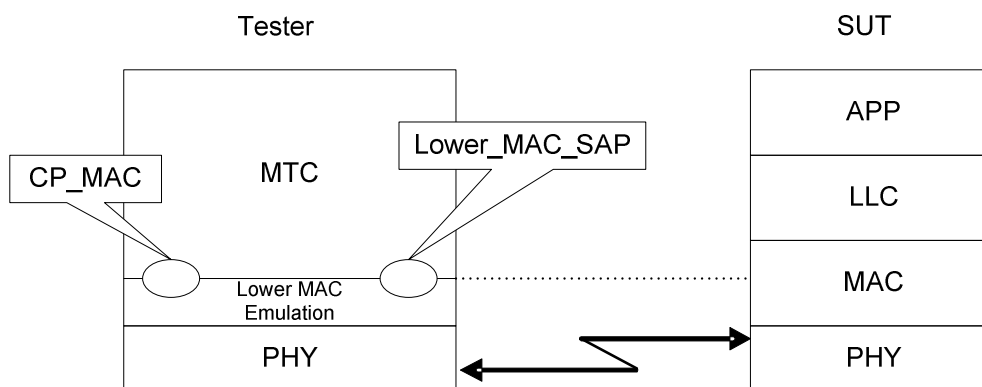


Figure 1: Test architecture for OBU DSRC MAC layer

A parallel testing concept is used, which consists of the following abstract testing parts:

- Tester:** A test machine that is running a TTCN engine allowing parallel testing and having a standard DSRC Physical layer.
- SUT:** System under test.
- MTC:** Master test component used to perform the test, and start/stop/configure the Lower MAC Emulation Parallel Test Component.
- MAC:** A standard DSRC MAC layer to be tested.
- Lower_MAC_SAP:** Interface between the Lower MAC emulation and MTC. MAC frames, minus their FCS and flags, are passed via this SAP. In addition, specific frame timing information is passed upwards on this SAP.
- Lower MAC emulation:** An DSRC MAC emulation performing some additional functions needed for covering the test purposes in addition of the behaviour of a standard DSRC MAC layer. In particular, FCS and flags are added/removed as required, and timing information on received frames is provided to the MTC.

4.2 DSRC MAC layer Abstract Test Method (ATM) for RSU

This clause describes the ATM used to test the DSRC MAC layer at the RSU side.

4.2.1 Test architecture

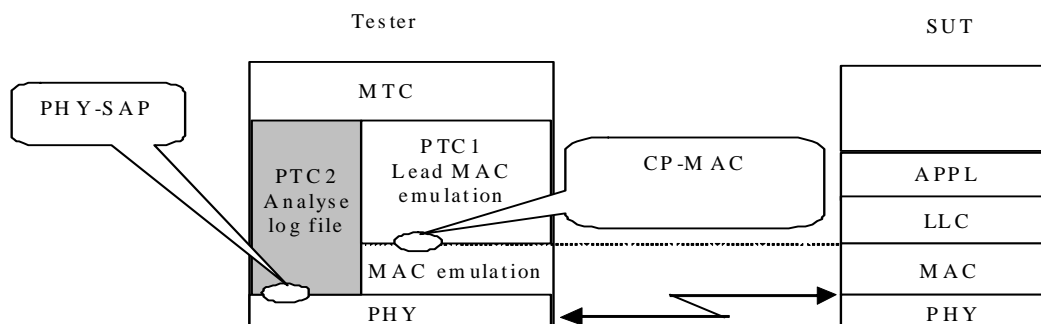


Figure 2: Test architecture for RSU DSRC MAC layer

A parallel testing concept is used, which consists of the following abstract testing parts:

Tester:	A test machine that is running a TTCN engine allowing parallel testing and having a standard DSRC Physical layer.
SUT:	System under test: Can be RSU or OBU Implementation.
MTC:	Master test component used to synchronize the parallel test components and to provide the final verdict of the test.
PTC1:	Parallel test component that is in charge of managing the MAC emulation by using external function like Start emulation, Stop emulation and some other behaviours needed for covering all test purposes.
PTC2:	Parallel test component that is in charge of analysing the log file to verify the conformity with the corresponding test purpose at MAC frame level.
MAC:	A standard DSRC MAC layer to be tested.
Log File:	Log file containing a trace of the physical frame exchange.
PHY-SAP:	For TTCN point of view: it is a PCO in which only receive events (without flags, FCS and after 0 insertion suppression) are observed and no control functions are provided.
CP-MAC:	Interface between the MAC emulation and PTC1. Usually a collection of Test Suite Operation implemented to command the behaviour of the MAC emulation.
MAC emulation:	A golden DSRC MAC emulation performing some additional functions needed for covering the test purposes in addition of the behaviour of a standard DSRC MAC layer.

4.3 DSRC LLC layer Abstract Test Method (ATM)

This clause describes the ATM used to test the DSRC LLC layer at the OBU side and at the RSU side.

4.3.1 Test architecture

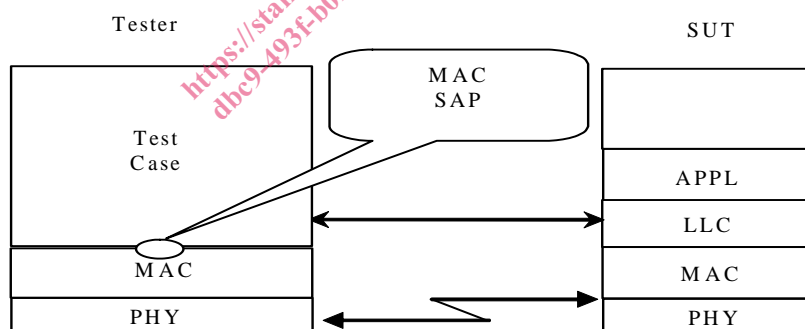


Figure 3: Test architecture for DSRC LLC layer

A single party testing concept is used, which consists of the following abstract testing parts:

Tester:	A test machine that is running a TTCN engine allowing single testing and having standard DSRC MAC and Physical layer.
SUT:	System under test: Can be RSU or OBU Implementation.
Test Case:	A standard TTCN test case.
LCC:	A standard DSRC LLC layer to be tested.
MAC:	A standard DSRC MAC layer.

MAC-SAP: To be defined or standard SAP referring to the standard.

4.4 Test strategy

The ATM defined in clauses 4.1 and 4.3 requires the use of concurrent TTCN, which is specified in ISO/IEC 9646-3 [6]. The parallel test components PTC1 and PTC2 are, however, seen as two independent entities. This means that there is no communication or synchronization between the two PTCs during the test.

PTC2 is specified in TTCN (see annex A). Since PTC2 is only observing at the PCO, this ATS does not contain any send statements. Once the Test Purposes (TP) are fulfilled, the PTC2 terminates, i.e. there are no postambles, unless required by the TP.

The requirements for PTC1 (see annex B) are specified using EN 12795 [1].

The Master Test Component (MTC) creates the two PTCs (using CREATE operation), PTC1 stimulates the emulation, and then MTC waits for the two PTCs to terminate (using the DONE event). The final verdict is computed as follows:

- a PASS is assigned if PTC2 returns a PASS verdict and the expected event is received from PTC1;
- a FAIL verdict is assigned if PTC2 returns a FAIL verdict independently of what is received from PTC1;
- an INCONC verdict is assigned if: PTC2 returns an INCONC verdict and the expected event is received from PTC1, or returns a PASS verdict and an unexpected event is received from PTC1.

5 Untestable Test Purposes (TP)

This clause gives a list of TPs which are not implemented in the Abstract Test Suites due to the chosen Abstract Test Method or other restrictions.

Table 1: Untestable TPs

Test purpose	Reason

6 ATS conventions

The ATS conventions are intended to give a better understanding of the ATS but they also describe the conventions made for the development of the ATS. These conventions shall be considered during any later maintenance or further development of the ATS.

The ATS conventions contain two clauses, the naming conventions and the implementation conventions. The naming conventions describe the structure of the naming of all ATS elements. The implementation conventions describe the functional structure of the ATS.

To define the ATS, the guidelines of the document ETS 300 406 [3] was considered.

6.1 Naming conventions

6.1.1 Declarations part

This clause describes the naming conventions chosen for the elements of the ATS declarations part.

6.1.1.1 General

The following general rules apply for the names given in the declarations part.