



SURFACE VEHICLE RECOMMENDED PRACTICE	J2962™-1	FEB2024
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Communication Transceivers Qualification Requirements - LIN		

RATIONALE

Historically, Original Equipment Manufacturers (OEMs) had their own communication transceiver qualification requirements that varied over time. The intent of this standard is to minimize test variation and to consolidate requirements among OEMs.

FOREWORD

The purpose of this recommended practice is to define a common test plan for approval of ICs that contain local interconnect network (LIN) communication transceivers. This document will define test circuits, bus load requirements, test procedures, and pass/fail criteria to validate transceivers.

NOTE: Understanding of this document requires a working knowledge of ISO EMC publications and SAE J2602.

TABLE OF CONTENTS

1.	SCOPE	4
2.	REFERENCES.....	4
2.1	Applicable Documents	4
2.1.1	SAE Publications.....	4
2.1.2	ISO Publications.....	4
2.1.3	IEC Publications.....	5
2.1.4	Other Publications.....	5
3.	DEFINITIONS	5
4.	ACRONYMS	6
5.	REQUIRED TEST CIRCUIT	7
5.1	Primary Device Under Test (DUT)	7
5.1.1	Microcontroller-Based Primary DUT Behavior.....	7
5.1.2	Square Wave-Based Primary DUT Behavior.....	7
5.1.3	Primary DUT Application Circuit	8
5.2	Electrostatic Discharge (ESD) Protection Options.....	8
5.3	Monitoring DUT	10
5.3.1	Microcontroller-Based Monitoring DUT Behavior	10
5.3.2	Load-Only Monitoring DUT Behavior	10
5.3.3	Monitoring DUT Application Circuit.....	11
5.4	Layout Best Practices	11
5.5	Network Load Simulation Test Circuit.....	12
5.6	Preferred Order for Testing Execution	12

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6.	ELECTROSTATIC DISCHARGE TESTING	12
6.1	ESD Handling (Unpowered).....	12
6.2	ESD Powered.....	15
6.2.1	ESD Requirements	15
6.2.2	ESD-Powered Test Setup	15
6.2.3	ESD-Powered Test Procedure.....	17
6.2.4	ESD-Powered Pass/Fail Criteria	17
7.	COUPLED TRANSIENTS TESTING	17
7.1	Slow Transient Coupling (Direct Capacity Coupling [DCC]) Requirements	17
7.2	DCC Test Setup	18
7.3	DCC Test Procedure.....	19
7.4	Fast Transient Coupling (CCC or DCC) to I/O (Excludes Nominal 12-V Lines)	19
7.5	Transient Coupling Immunity Pass/Fail Criteria.....	20
7.5.1	Slow Transient (DCC) Pass/Fail Criteria.....	20
7.5.2	Fast Transient Pass/Fail Criteria.....	20
8.	RADIATED EMISSIONS (RE)	20
8.1	RE Requirements	21
8.2	RE Test Setup	21
8.3	RE Test Procedure.....	22
8.4	RE Pass/Fail Criteria	22
9.	BULK CURRENT INJECTION (BCI).....	22
9.1	BCI Requirements	22
9.2	BCI Test Setup	23
9.3	BCI Test Procedure.....	25
9.3.1	Active Mode - Transceiver in Normal Communication Mode.....	25
9.3.2	Low Power Mode(s) - Transceiver in Sleep Mode	25
9.4	BCI Pass/Fail Criteria.....	26
9.4.1	Active Mode - Transceiver in Normal Communication Mode.....	26
9.4.2	Low Power Mode(s) - Transceiver in Sleep Mode	26
9.4.3	Monitoring Voltage Regulator	27
10.	GENERAL REQUIREMENTS	27
10.1	Report Requirements	27
10.2	Family of Transceiver Devices Qualification Requirements	27
11.	NOTES	28
11.1	Revision Indicator.....	28
Figure 1	Primary DUT with battery supply	8
Figure 2	ESD protection selection flowchart	9
Figure 3	Monitoring DUT with battery supply	11
Figure 4	ESD handling test setup.....	13
Figure 5	Handling ESD pre- and post-test setup (Network load simulation box and wiring not connected during discharges).....	14
Figure 6	Pass/fail criteria for after plots.....	14
Figure 7	Powered ESD test setup	16
Figure 8	Powered ESD: network load simulation box jumper open during discharges	16
Figure 9	DCC setup: network load simulation box jumper open during test pulses	18
Figure 10	DCC injection detail: load simulator is not used during pulse injection	19
Figure 11	RE test setup: network load simulation box is not used in this setup	21
Figure 12	BCI immunity testing limits	23
Figure 13	BCI test circuit setup: network load simulation box is not used in this setup.....	23
Figure 14	BCI test setup.....	25
Table 1	Battery supply components.....	8
Table 2A	Parameters for TVS (ESD protection) component performance	9
Table 2B	ESD protection components	9



Table 3	Termination components.....	11
Table 4	ESD handling requirements	12
Table 5	ESD network load simulation box components	14
Table 6	ESD-powered requirements.....	15
Table 7	Requirements of CCC and (Optional) DCC	20
Table 8	RE level requirements.....	21
Table 9	RF immunity test frequency steps.....	22
Table 10	BCI immunity testing limits and modulation	22
Table 11	Bus level requirements ⁽¹⁾	26

1. SCOPE

This document covers the requirements for transceiver qualification. Requirements stated in this document will provide a minimum standard level of performance for the LIN transceiver block in the IC to which all compatible transceivers shall be designed. No other features in the IC are tested or qualified as part of this recommended practice. This will assure robust serial data communication among all connected devices regardless of supplier.

The goal of SAE J2962-1 is to commonize approval processes of LIN transceivers across OEMs.

The intended audience includes, but is not limited to, LIN transceiver suppliers, component release engineers, and vehicle system engineers.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J2602-1 LIN Network for Vehicle Applications

SAE J2602-2 LIN Network for Vehicle Applications Conformance Test

SAE J2602-3 File Structures for a Node Capability File (NCF) and LIN Description File (LDF)

2.1.2 ISO Publications

Copies of these documents are available online at <https://webstore.ansi.org/>.

ISO 7498 Data Processing Systems - Open Systems Interconnection Standard Reference Model

ISO 7637-1 Road Vehicles - Electrical Disturbances from Conduction and Coupling - Part 1: Definitions and General Considerations

ISO 7637-2 Road Vehicles - Electrical Disturbances from Conduction and Coupling - Part 2: Electrical Transient Conduction Along Supply Lines Only

ISO 7637-3 Road Vehicles - Electrical Disturbances from Conduction and Coupling - Part 3: Electrical Transient Transmission by Capacitive and Inductive Coupling via Lines Other Than Supply Lines

ISO 10605 Road Vehicles - Test Methods for Electrical Disturbances from Electrostatic Discharge

ISO 11452-4 Road Vehicles - Component Test Methods for Electrical Disturbances from Narrowband Radiated Electromagnetic Energy - Part 4: Harness Excitation Methods

ISO 17987 Road Vehicles - Local Interconnect Network (LIN) - Part 1 through 7

2.1.3 IEC Publications

Available from IEC Central Office, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41 22 919 02 11, www.iec.ch.

IEC 62228-1 General Part and Conditions

IEC 62228-2 Integrated Circuits - EMC Evaluation of LIN transceivers

2.1.4 Other Publications

CISPR 25 Limits and Methods of Measurement of Radio Disturbance Characteristics for the Protection of Receivers Used On-Board Vehicles

3. DEFINITIONS

3.1 COMMAND FRAME

A frame with data published by the responder task in the commander node and subscribed to by one or more response tasks in responder nodes.

3.2 COMMANDER NODE

Responsible for initiating all message traffic. Refer to the glossary of the LIN specification package for additional information.

3.3 DATA LINK LAYER

This provides for the reliable transfer of information across the physical layer. It includes the message structure, framing, and error control.

3.4 DOMINANT SIGNAL

The driven and low voltage state of the LIN bus. If multiple devices access the bus, this state dominates the recessive or non-driven state.

3.5 DORMANT STATE

The state in which the response task state machine is waiting for reception of the break/synch sequence.

3.6 MEDIA

The physical entity that conveys the electrical (or equivalent means of communication) signal transmission among electronic control units (ECUs) on the network.

3.7 PHYSICAL LAYER

This ISO 7498 subsection consists of the media, mechanical interconnections, and transceivers that provide the interconnection between all ECU nodes.

3.8 PROTOCOL

The formal set of conventions or rules for the exchange of information among the ECUs. This includes the specification of the signal frame administration, frame transfer, and physical layer.

3.9 PUBLISHER

A commander or responder node that is the source of the data transmitted onto the bus within a LIN message.

3.10 RADIATED EMISSIONS

The electric field strength that radiates from the ECU (including LIN physical layer) and the associated wiring harness.

3.11 RADIATED IMMUNITY

The level of susceptibility of physical layer components to communication errors in the presence of high energy electromagnetic fields.

3.12 RECESSIVE SIGNAL

The undriven and high voltage state of the LIN bus. If multiple devices access the bus, this state is overridden by the dominant state.

3.13 REQUEST FRAME

A frame with data published by the response task in one and only one responder node and only subscribed to by the response task in the commander node.

3.14 RESPONDER NODE

A device that receives messages from the commander node or responds to messages initiated by the commander node. Refer to the glossary of the LIN specification package for additional information.

3.15 SUBSCRIBER

A commander or responder node that receives the data within a LIN message.

4. ACRONYMS

ALSE	Absorber-Lined Shielded Enclosure
AM	Amplitude Modulation
BCI	Bulk Current Injection Testing
CBCI	Common Mode BCI
CW	Continuous Wave
DBCI	Differential Mode BCI
DCC	Direct Capacitor Coupling
DUT	Device Under Test
ECU	Electronic Control Unit
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
INH	Inhibit Signal
ISO	International Organization for Standardization
LED	Light Emitting Diode (Indicator)

LIN	Local Interconnect Network
MCU	Microprocessor Control Unit
NCF	Node Capability File
OEM	Original Equipment Manufacturer
PK	Peak Limit
QP	Quasi-Peak Limit
RE	Radiated Emissions
RF	Radio Frequency
RI	Radiated Immunity
RXD	Receive Data Signal Line
TVS	Transient Voltage Suppression
TXD	Transmit Data Signal Line
Vbatt	Power Supply for the ECUs Present in a Communication Network (12 V Nominal)
Vs	Voltage Supply at the Power Pin of the Transceiver

5. REQUIRED TEST CIRCUIT

5.1 Primary Device Under Test (DUT)

5.1.1 Microcontroller-Based Primary DUT Behavior

- Primary DUT shall be configured as a LIN responder to communication requests from the monitoring DUT in LIN commander configuration.
- If the DUT has primary termination integrated, monitoring DUT shall be responder node. Example: Multiple DUTs in single integrated package.
- Total bus bandwidth shall be a minimum of 90%.
- The primary DUT shall contribute at least 60% of the bus traffic on average.
- The communication bit rate shall be the highest speed that the transceiver is intended to be approved for use at. A transceiver that passes at a higher speed is approved for lower speed applications.
- The primary DUT shall indicate the state of health of the mother board (e.g., LED, fault output). Some examples of faults to be indicated are: microprocessor control unit (MCU) reset, loss of power, watchdog timeout, or anything else that can prevent the LIN controller from operating correctly.

5.1.2 Square Wave-Based Primary DUT Behavior

- Primary DUT traffic generated from a square wave connected to the transmit data signal line (TXD) with 50% duty cycle. Frequency of operation determined by each test setup.
- Total bus bandwidth shall be 100%.

5.1.3 Primary DUT Application Circuit

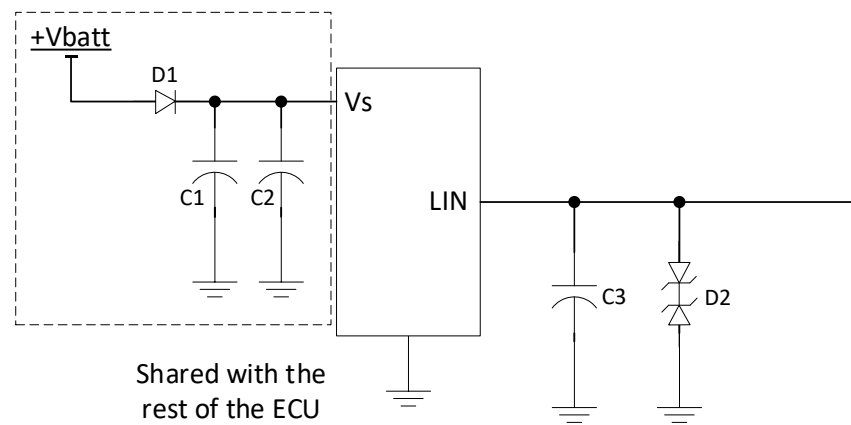


Figure 1 - Primary DUT with battery supply

Table 1 - Battery supply components

Component Name	Label	Parameter	Min	Max	Unit
Capacitor	C1		4.7% ± 10% 50 V	22% ± 10% 50 V	µF
Capacitor	C2		100% ± 10% 50 V		nF
Diode	D1	Forward Voltage Drop		1	Volts
		Reverse Breakdown Voltage	100		Volts
		Current	100		mA

5.2 Electrostatic Discharge (ESD) Protection Options

Table 2A - Parameters for TVS (ESD protection) component performance

	Option A	Option B
C _{MAX} (pF)	<25 pF	<50 pF
V _{RM} Positive	>20 V	>20 V
V _{RM} Negative	>14.5 V	>14.5 V
V _{BR} Min Positive	≥24 V	≥24 V
sV _{BR} Min Negative	≥17 V	≥17 V
Directionality	Bi-directional	Bi-directional
TLP V _{CL} @ 16A	<100 V	<50 V
ESD _{MAX} IEC 61000-4-2 Contact	≥23 kV	≥30 kV
Example Parts (but not limited to these)	Nexperia PESD1IVN27 (SOD323), ST ESDLIN1524BJ (SOD323)	On Semi MMBZ27x (SOT23 or SOT323), ST ESDLIN03-1BWY (SOT323)

The ESD protection components shall be selected for performance according to Table 2A.

The specific transceiver circuit allows for a few options as recommended by the chipset supplier. At least one of the following three options as shown in Table 2B shall be tested.

Table 2B - ESD protection components

Option No.	Component Name	Label	Primary DUT Value	Monitoring DUT Value
1	Capacitor	C3	220 pF $\pm$ 5% ⁽¹⁾ 100 V	680 pF $\pm$ 5% ⁽¹⁾ 100 V
	Zener	D2	Not Populated	Not Populated
2	Capacitor	C3	220 pF $\pm$ 5% ⁽¹⁾ 100 V	680 pF $\pm$ 5% ⁽¹⁾ 100 V
	Zener	D2	Option A (see Table 2A)	Option A (see Table 2A)
3	Capacitor	C3	220 pF $\pm$ 5% ⁽¹⁾ 100 V	680 pF $\pm$ 5% ⁽¹⁾ 100 V
	Zener	D2	Option B (see Table 2A)	Option B (see Table 2A)

⁽¹⁾Over entire voltage and temperature operating range.

NOTE: If any other protection components are required, the test setup has to be approved directly with the OEM.

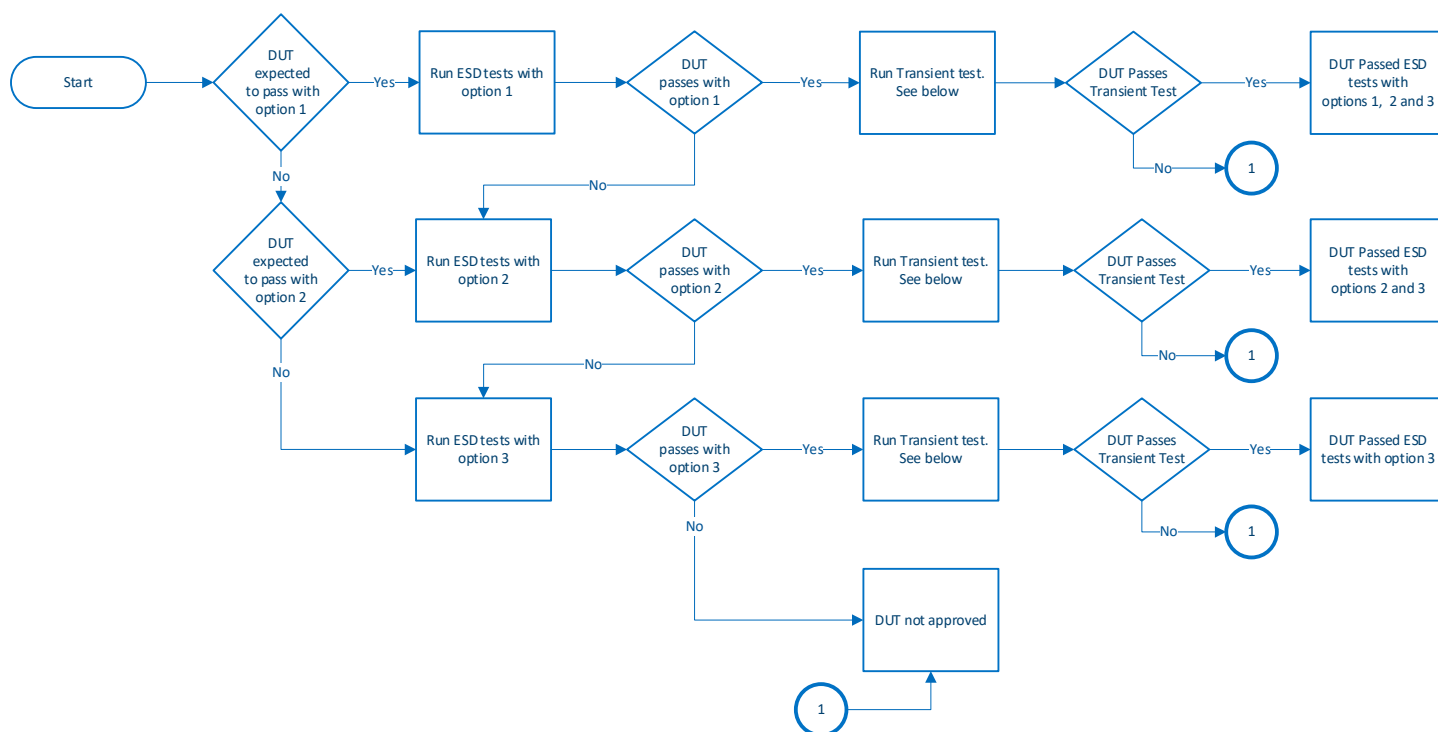


Figure 2 - ESD protection selection flowchart