LIN Conformance Tests

1 What is a LIN Conformance Test?

A LIN conformance test is a test procedure, used to determine, whether a component, a device, an implementation, or an ECU is matching the specified standards. By executing a conformance test the above described elements are scrutinized referring to the requirements of the conformance test specification.
The purpose of a conformance test is to enhance the feasibility of reliable interoperability of different system implementation, by considering technical and economic aspects at the same time .

2 Why LIN Conformance Tests?

Laboratories, where those devices and implementation are tested, operate worldwide. Thus a standardized conformance test, as defined in the conformance test specification is needed. This guarantees repeatable and traceable results, which are comparable with each other. Especially in respect of an automotive communication standard as per LIN.

3 The Test Types

The test specification defines three fields of the LIN bus and the LIN communication.

- LIN OSI Layer 1 - Physical Layer
- LIN OSI Layer 2 - Data Link Layer, inclusive NCNM (Node Configuration / Network Management)
- LIN EMC Test

3.1 Physical Layer Test

The conformance test specification concerning the physical layer test is close to the LIN specification and deals mainly with the following tests (depending on the version a variation is possible).

OPERATIONAL CONDITIONS – CALIBRATION

- Operating Voltage Range
- Signal Threshold Voltages
- IUT as Receiver
- Variation of VSUP_NON_OP
- IBUS Under Several Conditions
- IBUS_LIM @ Dominant State (Driver On)
- IBUS_Pas_dom : IUT in Recessive State
- IBUS_Pas_rec : IUT in Recessive State
- Slope Control
- Measuring the Duty Cycle @ 10.kBit/sec – IUT as Transmitter
- Measuring the Duty Cycle @ 20.0 kBit/sec – IUT as Transmitter
- Propagation Delay
- Propagation Delay of the Receiver
- GND / VBAT Shift Test - Dynamic
- GND Shift Test – Dynamic – IUT as Transceiver
- VBAT Shift Test – Dynamic – IUT as Transceiver
- Failure
- Loss of Battery
- Loss of GND

OPERATION MODE

- Termination
- Measuring Internal Resistor – IUT as Slave
- Measuring Internal Resistor – IUT as Master
- Measuring Internal Capacitance – IUT as Slave

3.2 Data Link Layer Test / NCNM

3.2.1 Data Link Layer

Also the data link layer test is close to the LIN specification and the following tests are dealt with (depending on the version a variation is possible).

TIMING PARAMETERS

- Length of Synch Break Low Phase, IUT as Master
- Variation of Length of Synch Break Low Phase, IUT as Slave
- Length of Synch Break Delimiter, IUT as Master
- Variation of Length of Synch Break Delimiter, IUT as Slave
- Length of Header, IUT as Master
- Variation of Length of Header, IUT as Slave
- Oscillator Tolerance, IUT as Master
- Oscillator Tolerance, IUT as Slave without Making Use of Synchronization
- Oscillator Tolerance, IUT as Slave with Making Use of Synchronization
- Length of Frame, IUT as Slave Answering to a Master Request
- IUT as Slave
- IUT as Master with a Slave Task

COMMUNICATION WITHOUT FAILURE

- Variation of LIN Identifier
- IUT as Master
- IUT as Slave
- IUT as Master with Slave Task
- Transmission of the Checksum Byte
- IUT as Slave
- IUT as Master with Slave Task
- Extended Frame, Reserved , IUT as Slave
- Command Frame 'Master Request', IUT as Master
- Command Frame 'Master Request', IUT as Slave
- Command Frame 'Slave Response Frame', IUT as Master
- Command Frame 'Slave Response Frame', IUT as Slave
- Supported Frames According to the IUT Specification', IUT as Slave

COMMUNICATION WITH FAILURE

- Bit Error, IUT as Slave
- Checksum Error, IUT as Slave

EVENT TRIGGERED FRAMES

- Event Triggered Frame, IUT as Slave

3.2.2 NCNM

The following tests are part of the Node Configuration / Network Management Tests.

STATUS MANAGEMENT

- Error in Received Frame, IUT as Slave
- Error in Transmitted Frame, IUT as Slave
- Error in Transmitted Frame with Collision, IUT as Slave

SLEEP / WAKE UP TESTS

- Send Command Frame 'Sleep Mode Command', IUT as Master
- Receive Command Frame 'Sleep Mode Command', IUT as Slave
- Receive a Wake Up Request, IUT as Master
- Receive a Wake Up Request, IUT as Slave

- Send a Wake Up Request
- IUT as Slave and Master with Slave Task
- Send a Wake Up Request, No Following Frame Header from a Master, IUT as Slave
- Send a Wake Up Request, Frame Header from a Master Following, IUT as Slave
- Sleep Mode After Bus Idle

NODE CONFIGURATION

- Frame ID Assignment
- Frame ID Assignment – with Indirect Response
- Frame ID Assignment – with Direct Response
- LIN Product ID
- LIN Product ID – with Direct Response
- LIN Product ID – with Indirect Response
- Read by Identifier Command
- Read by Identifier Command with Correct NAD
- Read by Identifier Command with Incorrect NAD
- NAD Assignment
- NAD Assignment – Followed by ”Read by Identifier
- NAD Assignment – with Positive Response
- Conditional Change NAD.

3.3 EMC

The following EMC tests are descibed in the conformance test specification.

TEST SET-UP

- Immunity Against Transients
- RF- Immunity
- ESD
- Emission of RF Disturbances
- Test Circuit Boards

REQUIREMENTS

- Immunity Against Transients
- Immunity Against RF Disturbances
- Immunity Against ESD
- Emission

4 LIN related bus systems

Based on the LIN bus two additional automotive bus systems have established. The Cooling bus on the one hand and then again the SAE-J2602 called bus standard.

4.1 Cooling Bus

The Cooling bus is a proprietary bus adopted to automotive air condition. The bus is based on LIN 1.3 and shows the following LIN-differing features:

- address-orientated communication system
- especially developed for motors, sensors and actuators in air condition
- auto-addressing of actuators (flaps) for reuse of non-variable parts
- special command for auto-addressing
- physical daisy chain
- special measuring method (via a resistor chain) for the positioning inside the network

4.2 SAE-J2602

Bus systems referring to SAE standard J2602 are generally in use by US American OEM. This bus is based on LIN 2.0 and shows the following basic differences:

- 10417bit/s transfer rate (for reducing radiation)
- maximum wiring length and number of ECU
- fixed assignment for frame identifier
- the 1st data byte of a slave response has a defined structure for the transmission of slave status and indication of communication error
- specification of additional parameters for efficient bus load is possible

There are no differences to the physical layer.

5 Documents

For those, who want further information about the mentioned bus systems, the referred specifications are listed below. The according organizations may provide you with the documents partially for a fee (please understand that ihr GmbH does not allocate any papers).

- LIN Specification Package, Revision 2.0, September 23, 2003
- LIN Conformance Test Specification for the LIN Specification Package, Revision 2.0,Sep. 18, 2003, Version 1.0, August 1, 2004 with sub-specifications
  - LIN OSI Layer 1 – Physical Layer for the LIN Physical Layer Specification, Revision 2.0, Sep. 23, 2003, Version 1.0, August 1, 2004
  - LIN OSI Layer 2 – Data Link Layer for the LIN Protocol Specification, Revision 2.0, Sep. 18, 2003, Version 1.0, August 1, 2004
  - Node Configuration / Network Management for the LIN Specification Package, Revision 2.0, Sep. 18, 2003 Version 1.0, August 1, 2004
- SAE-J2602-1, Issued 2004-08, Revised 2005-09, LIN Network for Vehicle Applications
- SAE-J2602-2, Issued 2005-09, LIN Network for Vehicle Applications Conformance Test

6 Addresses

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