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

Part 2: High-speed medium access unit — Conformance test plan

Véhicules routiers — Gestionnaire de réseau de communication (CAN) plan d'essai de conformité —

Partie 2: Unité d'accès au medium haute vitesse — Plan d'essai de conformit

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Contents

Page

Foreword ... **vi**

Introduction ... **vii**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **1**

4 Symbols and abbreviated terms ... **2**

5 Global overview ... **3**

5.1 OSI conformance test method ... 3
5.2 General organization ... 7
5.3 Test case organization ... 7
5.3.1 Overview ... 7
5.3.2 Setup state ... 7
5.3.3 Test state ... 8
5.3.4 Test frame definition for protocol related test cases ... 8
5.3.5 Hierarchical structure of tests ... 9
5.3.6 Elementary tests ... 10
5.3.7 Applicable test cases for IUTs with enhanced voltage biasing ... 10

6 Test type 1, static test cases ... **10**

7 Test type 2, normal CAN communication acceptance ... **15**

7.1 Test class 1, valid frame format ... 15
7.1.1 ID test in CBFF messages ... 15
7.1.2 ID test in CEFF messages ... 16
7.1.3 WUP element of WUF ... 17
7.1.4 WUF element of another valid frame — CBFF message ... 18
7.1.5 WUF element of another valid frame — CEFF message ... 19
7.1.6 Acceptance of no nominal "SRR" in CEFF message ... 19
7.1.7 Absent bus idle after data frame ... 20
7.1.8 Stuff acceptance test 1 ... 20
7.1.9 Stuff acceptance test 2 ... 21
7.1.10 Acceptance of Sync Sequence ... 22
7.1.11 Idle detection after CAN FD frame (FD tolerant implementation only) ... 23
7.2 Test class 2, error detection ... 24
7.2.1 Stuff error test 1 ... 24
7.2.2 Stuff error test 2 ... 25
7.2.3 CRC error test ... 26
7.2.4 Form error in data frame ... 26
7.3 Test class 3, error frame management ... 27
7.3.1 Absent bus idle after error scenario ... 27
7.3.2 Active error condition during ignored frames after switching on the bias ... 28
7.3.3 Passive error condition during ignored frames after switching on the bias ... 28
7.4 Test class 4, CAN bit decoding ... 29
7.4.1 Correct sampling of the 10th bit after the last dominant edge causing resync ... 29
7.4.2 Correct sampling of the 10th bit after the last dominant edge after hard sync ... 30
7.4.3 IUT robustness against dominant bit extensions ... 31
7.4.4 IUT robustness against dominant bit shortening ... 31
7.4.5 Correct sampling after bit deformation and hard sync ... 32
7.4.6 No frame constant bit deformation due to loss of arbitration or ringing effects ... 33
7.4.7 Glitch filtering test in idle state ... 34
7.4.8 Glitch filtering test after FD format frame after IFS and EOF (FD tolerant implementation only) ... 34
7.4.9 Glitch filtering test in CAN FD data phase (FD tolerant implementation only) ... 35

7.4.10 Bit (glitch) detection test in CAN FD data phase (FD tolerant implementation only) 36
7.4.11 Clock tolerance test 36
7.4.12 Not constant network timing due to loss of arbitration 37

8 Test type 3, WUF evaluation 38
8.1 Test class 1, CAN message ID filter test 38
8.1.1 Message filter / CBFF – test 1 38
8.1.2 Message filter / CBFF – test 2 39
8.1.3 Message filter / CBFF – test 3 40
8.1.4 Message filter / CBFF – test 4 41
8.1.5 Message filter / CEFF – test 1 42
8.1.6 Message filter / CEFF – test 2 43
8.1.7 Message filter / CEFF – test 3 44
8.1.8 Message filter / CEFF – test 4 45
8.2 Test class 2, CAN message data filter test 46
8.2.1 Message data filter – matching data field 46
8.3 Test class 3, CAN message DLC filter tests 47
8.3.1 Message DLC filter test 47
8.4 Test class 4, optional data mask bit tests 48
8.4.1 Message filter / CBFF – test 1 while DLC matching condition disabled 48
8.4.2 Message filter / CBFF – test 2 while DLC matching condition disabled 49
8.4.3 Message filter / CBFF – test 3 while DLC matching condition disabled 50
8.4.4 Message filter / CBFF – test 4 while DLC matching condition disabled 51
8.4.5 Message filter / CEFF – test 1 while DLC matching condition disabled 52
8.4.6 Message filter / CEFF – test 2 while DLC matching condition disabled 53
8.4.7 Message filter / CEFF – test 3 while DLC matching condition disabled 54
8.4.8 Message filter / CEFF – test 4 while DLC matching condition disabled 55
8.4.9 Acceptance of frames independent of the DLC while DLC matching condition disabled 56
8.4.10 Acceptance of remote frames independent of the DLC while DLC matching condition disabled 57
8.5 Test class 5, non-acceptance of remote frames 58
8.5.1 Non-acceptance of remote frames 58

9 Test type 4, FEC management 59
9.1 General 59
9.2 Test class 1, valid frame format 59
9.2.1 FEC decrement on valid frame presence 59
9.2.2 FEC no increment on form error in error delimiter 60
9.2.3 FEC no increment on sixth bit of error delimiter 61
9.2.4 FEC no increment on ACK error 62
9.2.5 FEC no increment on form error in ACK delimiter 63
9.2.6 FEC no increment on form error in EOF field 64
9.2.7 FEC no increment on glitches 65
9.2.8 FEC no increment on classical CAN frames with not nominal "FDF, r0" 66
9.2.9 FEC no increment on CAN FD frames (FD tolerant implementation only) 67
9.3 Test class 2, error detection 69
9.3.1 FEC increment on form error in CRC delimiter 69
9.3.2 FEC increment on stuff error 70
9.3.3 FEC increment on CRC error 71
9.3.4 FEC incremented once when active error flag length is 13 bit 72
9.3.5 FEC incremented once when active error flag is longer than 13 bit 72
9.4 Test class 3, HS-PMA handling 73
9.4.1 FEC reset after expiration of $t_{SILENCE}$ 73
9.4.2 FEC reset on enabling selective wake-up function 74
9.4.3 FEC no reset during change from normal to low-power mode (optional) 75
9.4.4 FEC evaluation direct after WUP presence 76

10 Test type 5, HS-PMA implementation 77

10.1 Test class 1, WUP ... 77
10.1.1 Wake-up after valid WUP ... 77
10.1.2 No wake-up after invalid WUP ... 78
10.1.3 No wake-up after expiration of optional timer t_{Wake} ... 79
10.1.4 Reset of the optional timer t_{Wake} ... 80
10.1.5 No wake-up due to not stabilized recessive bus state ... 81
10.2 Test class 2, low-power mode operation ... 82
10.2.1 Reset of the timer $t_{SILENCE}$ ... 82
10.2.2 Expiration of the timer $t_{SILENCE}$ AND implementation in low-power mode ... 83
10.2.3 Biasing independency from V_{CC} availability ... 84
10.2.4 Transmitter in low-power mode ... 85
10.2.5 Wake-up independency from V_{CC} availability ... 86
Bibliography ... 87

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by ISO/TC 22, *Road vehicles*, Subcommittee SC 31, *Data communication*.

This second edition cancels and replaces the first edition (ISO 16845-2:2014), which has been technically revised and includes the following changes:

— several clauses, subclauses, tables and figures have been technically revised. In particular, the test cases and test requirements to verify if the CAN transceiver with implemented selective wake-up functions conform to the specified functionalities within ISO 11898-6:2013 were extended. This was done to provide a conformance test plan for the whole CAN medium access unit implementations compliant with ISO 11898-2:2016 (which is the result of the merge of ISO 11898-2:2003, ISO 1898-5:2007 and ISO 11898-6:2013).

A list of all the parts in the ISO 16845 series can be found on the ISO website.

Introduction

ISO 16845 was first published in 2004 to provide a test plan for conformance testing of the CAN data link layer and physical signalling as standardized in ISO 11898-1. With ISO 11898-6:2013, CAN high-speed medium access units were standardized, which partly implements a CAN data link layer, in order to provide selective wake-up functionality. This standard was merged together with ISO 11898-5:2007 and ISO 11898-2:2003 to produce ISO 11898-2:2016. In order to provide a conformance test plan for CAN medium access unit implementations compliant with ISO 11898-2:2016, this document has been developed. It comprises static tests and dynamic tests.

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

Part 2: High-speed medium access unit — Conformance test plan

1 Scope

This document specifies the conformance test plan for the CAN physical layer as standardized in ISO 11898-2:2016. It specifies static and dynamic tests. The dynamic tests includes the test cases for the partly implemented Classical CAN protocol and CAN FD protocol as standardized in ISO 11898-1:2015. The static tests describe the data to be given in datasheets.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 11898-1:2015, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

ISO 11898-2:2016, *Road vehicles — Controller area network (CAN) — Part 2: High-speed medium access unit*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11898-2:2016 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

3.1
implementation under test
IUT
HS-PMA which will be conformance tested according to this document

EXAMPLE Standalone transceiver or SBC.

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
normal mode
mode, in which biasing as well as RX and TX are enabled and low-power mode is disabled

3.4
system under test
SUT
system, which embeds the IUT as a part or contains the IUT, because it cannot operate as a stand-alone component

3.5
test system
TS
system, which fulfils in this case all requirements to perform the tests defined in this specification

3.6
upper tester
UT
part of the test system, which emulates the interfaces of the overlying OSI layer from sight of the IUT

3.7
valid frame
syntactically correct CAN frame

3.8
invalid frame
syntactically incorrect CAN frame with CAN conform error treatment

3.9
sync frame
syntactically correct CAN frame which is present on the bus while the IUT is in low power mode.

Note 1 to entry: It could be a WUF or non WUF.

3.10
sync sequence
group of sync frames which the IUT may use to calibrate or fine tune internal parameter to be prepared to detect a WUF

4 Symbols and abbreviated terms

The following symbols and abbreviated terms are used in this document:

ACK acknowledge

ASP abstract service primitives

CAN controller area network

CBFF classical base frame format

CEFF classical extended frame format

CRC cyclic redundancy check

DLC data length code

EOF end of frame

FBFF FD base frame format

FEC frame error counter

FEFF FD extended frame format

ID identifier

IMF intermission field

MAC medium access control

OSI open system interconnection

PCO point of control and observation

PHS physical signalling

PL physical layer

PMA physical medium attachment

SBC system base chip

SOF start of frame

WUF wake-up frame

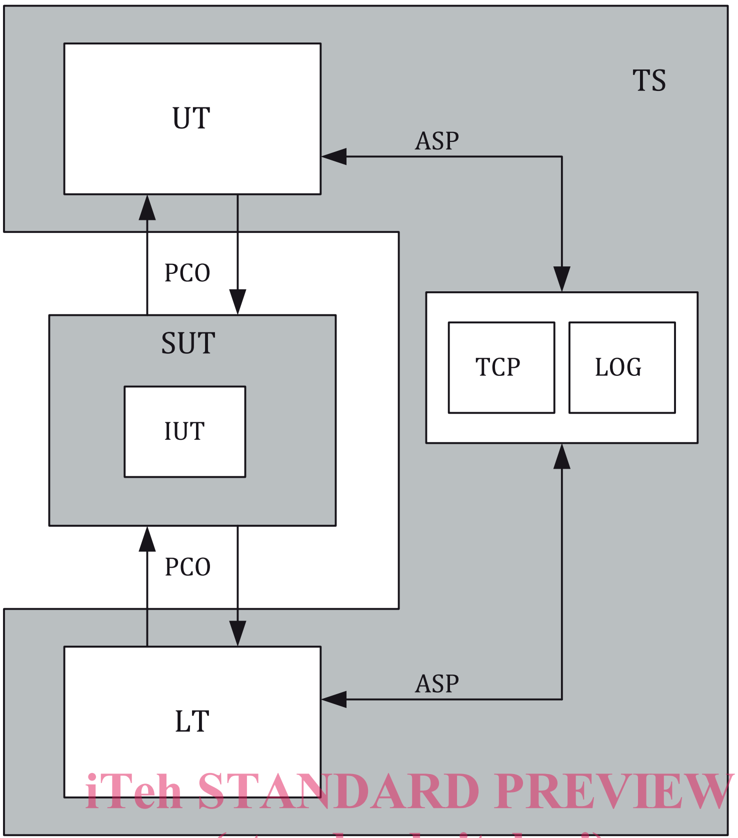
WUP wake-up pattern

5 Global overview

5.1 OSI conformance test method

OSI conformance testing was mainly introduced by the ISO 9646, ISO 9646-1 and ISO 9646-2, 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 — The OSI coordinated test method depicts the OSI coordinated test method.



Key

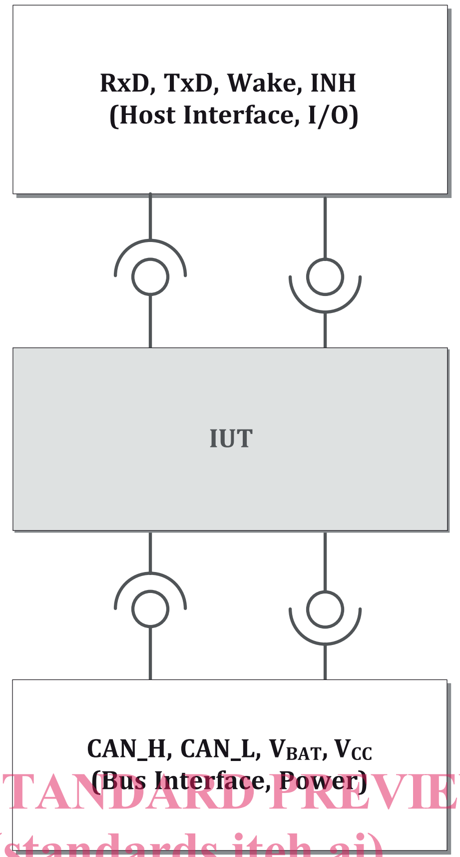
ASP abstract service primitives
IUT implementation under test
LOG logger
LT lower tester
PCO point of control and observation
SUT system under test
TCP test coordination procedure
TS test system
UT upper tester

Figure 1 — The OSI coordinated test method

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

A coordinated test method which provides a simple interface to the IUT is the most suitable for HS-PMA, i.e. the CAN network itself, and a flexible test coordination protocol using CAN messages between the LT as part of the TS and the UT in the SUT. The LT controls and observes the IUT lower service boundary indirectly via the underlying service provider, using the ASPs of the CAN protocol. The UT controls and observes the IUT upper service boundary. The TCPs ensure the cooperation between the LT and the UT.

In case of IUTs with partial networking functionalities, influencing variables from the UT side are the digital CAN signals (RXD and TXD), host interface signals and I/O signals like INH or wake. The LT 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.



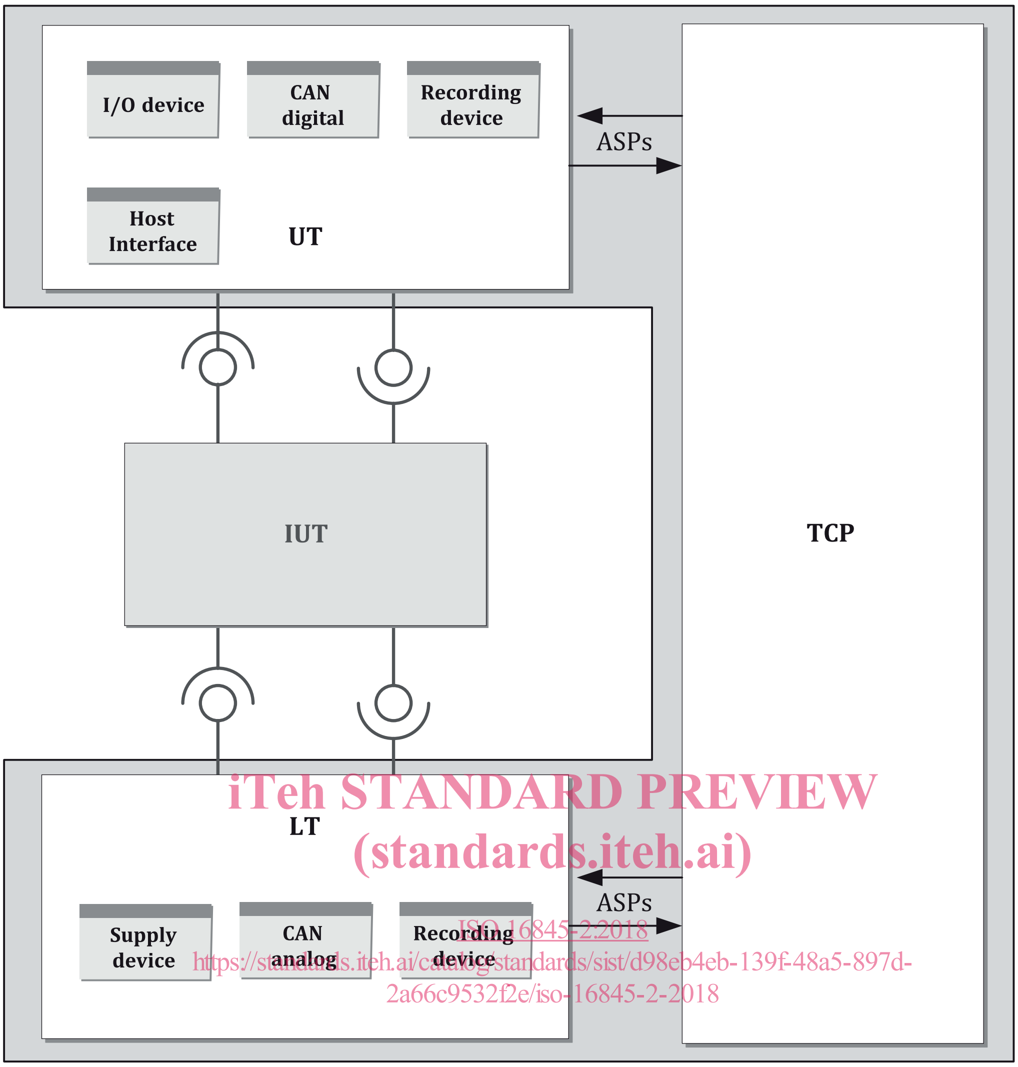
Key

CAN_H	CAN high signal
CAN_L	CAN low signal
INH	inhibit output
IUT	implementation under test
I/O	input/output
RXD	receive data output
TXD	transmit data input
V_{BAT}	battery supply input
V_{CC}	supply input
Wake	mode signalling output

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 — Abstract logical devices of UT and LT depicts abstract logical devices of UT and LT.



Key

IUT implementation under test

LT lower tester

TCP test coordination procedure

UT upper tester

Figure 3 — Abstract logical devices of UT and LT

The OSI model divides a communication interface in seven logical layers which contain defined interfaces from / to the upper or lower layer (as introduced by the ISO 7498-1). Following the OSI coordinated test method the TS realises the upper layer with help of the UT and the lower layer with help of the LT. For IUTs without partial networking capability, the IUT is implemented inside the logical layer 1 – the physical layer with the lower interface as the CAN network and the upper interface to the layer 2, known as the data link- or protocol layer, with logical signals TXD and RXD. In case of an IUT 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.

5.2 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 protocol as defined in ISO 11898-1:2015. Each test case may be executed one after another in any order or alone.

Test cases requiring variations of individual parameters shall 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 document is designed in the way to minimize the possibility that a test case produces different test outcomes on different occasions. Therefore, test requirements, which shall be met, and how the verdicts are to be assigned are defined in an unambiguous way.

All parameters in a test case are given for the electrical interface pins of IUT. The stimulus generator should correctly signal delays and voltage drops of test setup.

If not explicitly different described in test case, all applied stimuli for CAN data and remote frames are built according to the CAN protocol behaviour as expected on a real CAN network.

5.3 Test case organization

5.3.1 Overview

All defined test cases should be executed in accordance with the supported IUT-specific bit rates defined in the IUT's datasheet.

In case the IUT supports other bit rates, the following scenarios are possible.

— if the IUT supports only one bit rate, then all test cases should be executed using this specific bit rate;

— if the IUT supports two bit rates, then all test cases should be executed with both bit rate; and

— if the IUT supports more than two bit rates or a range of bit rates, then all test cases should be executed considering the highest and the lowest bit rate, as well as a bit rate in-between.

5.3.2 Setup state

5.3.2.1 General

The setup state is a defined and explicitly entered and verified state in which the IUT shall be before entering the test state. A test starts with unpowered IUT. The first step is to set IUT power supply on. The IUT, unless otherwise specified, is configured with data as found in 5.3.4.2.

Each elementary test is made of three states:

— setup state;

— test state; and

— verification state.

Before the first elementary test is started, the IUT shall be initialised into the default state.

5.3.2.2 Default setup

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

