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Road vehicles — Controller area network (CAN) — Conformance test plan —

Part 2:
High-speed medium access unit with selective wake-up functionality — Conformance test plan

Véhicules routiers — Gestionnaire de réseau de communication (CAN) — Plan d'essai de conformité — Partie 2

ICS 43.045.15

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Foreword

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ISO 16845-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 3, *Electrical and electronic equipment*.

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 16845 consists of the following parts, under the general title *Road vehicles — Controller area network (CAN)*:

— *Part 1: Conformance test plan (in preparation)*

— *Part 2: High-speed medium access unit with selective wake-up functionality - Conformance test plan*

Introduction

ISO 16845 was first published in 2004 to provide the methodology and abstract test suite necessary for checking the conformance of any CAN implementation of the CAN specified in ISO 11898-1. The new restructured ISO 11898 contains among other series the ISO 11898-6, defining the physical layer requirements for partial networking.

ISO 16845-2 provides the methodology and abstract test suite necessary for checking the conformance of any CAN implementation of the specified ISO 11898-6.

Road vehicles — Controller area network (CAN) — Part 2: High-speed medium access unit with selective wake-up functionality - Conformance test plan

1 Scope

Standards always imply a certain expectation regarding the interoperability of devices produced by different manufacturers. In fact a standard describes what we want and expect to see, but it is hard to guarantee each feature without deep and thorough testing of the functionality described and demanded by the chosen standard.

Scope of this document is to establish test cases and test requirements to realize a test plan verifying if the CAN transceiver with implemented selective wake-up functions are conform the specified functionalities referenced in clause 2. This kind of testing defined in this document is named as conformance testing.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments and technical corrigenda) applies.

ISO 7498-1, *Information technology — Open systems interconnection — Basic reference model — Part 1: The basic model*

ISO 9641-1, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 1: General concepts*

ISO 9641-1, *Information technology — Open Systems Interconnection — Conformance testing methodology and framework — Part 2: Abstract Test Suite specification*

ISO 11898-1, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

ISO 11898-2:2003, *Road vehicles — Controller area network (CAN) — Part 2: High-speed medium access unit*

ISO 11898-5:2007, *Road vehicles — Controller area network (CAN) — Part 5: High-speed medium access unit with low-power mode*

ISO 11898-6:2012, *Road vehicles — Controller area network (CAN) — Part 6: High-speed medium access unit with selective wake-up functionality*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11898-2:2003, ISO 11898-5:2007 and the following apply.

3.1
Implementation under test
IUT
The device (e.g. standalone transceiver, SBC) which will be tested according this conformance test plan. An IUT can be part of a SUT

3.2
Lower tester
LT
Part of the test system which emulates the interfaces of the underlying OSI layer from sight of the IUT

3.3
System under test
SUT
If the IUT is part of a system or cannot operate as a standalone device, the system under test is the system where the IUT is implemented

3.4
Test system
TS
A system which fulfils in this case all requirements to perform the tests defined in this specification

3.5
Upper tester
UT
Part of the test system which emulates the interfaces of the overlying OSI layer from sight of the IUT

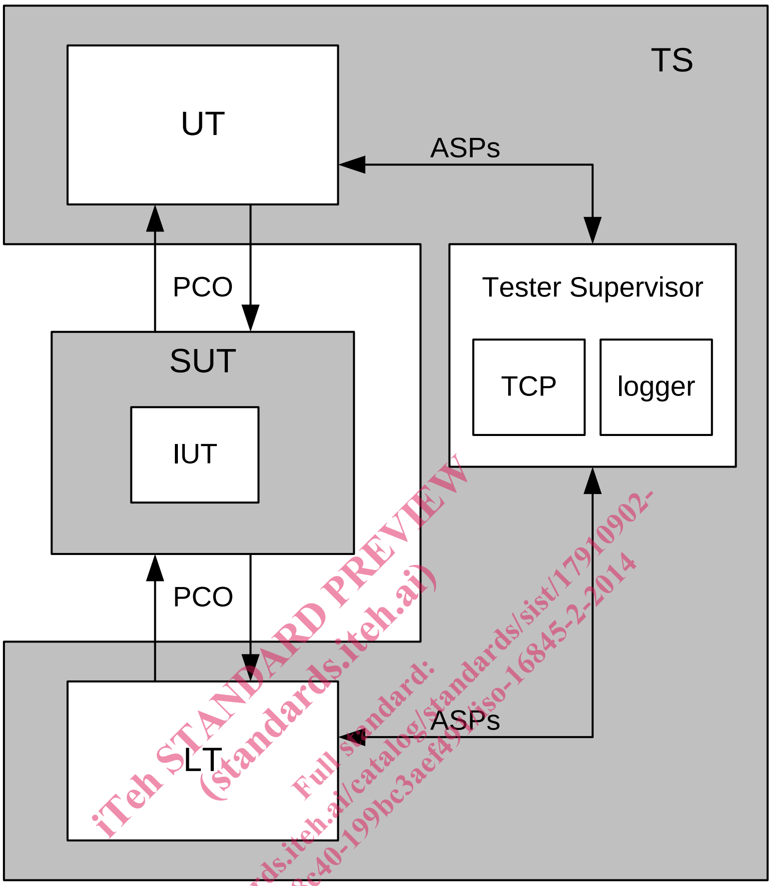
4 Symbols and abbreviated terms

ACK	Acknowledge
ASP	Abstract service primitives
CAN	Controller Area Network
CRC	Cyclic Redundancy Check
DLC	Data Length Code
EOF	End of Frame
ID	Identifier
MAC	Medium Access Control
OSI	Open System Interconnection
PCO	Point of control and observation
PHS	Physical Signalling
PL	Physical Layer
PMA	Physical Medium Attachment
FEC	Frame Error Counter
SOF	Start of Frame
WUF	Wake-up frame
WUP	Wake-up pattern
IMF	Intermission field

5 OSI conformance test method

OSI conformance testing was mainly introduced by the ISO 9646, ISO 9641-1 and ISO 9641-2, for the purpose of regulating and harmonizing impartial tests. In general information about the internal structure of the implementation as well as source code is not available to the party performing the tests. This explains why the preferred OSI conformance testing methodology is black box testing and consequently does not take into account any implementation details.

Figure 1 depicts the OSI coordinated test method.



Key

SUT System Under Test

UT Upper Tester

IUT Implementation Under Test

LT Lower Tester

TCP Test Coordination Procedure

TS Test System

Figure 1 — The OSI coordinated test method

OSI conformance testing proposes many test methods suitable for different sorts of Implementation Under Test (IUT), providing different points of control and observation.

The coordinated test method, is the most suitable for CAN devices, it provides a simple interface to the Implementation Under Test, i.e. the CAN-Bus itself, and a flexible test coordination protocol using CAN messages between the Lower Tester (LT) as part of the Test System and the Upper Tester (UT) in the System Under Test. The Lower Tester controls and observes the Implementations Under Test lower service boundary indirectly via the underlying service provider, using the Abstract Service Primitives (ASPs) of the

CAN protocol. The Upper Tester controls and observes the Implementations Under Test upper service boundary. The Test Coordination Procedures (TCPs) ensure the cooperation between the Lower Tester and the Upper Tester.

In case of CAN Transceiver with partial networking functionalities influencing variables from the upper tester side are the digital CAN signals (RxD and TxD), host interface signals and I/O signals like INH or Wake. The lower tester influencing variables are the analogue bus interface with the signals CAN_H and CAN_L and the supply power. Figure 2 depicts the influencing variables on the IUT.

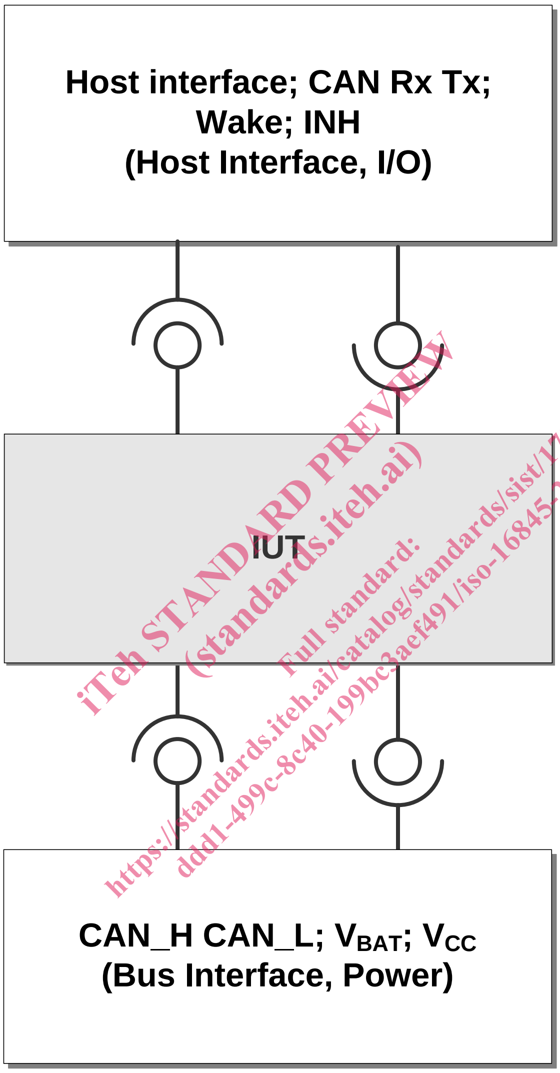


Figure 2 — Influencing variables on IUT

To realise all services stimulating the IUT and recording the responses of the IUT regarding all influencing variables, abstract logical devices are defined as followed.

Figure 3 depicts abstract logical devices of upper and lower tester.

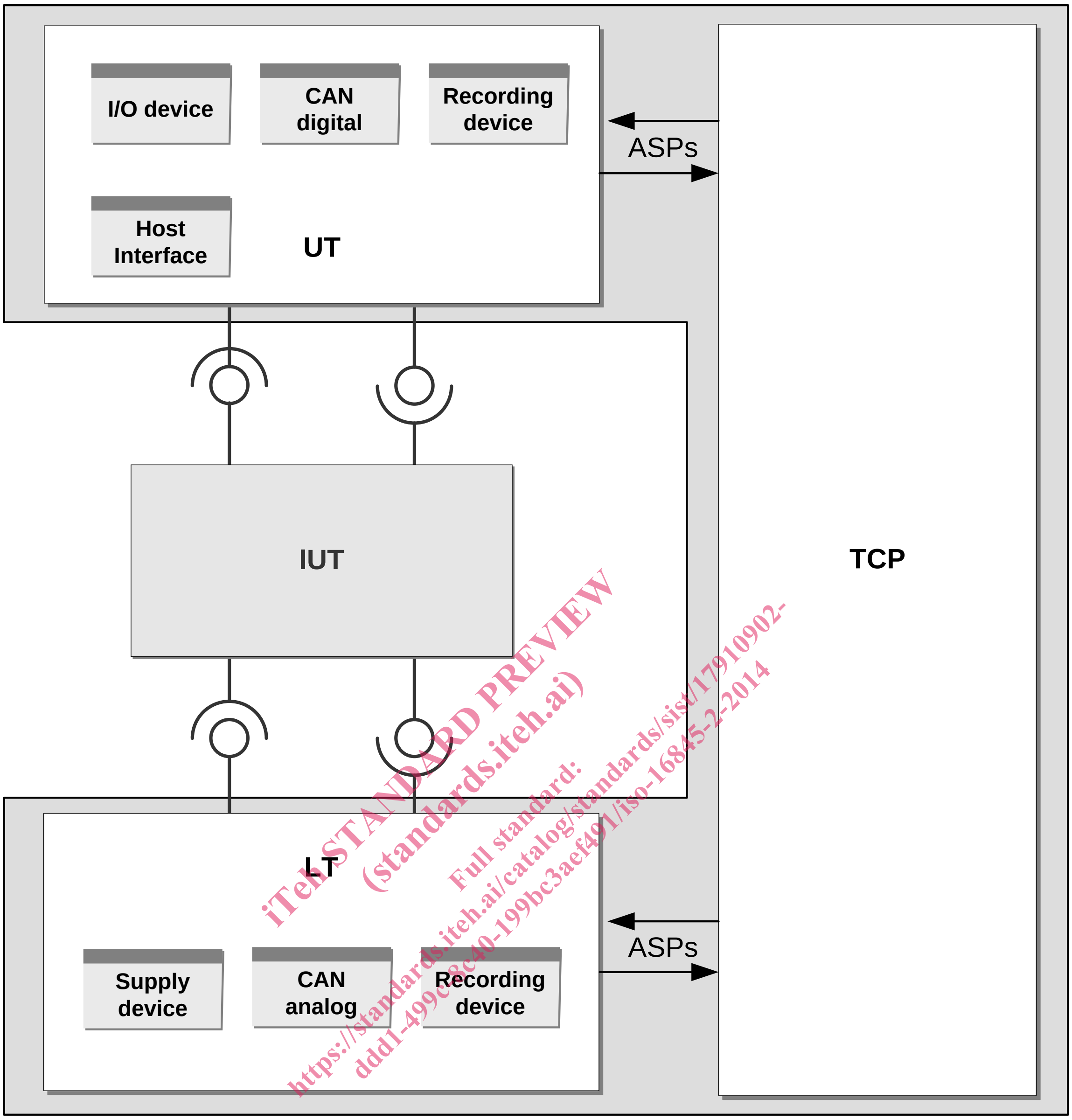


Figure 3 — Abstract logical devices of upper and lower tester

The OSI model divides a communication interface in seven logical layers which contain defined interfaces from / to the upper or lower layer. Following the OSI coordinated test method the test system realises the upper layer with help of the upper tester and the lower layer with help of the lower tester. For transceivers without partial networking capability, the transceiver is implemented inside the logical layer 1 – the physical layer with the lower interface as the CAN bus and the upper interface to the 2nd layer, known as the data link- or protocol layer, with logical signals TxD and RxD. In case of a high speed CAN transceiver supporting partial networking the IUT itself contains functionalities appropriate to the data link layer (partial networking functionalities) and physical layer (typical transceiver functionalities). To follow the OSI coordinated test method this test specification is split in a physical layer part, verifying the transceiver characteristics appropriated to the OSI physical layer and a data link layer part, verifying the protocol implementation necessary for partial networking functionalities.

6 Organization

6.1 General organization

The abstract test suites of the TS are independent to one another. Each abstract test suite checks the behaviour of the IUT for a particular parameter of the CAN specification ISO 11898-1. Each test case may be executed one after another in any order or alone.

Test cases requiring variations of individual parameters have to be repeated for each value of the parameter. Each repetition is named elementary test. A test case including different elementary tests is valid only if all tests pass.

The result of executing a test case on an IUT should be the same whenever it is performed. To realize such reproducibility of test results this specification is designed in the way to minimize the possibility that a test case produces different test outcomes on different occasions. Therefore, test requirements which have to be met and how the verdicts are to be assigned are defined in an unambiguous way.

6.2 Test case organization

6.2.1 Overview

Each elementary test is made of three states:

- Setup state;
- Test state;
- Verification state.

Before the first elementary test is started the IUT has to be initialised into the default state.

6.2.2 Setup state

The Setup state is a defined and explicitly entered and verified state in which the IUT has to be before entering the test state. The IUT, unless otherwise specified, is configured with data determined by the test frame that is being used (the test frame will cause a wake-up). The ID mask, unless otherwise specified, is configured with must-care fields.

6.2.2.1 Default setup

Figure 4 describes the default setup for test which shall be applied unless otherwise specified in Setup of the test case description. Furthermore, the setup information of the related device documentation shall be followed.

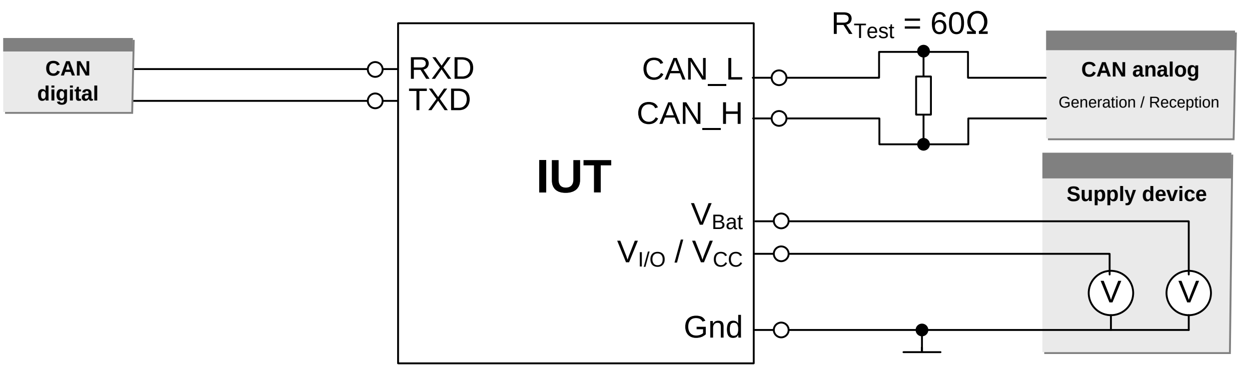


Figure 4 — Default setup for test

6.2.2.2 Default state

The Default state is characterised by the following default value:

— IUT power supply on;

— IUT configured to test bit rate;

— IUT set to Normal mode.

After the end of each Elementary test, the default state must be re-applied.

6.2.3 Test state

The time between two frames on the bus shall be, unless otherwise specified, at least 2 bits of idle after IMF. The idle phase shall not be longer than $t_{SILENCE(min)}$.

6.2.4 Test frame definition for protocol related test cases

6.2.4.1 Elements of test frames

In the protocol related test cases the focus is on correct frame reception and handling. Therefore, test frames or test pattern will be sent to the IUT. The test frames with 11-bit identifiers are structured as depicted in Figure 5. The elements of the test frame are described below.

SOF	ID	RTR	IDE	r0	DLC	Data	CRC	CRC_DEL	ACK	ACK_DEL	EOF	INTERM_#

Figure 5 — 11-bit CAN-ID format frame elements

Figure 6 depicts the structure of the test frames in extended frame format. The elements of the test frame are described below.

SOF	ID_1	SRR	IDE	ID_2	RTR	r1	r0	DLC	Data	CRC	CRC_DEL	ACK	ACK_DEL	EOF	INTERM_#

Figure 6 — 29-bit CAN-ID format frame elements