SAE International VEHICLE

SURFACE RECOMMENDED PRACTICE

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2008-08 Issued

Compliance—Truck and Bus

RATIONALE

Not applicable.

FOREWORD

This series of SAE Recommended Practices has been developed by the Truck and Bus Control and Communications Network Subcommittee of the Truck and Bus Electrical and Electronics Committee. The objectives of the subcommittee are to develop information reports, recommended practices, and standards concerned with the requirements, design, and usage of devices that transmit electronic signals and control information among vehicle components. The usage of these Recommended Practices is not limited to truck and bus applications. Other applications may be accommodated with immediate support being provided for construction and agricultural equipment, and stationary power systems. These SAE Recommended Practices are intended as a guide toward standard practice and are subject to change so as to keep pace with experience and technical advances.

This particular document, SAE J1939-82, describes the compliance tests and procedures to verify an SAE J1939 ECU will operate correctly on a SAE J1939 network. This compliance document is used for all SAE J1939 applications.

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1. SCOPE

The purpose of these compliance procedures is to generate one or more test documents that outline the tests needed to assure that an ECU that is designed to operate as a node on a SAE J1939 network would do so correctly. SAE does not certify devices and these tests and their results do not constitute endorsement by SAE of any particular device. These tests are presented to allow testing of a Device to determine self-compliance by the manufacturer of a device. The manufacturer can use its record of what procedures were run successfully to show the level of compliance with SAE J1939.

2. REFERENCES

This specification takes precedence over all conflicts in the documents cited in this section.

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise specified, 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 724-776-4970 (outside USA), www.sae.org.

SAE J1455	Recommended	Environmental	Practices	for	Electronic	Equipment	Design	in	Heavy-Duty	Vehicle
	Applications									

SAE J1939 Recommended Practice for a Serial Control and Communications Vehicle Network

SAE J1939-11 Physical Layer, 250K bits/s, Twisted Shielded Pair

SAE J1939-15 Reduced Physical Layer, 250K Bits/Sec, Un-Shielded Twisted Pair (UTP)

SAE J1939-21 Data Link Layer

SAE J1939-31 Network Layer

SAE J1939-81 Network Management

2.1.2 ISO Publications

Available from American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

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

3. DEFINITIONS

Terms and definitions are defined in SAE J1939, except the following:

3.1 Certification

Public announcement, using documentation with signatures from a member of a duly recognized competent body (i.e. UL, TUV, CSA), to give notice that a given device has been tested and found to meet all necessary issues of a particular requirement or standard, whether legislated or of purely common industrial usage.

3.2 Compliance

Announcement that a device has been tested and found to meet a particular set (not necessarily all) of issues of a particular requirement or standard, without any supporting signatures from a recognized standard agency as performed by a third party investigator.

3.3 Self-Compliance

Announcement that a device has been tested and found to meet a particular set (not necessarily all) of issues of a particular requirement or standard, without any supporting signatures from a recognized standard agency.

4. ABBREVIATIONS

CTC Compliance Test Computer

DUT Device Under Test

5. EQUIPMENT

The Standard Test Configuration will contain two nodes, the Compliance Test Computer (CTC) and the Device Under Test (DUT), with appropriate media and termination, as well as power supplies and DUT loads.

5.1 Compliance Test Computer (CTC)

A Compliance Test Computer with the following capabilities:

5.1.1 Message Transmission

Must be able to send any specified message.

5.1.2 Message Reception

Must be able to receive all bus messages.

5.1.3 Time Stamp

Must be able to time stamp at the beginning of received messages at the required resolution.

5.1.4 Time Resolution

Must possess a minimum time resolution of 10 microsecond. The actual time resolution must be specified.

5.1.5 Time Stamp Accuracy

The error between any two timestamps shall be less than 1% of the time difference between the two timestamps or 1 millisecond, whichever is greater.

5.1.6 Time Stamp Latency Error

Must be less than 1 count of the time resolution.

5.1.7 Transmission Synchronization

Must be able to control the time between messages it transmits.

5.1.8 Reception Timeout

In cases where DUT should have 'no response' the CTC must be able to monitor that no response message is transmitted by the DUT for a minimum time equal to the allowed transmission response time plus two times the allowed latency (for example when transmission should be within 200 milliseconds and 50 millisecond latency is allowed then CTC must check for a minimum time of 300 milliseconds). Longer times are at the discretion of the designers.

5.1.9 CAN Interface

At least one CAN interface is required. Two CAN interfaces are required for testing Bridge functions.

5.2 Device Under Test (DUT)

The Device Under Test with the following features:

5.2.1 Operation

Must be able to perform its normal intended use (not operating any special testing mode of operation).

5.2.2 Controls

Must be able to initiate the action under test when directed.

6. SETUP

The setup will consist of a minimum network with two nodes. Any additional requirements for a specific test procedure will be specified within that procedure.

6.1 Minimum Network

Two nodes, the DUT and the CTC, with terminations, a short length of the appropriate media, power supplies.

6.2 Message Traffic

Minimal normal network traffic, only the messages necessary for the specific test procedure (see 5.2.1).

6.3 Test Message Set

Messages that are applicable to a specific test procedure will be listed in the test outline. This message list will be broken into two pieces: those supported for reception and those supported for transmission.

7. TEST SELECTION

The procedure to select a test or set thereof, necessary to check for compliance to a particular function or set of functions from the standard, are outlined within Appendix A. Appendix A is broken into tables, which identify functions, based on which document section(s) they are described within. Some tests will be pointed to by more than one entry.

7.1 Document Identifying Test

The specific document identifying a particular function will be outlined with any necessary cross-references within a Table for the specific task force document.

7.2 Requirement versus Device Characteristics

The 'SAE and User Requirements' status of each function will be cross referenced with the Device Characteristics (such as: Arbitrary Address Capable, Command Configurable, Diagnostic Tool, etc.) that will affect whether a device should provide said function.

8. RUNNING A TEST

The steps necessary to run a test are outlined as follows:

8.1 Identify Test

Using Appendix A the reviewer should identify the test number(s) necessary to check any particular function(s) that they desire. Note that all tests are not applicable to all systems. The "Requiring Document" column refers the reviewer to the appropriate document section the test is intended to cover.

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8.2 Report Generation

Using APPENDIX A the reviewer should document the test(s) performed and the results, as well as whether the device had requirement exceptions (additions or exclusions) for each of the particular functions.

9. REPORTING COMPLIANCE TEST RESULTS

Appendix A, Compliance Tests, contains columns in the forms for reporting the results of compliance testing. These columns are used to report the test date, whether a particular test is required for the specific device being tested and whether the test has been run, as well as whether the device passed (complied with) the test.

9.1 Self-Compliance

Appendix A is intended to be used by an OEM as self-compliance documentation. When certifying a device the OEM can indicate whether that the device is intended to provide each function, as well as the general level to which the device is designed. The passage of each function by the particular device can then be documented along with the date of testing. The inclusion of the specific test number(s) should enable future comparison among devices, as well as, among testers.

9.2 Device Support

The reporting forms record the test(s) conducted, the test results, and whether a device is intended to support a particular function, which makes these reporting forms very helpful to a customer locating a desired device.

PREPARED BY THE SAE TRUCK AND BUS CONTROL AND COMMUNICATIONS NETWORK SUBCOMMITTEE OF THE SAE TRUCK AND BUS ELECTRICAL AND ELECTRONICS COMMITTEE

APPENDIX A - COMPLIANCE TESTS

A.1 INTRODUCTION

Tables herein describe tests and/or procedures needed to check compliance of a device against each requirement of the SAE J1939 document set. The sections are divided by document title with section number references to the specific text defining a function and its operation. The tables include all described network functions not simply minimum requirements. The requirement to perform a test or procedure for an ECU can be discerned by looking in the applicable ECU Class columns under the 'SAE and User Requirements' heading. See Section A.2.5 below for more details about interpreting testing requirements.

A.2 TEST OUTLINE TABLE STRUCTURE AND COLUMN DEFINITIONS

The following definitions and values are identified to enable completion of the entries into the respective columns of the compliance test tables.

A.2.1 Row

Provides a numeric tag to use in references to particular tests.

A.2.2 Test Name

Name or title for the particular test.

A.2.3 Requiring Document

Specifies the source of the particular item. Usually this will be a particular section of a SAE J1939-xx document.

A.2.4 Description

Provides a short outline of the identified feature and the test.

A.2.5 SAE and User Requirements

The SAE and User Requirements consists of several 'ECU Classes' columns and a User column. The set of columns under the 'ECU Class' heading are used to identify the necessity to check compliance to a particular test, based upon the ECU class. The column under the 'User Add./Excl.' heading is provided to allow users to customize the necessity to check compliance to a particular test. An 'X' in any of the 'ECU Classes' columns implies the test is required by SAE for that ECU Class (see A.2.5.2 below for ECU Class definition). A 'D' in the User column implies this test is desired as an additional feature for the particular ECU under test. An 'E' implies that the ECU under test is not required to provide this feature even when it might be a requirement.

- The presence of a code in an 'ECU Class' column conveys a requirement to evaluate the test for an ECU of that class.
- The presence of a code in the 'User Add./Excl.' column conveys a requirement to evaluate the test per the requirements of the 'user'.
- The absence of a code in a 'SAE and User Requirements' column indicates there is no explicit requirement to evaluate the test for an ECU of that class or per the requirements of the 'user'.

A.2.5.1 Requirement Codes

There are currently three (3) codes defined to denote the requirement for evaluating a particular test. New codes will be added as the need is identified. The test requirement codes supported for the Test Outlines are summarized in Table A1.

TABLE A1 - TEST REQUIREMENT CODES

Code	Meaning	Specified By
Х	Compliance to the test is Required by SAE for that ECU Class	SAE J1939 Subcommittee
D	Compliance to the test is Desired as an additional feature for the particular ECU under test	User
Е	Compliance to the test is not required (i.e. may be excluded) for the test ECU, even though the test might be a requirement for the ECU Class	User

A.2.5.2 For example, an 'X' in any of the 'ECU Classes' columns implies the test is required by SAE for that ECU Class. A 'D' in the 'User Add./Excl.' column implies this test is desired as an additional feature for the particular ECU under test. An 'E' in the 'User Add./Excl.' column implies that the ECU under test is not required to provide this feature even when it might be a requirement. The marking of these extra conditions would enable the tables to be used for test reporting or purchasing specification, as well as to identify all the compliance tests. ECU Class

There are currently seven (7) ECU Classes defined for testing requirement association. New ECU Classes will be added as the need is identified. The ECU Class codes supported for the Test Outlines are summarized in Table A2.

TABLE A2 - ECU CLASS CODES

ECU Class Code	Code Description	Description of Applicable ECUs
ALL	All ECUs	All SAE J1939 ECUs, regardless of the ECU's design function or specifications
BDG	Network Interconnect ECUs	General network interconnect devices (bridge, router, etc)
AAC	'Arbitrary Address Capable' ECUs	ECUs or Controller Applications that are 'Arbitrary Address Capable' regarding address claim
CC	'Command Configurable' Address ECUs	ECUs or Controller Applications that support 'Command Configurable' addressing
SC	'Self Configurable' Address ECUs	ECUs or Controller Applications that are 'Self Configurable' regarding address claim
ТОО	Tool	ECU's that are to function as a 'tool'
EMS	On-Highway Emissions Regulated ECUs	ECU's are operating with On-Highway Emissions regulated engines

A.2.5.3 User Add./Excl.

The 'User Add./Excl.' column provides a place for the "User" to indicate the Addition (D) or Exclusion (E) of the test for a test ECU. The "User" is the user of this document and could be a purchasing agent, a system specifier, a supplier, a tester, etc. The marking of these extra conditions enable the tables to be used for test reporting or other specification, such as purchasing specification, as well as to identify all the compliance tests.

A.2.6 Date Tested

Identifies the date the test was conducted.

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A.2.7 Pass - Fail

Record the test results. The designation choices are

P for Pass

F for Fail

A.2.8 Test Result Comments

Record the comments the tester or others may choose to include.

A.3 COMPLIANCE TESTS FOR DATA LINK LAYER (J1939-21)

SAE

A.3.1 Data Link Layer Tests - Transmit Behavior

The Compliance Tests in Table A3 evaluate the general message transmit behaviors of the DUT. The tests for evaluating the behaviors of the DUT as the data source using the Transport Protocols are presented in Table A5 and Table A7.

TABLE A3 - DATA LINK TRANSMIT TESTS - GENERAL

RequiringDescriptionar of PGNJ1939-21Verify proper placement of PGN within 5.1.329-bit header of all framesbidentifyJ1939-21Verify DUT properly sets the EDP Bit for 5.2.2all 29-bit frames.clentifyJ1939-21Verify DUT properly sets the DP Bit for all 5.2.329-bit frames.clentifyJ1939-21Verify DUT properly sets the DP Bit for all 5.2.329-bit frames.clentifyJ1939-21Verify the length of the data field for all 5.2.7.1cengthJ1939-21Verify proper byte ordering of the parameter data for multiple byte parameters. (e.g. Verify Address Claim data meters. (e.g. Verify Address Claim data for North DUT indeed uses single CAN parameters. (e.g. Verify DUT indeed uses single CAN sytes of applies to -7.X.ble PGNJ1939-21Verify DUT indeed uses single CAN sytes of applies to -7.X.le CAN5.10.5.2Frame to send PGN under this situation. 5.2.7.18 byte data5.2.7.2Verify any unused bytes are filled with \$FF.	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded Excluded A B A B A C S O M Add./ Date B A C S C C S C C C S Excl Tested Fail Test Result Comments					
Test Name In the 29-bit Frame Header (DUT as Source) Use of EDP Bit to identify PGN (DUT as Source) Use of DP Bit to identify PGN (DUT as Source) Use of DP Bit to identify PGN (DUT as Source) Use of DP Bit to identify PGN (DUT as Source) Byte Ordering within Data Field Byte Crdering within Data Field (DUT as Source) Multipacket capable PGN with less than 9 bytes of data sent as single CAN Data Frame with 8 byte data field.	Description	Verify DUT properly sets the EDP Bit for all 29-bit frames.			Claim on also	tion.
3	Test Name	of EDP Bit to identify 11939-21 5.2.2 as Source)	J1939-21 5.2.3	J1939-21 5.2.7.1	J1939-21 5.4	less than 9 bytes of 5.10.5.2 sent as single CAN 5.2.7.1 Frame with 8 byte data 5.2.7.2

TABLE A3 - DATA LINK TRANSMIT TESTS - GENERAL (CONTINUED)

				SAE	und Us	er Req	SAE and User Requirements	ts		
				X: Tes	st is Re	X: Test is Recommended	ended			
	-	_		E: Tes	E: Test Excluded	nded	מפוועמ			
				Ĕ	ECU Classes	sess	User	ř		
				8	۷,	(ш :			
Row	Test Name	Requiring Document	Description	L G	A C C	s C 0	S Excl	i./ Date	rass- Fail	Test Result Comments
7	Request Scheduling (DUT as Source)	J1939-21 5.12.2	Verify the DUT does not send a Request message for a PGN if that PGN was received with the last 50 mS	×						
ω	Request Retries (DUT as Source)	J1939-21 5.12.3	Verify the DUT stops sending the same Request message after the third attempt (second retry). A Request retry is issued following a Response Timeout (Tr) failure.	×						
6	Correct Interpretation of 'Requested PGN' in	J1939-21 5.4.2	Verify Correct Request message structure	×						
	Request (PGN 59904) (DUT as Source)	6	Verify 'Requested PGN' in Request sent by DUT has correct content (order and position)							
10	Response Timing (DUT as Source)	J1939-21 5.12.3	Verify DUT waits 1.25 S (T3) for a required response before retrying or quitting	×						
1	Devices Responds to its own Global Read Requests (DUT as Source)	J1939-21 5.12.4	Verify DUT sends a response to its own Global Read request within the Tr Time	×						
	·		Verify the DUT uses the appropriate type of response							
12	Support of the Acknowledgement Address data byte for each ACK and NACK (DUT as Source)	J1939-21 5.4.4	Verify DUT evaluates the 'Acknowledgement Address' data field byte to determine the context of the Acknowledgement (ACK and NACK of same PGN with different 'Acknowledgement Address' data values)	×						

A.3.2 Data Link Layer Tests - Receive Behavior

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The Compliance Tests in Table A4 evaluate the general message receive behaviors of the DUT. The tests for evaluating the behaviors of the DUT as the data recipient using Transport Protocol are presented in Table A6 and Table A8.

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL

				CAE.	7 2	1 2 2	in 50,	of a come			
				X: Action 1	and control set is I dition and ist Exc	X: Test is Recoming Additional Test	X: Test is Recommended D: Additional Test Desired E: Test Excluded	X: Test is Recommended D: Additional Test Desired E: Test Excluded			
				Ш	SCUC	ECU Classes	ŵ	User	I		
				A	A						
Row	Test Name	Requiring Document	Description	L G G	v ک	ဖ ပ ပ ပ	≥ ഗ ೦ ೦	Add./ Excl	Date Tested	Pass- Fail	Test Result Comments
-	Standard Frame Message Tolerance	J1939-21 5.1.3	Verify DUT not affected by standard frames								
7	Device not a CAN 2.0A Device	J1939-21 5.1.3	Verify DUT not CAN 2.0A device by issuing 29-bit (CAN 2.0B) frames								
ო	Independence of Priority Bits in PGN Receive (DUT as Recipient)	J1939-21 5.2.1	Verify DUT receives a PGN regardless of the priority bits in 29-bit header. Change priority bits and confirm received.	×							
4	Use of EDP Bit to identify PGN (DUT as Recipient)	5.2.2	Verify DUT evaluates the EDP Bit when processing in 29-bit frames. (Same CAN header except for EDP bit and different data values to see if DUT acts on data values)	×							
2	Use of DP Bit to identify PGN (DUT as Recipient)	J1939-21 5.2.3	Verify DUT evaluates the DP Bit when processing in 29-bit frames.	×							
9	Filtering on Destination Address (DUT as Recipient)	J1939-21 5.2.5.1	Verify DUT evaluates the Destination Address for 29-bit frames. (Same PGN to different DA with different data values to see if DUT acts on data values)	×							
۷	Supports Receive of Global Destination Address (DUT as Recipient)	J1939-21 5.2.5.1	Verify DUT responds to globally addressed messages.	×							

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

						Test Result Comments						
					Dace	Fail						
I					ţ	Tested						
	SAE and User Requirements	ם ק	5	User	700							
	uire	ande			ш∑	S						
	Req	X: Test is Recommended D: Additional Test Desired	2 p	es	⊢ C	0						
	ser	Çeco ∀	E: Test Excluded	ECU Classes))						
	D i	is R	EXC	O C	< <	l O						
	Ear	Test Add	Test	EC	<u> </u>							
	SA	∷ ċ	نن د		⋖ -		×		×	×	×	×
						Description	Verify device does not lose messages when the data link is at 100 percent utilization for 10 mS.	Verify device does not lose back-to-back messages when the data link is at 100 percent utilization for 10 mS	Verify DUT receives the PGN in the single CAN Frame format.	Verify DUT can receive both concurrent instances of same PGN	Verify DUT can receive both concurrent instances of same PGN	Verify DUT properly interprets 'Requested PGN' in Request message by monitoring for correct PGN response
					Dairiingod	Document	J1939-21 5.11		J1939-21 5.10.5.2 5.2.7.1 5.2.7.2	J1939-21 5.10.5.3 5.2.7.1 5.2.7.2	J1939-21 5.10.5.3 5.2.7.1 5.2.7.2	J1939-21 5.4.2 Table 6
			- -			Test Name	PDU Processing Capabilities (DUT as Recipient)		Multipacket capable PGN with less than 9 bytes of data sent as single CAN Data Frame with 8 byte data field.	Concurrent receive of Multipacket capable Destination Specific (PDU1) PGN - one instance with less than 9 bytes (single CAN Frame) and the other instance with more than 9 bytes (RTS/CTS) (DUT as Recipient)	Concurrent receive of Multipacket capable Broadcast (PDU2) PGN - one instance with less than 9 bytes (single CAN Frame) and the other instance with more than 9 bytes (BAM) (DUT as Recipient)	Correct Interpretation of 'Requested PGN' in Request (PGN 59904) (DUT as Recipient)
						Row	∞		თ	10	-	12

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

					Test Result Comments									
					Pass- Fail									
					Date Tested									
SAE and User Requirements	pe	red	User		Add./ Excl									
auire	X: Test is Recommended	D: Additional Test Desired E: Test Excluded			Σળ									
r Re	nmo	rest ded	ses		၀ ၀ ဖ ပ									
Use	Rec	onal -	ECU Classes		ပပ									
and	est is	dditic sst E	ECU	٧										
SAE	×	, A H	ш	A B	L G	×		×		×			×	×
					Description	Verify DUT sends the Requested PGN with the Destination Address set to the Source Address from the Request message	Verify DUT sends response within 200 mS (Tr) after the Request	Verify DUT sends the Requested PGN with the Destination Address set to the Global Address	Verify DUT sends response within 200 mS (Tr) after the Request		Verify DUT sends the RTS response within 200 mS (Tr) after the Request	Verify DUT sends a SAE J1939 Transport BAM for the Requested PGN Verify DUT sends the BAM response within 200 mS (Tr) after the Request	Verify DUT sends the Requested PGN Verify DUT sends response within 200 mS (Tr) after the Request	Verify DUT sends the Requested PGN Verify DUT sends response within 200 mS (Tr) after the Request
					Requiring Document	J1939-21 5.4.2 Table 5		J1939-21 5.4.2 Table 5		J1939-21 5.4.2 Table 5		J1939-21 5.4.2 Table 5	J1939-21 5.4.2 Table 5	J1939-21 5.4.2 Table 5
					/ Test Name	Proper Response to Destination Specific Request for Single Packet Destination Specific (PDU1)	(DUT as Recipient)	Proper Response to Global Request for Single Packet Destination Specific (PDU1) PGN	(DUT as Recipient)	Proper Response to Destination Specific Request for Multipacket Destination Specific (PDU1)	PGN (DUT as Recipient)	Proper Response to Global Request for Multipacket Destination Specific (PDU1) PGN (DUT as Recipient)	Proper Response to Destination Specific Request for Single Packet Broadcast (PDU2) PGN (DUT as Recipient)	Proper Response to Global Request for Single Packet Broadcast (PDU2) PGN (DUT as Recipient)
					Row	13		14		15		16	17	18

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

				Test Result Comments													
			Pass-	Fail													
			Date	Tested													
	ed ed	User	Add./														
	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	Se	⊒ <u>≥</u>	0													
	SAE and User Re X: Test is Recom D: Additional Tes E: Test Excluded	ECU Classes	ပ	င													
	E and Fest is Additic	ECU	B D A	GC													
l	% ∴∴∷		4 –		×			×			×	×				×	
				Description	Verify DUT sends a SAE J1939 Transport RTS for the Requested PGN to the Source	Address from the Request message	Verify DUT sends the RTS response within 200 mS (Tr) after the Request	Verify DUT sends a SAE J1939 Transport BAM for the Requested PGN	Verify DUT sends the BAM response	within 200 mS (1r) after the Request	Verify DUT sends all required responses within 200 mS (Tr)	Verify DUT does nothing if it wasn't the Destination of the Regulast		Verify DUT uses the Global Address for the message	Verify DUT sends NACK within 200 mS (Tr)	Verify DUT does not send any Acknowledgement message PGN 59392)	Monitor for DUT messages for 1.25 S (T3) to verify the DUT does not send an Acknowledgement for the requested PGN
			Reanirina	Document	J1939-21 5.4.2	Table 5		J1939-21 5.4.2	Table 5		J1939-21 5.12.3	J1939-21 5.4.4	5.4.2	Table 5		J1939-21 5.4.4,	5.4.z Table 5
				Test Name	Proper Response to Destination Specific	Request for Multipacket Broadcast (PDU2) PGN	(DUT as Recipient)	Proper Response to Global Request for Multipacket	Broadcast (PDU2) PGN (DUT as Recipient)		Response Timing (DUT as Recipient)	Proper NACK Response for Destination Specific	Request for Unsupported	PGN (DLIT as Recipient)		Proper NACK Response for Globally Addressed	Request for Onsupported PGN (DUT as Recipient)
				Row	19			20			21	22				23	

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

				L				
	_	-		SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	ements ded sired			
				ECU Classes	User			
		,		⊢				
Row	v Test Name	Requiring Document	Description	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Add./ Excl	Date Tested	Pass- Fail	Test Result Comments
24	Proper use of ACK Response when Applicable (DUT as Recipient)	_	Verify DUT sends an Acknowledgement (PGN 59392) with Requested PGN and Control Byte of ACK (= 0)	×				
		200 000 000 000 000 000 000 000 000 000	Verify DUT sends ACK only if it was the Destination of the Request					
			Verify DUT does nothing if it wasn't the Destination of the Request					
		-	Verify DUT uses the Global Address for the message					
			Verify DUT sends ACK within 200 mS (Tr)					
25	Proper use of Access Denied NACK Response (DUT as Recipient)	_	Verify DUT sends an Acknowledgement (PGN 59392) with Requested PGN and Control Byte of NACK Access Denied (= 2)	×				
		able 5	Verify DUT sends NACK only if it was the Destination of the Request					
			Verify DUT does nothing if it wasn't the Destination of the Request					
		-	Verify DUT uses the Global Address for the message					
			Verify DUT sends ACK within 200 mS (Tr)					

TABLE A4 - DATA LINK RECEIVE TESTS - GENERAL (CONTINUED)

					Test Result Comments									
					Pass- Fail									
					Date Tested									
ments	<u>р</u>	pe	User		Add./ Excl									
SAE and User Requirements	X: Test is Recommended	D: Additional Test Desired E: Test Excluded	ECU Classes	-	S O S C C C C C C C C C C C C C C C C C									
SAE and	X: Test is	D: Additional Test E: Test Excluded	ECU	A B A		×					×	×	×	×
					Description	Verify DUT sends an Acknowledgement (PGN 59392) with Requested PGN and Control Byte of NACK Cannot Respond (= 3)	Verify DUT sends NACK only if it was the Destination of the Request	Verify DUT does nothing if it wasn't the Destination of the Request	Verify DUT uses the Global Address for the message	Verify DUT sends ACK within 200 mS (Tr)	Verify the 'Acknowledgement Address' data field byte contains a valid or appropriate address value	Verify the response data field byte contains a valid or appropriate address value	Verify the response data field byte contains a valid or appropriate address value	Verify the response data field byte contains a valid or appropriate address value
					Requiring Document	J1939-21 5.4.4, 5.4.2 Table 5					J1939-21 5.4.4	J1939-21 5.4.6 5.4.7	J1939-21 5.4.6	J1939-21 5.4.6
					Test Name	Proper use of Cannot Respond NACK Response (DUT as Recipient)					Support of the Acknowledgement Address data byte for each ACK and NACK (DUT as Recipient)	Correct Response to Request2 with 'yes' for the "Use Transfer PGN" Option (DUT as Recipient)	Correct Response to Request2 with 'no' for the "Use Transfer PGN" Option (DUT as Recipient)	Proper NACK Response for Request2 for Unsupported PGN (DUT as Recipient)
					Row	26					27	28	29	30

A.3.3 Data Link Layer Tests - BAM Originator Behaviors

SAE

The Compliance Tests in Table A5 evaluate the behaviors of the DUT as the data originator for the SAE J1939 Transport Protocol BAM service. The SAE J1939 Transport Protocol RTS/CTS tests for the data originator are presented in Table A7.

TABLE A5 - DATA LINK TRANSMIT TEST - TP BAM

				L							
				¥ . 7 >	E :		nhay	SAE and Oser Requirements			
				- ĕ	est is dditio	nal	A: Test is Recommended D: Additional Test Desired	sired			
	-	-		Ë	E: Test Excluded	clud	po				
					ECU Classes	Class	ses	User			
				A	4		H				
Row	Test Name	Requiring Document	Description	L D L G	C A	c c c	00	M Add./ S Excl	Date Tested	Pass- Fail	Test Result Comments
~	BAM Protocol: BAM is valid	_	Verify correct PGN, data size, & # packets.	×		-					
	(content and format) (DUT as Originator)	5.10.2.1 5.10.3 5.10.3.5	Verify all match the BAM TP.DT from the DUT.								
7	BAM Protocol: BAM is sent before Data Packets		Verify DUT sends BAM prior to Data Packets	×							
	(DUT as Originator)										
			Verify time between BAM and first Data Packet is is between 50 and 200 mS (5.10.1.3)								
3	BAM Protocol: Verify no		Verify DUT does not send a	×							
	Conn_Abort is sent (DUT as Originator)	5.10.2.4	TP.Conn_Abort for any reason for a BAM								
		. 1	Verify DUT ignores a TP.Conn_Abort received for the PGN of the BAM								
4	BAM Protocol: Only one		Verify DUT doesn't start a BAM a previous	×							
	per Originator at a time (DUT as Originator)	5.10.5.1	bAM data transferred								
2	BAM Protocol:		Verify DUT doesn't start a BAM a previous	×							
	Simultaneous BAMs with	5.10.5.1	BAM data transferred								
	(DUT as Originator)										
9	Transport Data Packets	J1939-21 7	Verify first data byte is sequence number	×							
	(DUT as Originator)		Verify remaining 7 bytes are correct data for packet								
		۱			l	١					

TABLE A5 - DATA LINK TRANSMIT TEST - TP BAM (CONTINUED)

				SAE	and:	User	Redu	SAE and User Requirements	9		
				: :: :: :: :: ::	X: Test is Recomi D: Additional Test E: Test Excluded	Recc Inal T xclude	X: Test is Recommended D: Additional Test Desired E: Test Excluded	nded			
					ECU	ECU Classes	ses	User	Ι.		
Ċ		Requiring		A 1 -	B A O	s o	-00		/ Date		2
2	lest Name	Document	Description	7	ر	C)	S EXCI		בשוו	i est Resuit comments
7	7 BAM Transport Data	J1939-21	J1939-21 Verify DUT sends the TP Data Packets for	×							
	rackets sent in ascending sequential order	5.10.1.2	DAIM III sedueliual oluel								
	(DUT as Originator)	5.10.1.4	Verify the first TP.DT packet is sequence								
			number = 1								
∞	All Transport Data packets	J1939-21	Verify DUT sends packets with 8 bytes	×							
	(PGN 60160) have an 8	5.10.1.3									
	byte data field	5.2.7.2									
	(DUT as Originator)	5.10.4									
စ	Unused bytes of Last	J1939-21	Verify unused bytes of last packets sent &	×							
	Transport Data packets	5.10.1.3	filled properly								
	(PGN 60160) filled with	5.10.4									
	"FF ₁₆ "										
	(DUT as Originator)										
10	10 Time between Transport	J1939-21	J1939-21 Verify packets are sent between 50 and	×							
	Data Packets for BAM	5.10.1.3	200 mS apart								
	(DUT as Originator)										

A.3.4 Data Link Layer Tests - BAM Receive Behaviors

SAE

The Compliance Tests in Table A6 evaluate the behaviors of the DUT as the data recipient for the SAE J1939 Transport Protocol BAM service. The SAE J1939 Transport Protocol RTS/CTS tests for the data recipient are presented in Table A8.

TABLE A6 - DATA LINK RECEIVE TESTS - TP BAM

	Requiring		SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded ECU Classes ABABABABABABABABABABABABABABABABABABAB	ments id ed User Add./ Date	Pass-	
BAM Protocol: BAM is valid (content and format) (DUT as Responder)	J1939-21 5.10.2.1 5.10.3 5.10.3.5	Verify behavior when receiving the BAM with correct PGN placed, data size, & Number of Data packets Verify behavior when receiving the BAM with incorrect PGN placed, data size, &				
BAM Protocol: BAM is sent before Data Packets (DUT as Responder)	J1939-21 5.10.2.1 5.10.1.3	Verify behavior when time between BAM and first packet is between 50 and 200 mS Verify behavior when time between BAM and first packet is faster than 50 mS Verify behavior when time between BAM and first packet is loader than 200 mS	*			
BAM Protocol: Verify no EndOffNsgACK is sent after final Data Packet (DUT as Responder)	J1939-21 5.10.2.4	Verify DUT does not sent an TP.CM_EndOffNsgACK after the final data packet of the BAM	×			
BAM Protocol: Verify no Conn_Abort is sent (DUT as Responder)	J1939-21 5.10.2.4	Verify DUT does not sent an TP.Conn_Abort for any reason for a BAM	×			
BAM Protocol: Only one per Originator at a time (DUT as Responder)	J1939-21 5.10.5.1	Verify behavior when sees a BAM from an originator before previous BAM data transferred	×			

TABLE A6 - DATA LINK RECEIVE TESTS - TP BAM (CONTINUED)

				Test Result Comments							
			Pass-	Fail							
			Date	Tested							
aments ed red	User		Add./	Excl							
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	ECU Classes		D A C S O M	0 ၁ ၁							
SAE C.A.E.		4		L	×		×		×		
				t Description	Verify ability of DUT to successfully receive multiple simultaneous BAMs from different originators		Verify DUT behavior when the TP Data packets for a BAM are received in sequential order	Verify behavior when TP Data packets for a BAM are received out of sequential order	Verify behavior when packets are sent between 50 and 200 mS apart	Verify behavior when packets are sent faster than 50 mS apart	Verify behavior when packets are sent longer than 200 mS apart
			Requiring	Document	J1939-21 5.10.5.1		5.10.1.2 5.10.1.2 5.10.1.2	; ; ;	J1939-21 5.10.1.3		
				/ Test Name		(DUT as Responder)	BAM Transport Data Packets sent in ascending sequential order		BAM Data Packets: Time between Transport Data	(DUT as Responder)	
-				Row	ဖ	_	<u></u>		ω	-	

SAE

A.3.5 Data Link Layer Tests - RTS/CTS Transport Protocol Originator Behaviors

The Compliance Tests in Table A7 evaluate the behaviors of the DUT as the data originator for the SAE J1939 Transport Protocol RTS/CTS service. The SAE J1939 Transport Protocol BAM tests for the data originator are presented in Table A5.

TABLE A7 - DATA LINK TRANSMIT TESTS - TP RTS/CTS

SAE and Upper Requirements SAE and Upper Requirements SAE and Upper Requirements	L					ľ		ı					
Test Name Requiring Requiring Requiring Requiring Requiring Requiring Requiring Requiring Description L G C C O S Exci Tested Fall Response to the NS is valid Connect and formation 5.10.2 Connection Conn					SAE	and	nse	r Re	anire daire	ments			
Requiring Requiring Description L G C C O S Exci Tested Fail Expurence L D A C C O S Exci Tested Fail Expurence					<u> </u>	est is Additic est E	s Reconal :	comn Test ded	nend(Desi	pe ed			
Test Name Description L G C C C O S Exc1 Tested Fail						ECU	Clas	ses		User			
RTS/CTS Protocol: RTS is J1939-21 Verify DUT sends RTS to initiate Transfer Connection 1.0.2.2 connection 1.0.2.2 connection 1.0.2.2 connection 1.0.2.2 Dackets. max packets. 1.0.3.3 Verify send of math 1.0.3.1 Verify behavior when CTS sent within 1.0.2.2 200 mS (Tr) following RTS (CTS Protocol: CTS 1.0.3.2 Verify behavior when CTS sent after more 1.0.3.3 Verify behavior when CTS sent after more 1.0.3.3 Verify behavior when RTS/CTS Protocol: To 1.0.3.2 Verify behavior when RTS (CTS) > 1.0.3.2 Verify behavior when RTS (CTS) > 1.0.3.2 Verify behavior when # packets (CTS) > 1.0.3.2 Verify behavior when # packets (CTS) > 1.0.3.2 Verify behavior or wrong/invalid next 1.0.3.2 Verify behavior for wrong/invalid next 1.0.3.2 Verify behavior for wrong/invalid next 1.0.3.2 Verify behavior for wrong/invalid next 1.0.3.3 Verify behavior for wrong/invalid next 1.0.3.4 Verify DUT checks PGN 1.0.3.4 Verify DUT	Row		Requiring Document	Description		4 4 0	ပပ			Add./ Excl	Date Tested	Pass- Fail	Test Result Comments
RTS/CTS Protocol: RTS is valid (content and format) 5.10.3.2 packets, max packets. (DUT as Originator) 5.10.3.1 Verify all match the RTS/CTS TP.DT from the DUT response to RTS is valid (content and format) 5.10.3.2 200 mS (Tr) following RTS 5.10.3.2 200 mS (Tr) following RTS 5.10.3.2 200 mS (Tr) following RTS 5.10.3.2 Verify behavior when CTS sent after more than 200 m average (CTS) > max packets (RTS) Verify behavior for wrong/invalid next packet RTS is followed by valid Conn_Abort (content and format) 5.10.2.2 response to reject (Abort) and format) 5.10.3.4 Verify DUT checks PGN 5.10.2.2 response to reject (Abort) 6.10.3.4 verify DUT checks PGN 5.10.3.4 verify DUT checks	~	RTS/CTS Protocol: RTS is sent before starting Data Transfer (DUT as Originator)		Verify DUT sends RTS to initiate connection	×								
RTS/CTS Protocol: CTS response to RTS is valid (content and format) (DUT as Originator) RTS/CTS Protocol: CTS (Content and format) (DUT as Originator) RTS/CTS Protocol: To reject, RTS is followed by valid Conn Abort (content and format) RTS/CTS Protocol: To reject, RTS is followed by valid Conn Abort (content and format) (DUT as Originator) (Content and format)	7	RTS/CTS Protocol: RTS is valid (content and format) (DUT as Originator)		Verify correct PGN, data size, & total # packets, max packets.	×								
RTS/CTS Protocol: CTS response to RTS is valid (content and format) (DUT as Originator) RTS/CTS Protocol: CTS 5.10.3.2 (DUT as Originator) RTS/CTS Protocol: To reject, RTS is followed by valid Conn_Abort (content and format) RTS/CTS Protocol: To J1939-21 Verify DUT checks PGN Verify DUT terminates or stops in reject, RTS is followed by valid Conn_Abort (content and format) Verify DUT checks PGN Verify DUT terminates or stops in 5.10.3.2 Verify DUT checks PGN				Verify all match the RTS/CTS TP.DT from the DUT									
(DUT as Originator) 5.10.3.2 Verify behavior when CTS sent after more than 200 mS (Tr) following RTS Verify DUT checks PGN	ဗ	RTS/CTS Protocol: CTS response to RTS is valid		Verify behavior when CTS sent within 200 mS (Tr) following RTS	×								
Verify DUT checks PGN Verify DUT checks PGN Verify behavior when # packets (CTS) > max packets (RTS) Verify behavior for wrong/invalid next packet RTS/CTS Protocol: To packet RTS/CTS Protocol: To J1939-21 Verify DUT terminates or stops in feject, RTS is followed by 5.10.2.2 response to reject (Abort) and format) (DUT as Originator)		(DUT as Originator)		Verify behavior when CTS sent after more than 200 mS (Tr) following RTS									
RTS/CTS Protocol: To reject, RTS is followed by valid Conn_Abort (content) and format) (DUT as Originator) Verify behavior when # packets (CTS) > max packets (RTS) Verify behavior for wrong/invalid next packet Packet Dacket Verify DUT terminates or stops in 5.10.2.2 response to reject (Abort) Verify DUT checks PGN Verify DUT checks PGN				Verify DUT checks PGN									
RTS/CTS Protocol: To J1939-21 Verify behavior for wrong/invalid next packet reject, RTS is followed by valid Conn_Abort (content and format) (DUT as Originator)			· -	Verify behavior when # packets (CTS) > max packets (RTS)									
RTS/CTS Protocol: To 1939-21 Verify DUT terminates or stops in reject, RTS is followed by 5.10.2.2 response to reject (Abort) valid Conn_Abort (content 5.10.3.4 and format) Verify DUT checks PGN (DUT as Originator)				Verify behavior for wrong/invalid next packet									
t.	4	RTS/CTS Protocol: To reject, RTS is followed by		Verify DUT terminates or stops in response to reject (Abort)	×								
		valid Colling About (Collient and format) (DUT as Originator)		Verify DUT checks PGN									

TABLE A7 - DATA LINK TRANSMIT TESTS - TP RTS/CTS (CONTINUED)

							Test Result Comments										
							Pass- Fail										
							Date Tested										
	SAE and User Requirements	Q	ed		User		Add./ Excl										
	luire	X: Test is Recommended	D: Additional Test Desired			Ш	≥ ທ										
	Rec	mmc	est	eq	ses		0 0 0 0										
	User	Rec	nal T	cclud	ECU Classes		<u>ပ ပ</u>										
	and	Stis	ditio	st E	CU (٧	ح ن										
	AE (: Te		E: Test Excluded	В	B											
ŀ	တ	×		Ш		٧		×	a				×				
				_			Description	Verify behavior when CTS sent within T3 time following last packet	Verify behavior when CTS sent after more than T3 time following last packet	Verify DUT checks PGN	Verify behavior when # packets (CTS) > max packets (RTS)	Verify behavior for wrong/invalid next packet	Verify behavior if next packet number specified in CTS is same as next packet number of previous CTS	Verify behavior if next packet number specified in CTS is within packet range of previous CTS	Verify behavior if next packet number specified in CTS is less than last confirmed packet number	Verify behavior if next packet number specified in CTS is one greater than next packet number plus number of packets from last CTS	Verify behavior if next packet number specified in CTS is two or more greater than next packet number plus number of packets from last CTS
				-			Requiring Document	J1939-21 5.10.2.2	5.10.2.4 5.10.3 5.10.3.2				J1939-21 5.10.3.2				
				_			Test Name	RTS/CTS Protocol: CTS issued after last Transport	Data packet of previous CTS (DUT as Originator)				RTS/CTS Protocol: CTS next packet numbering (DUT as Originator)				
							Row	Ŋ					9				

TABLE A7 - DATA LINK TRANSMIT TESTS - TP RTS/CTS (CONTINUED)

				Test Result Comments														
				rass- Fail														
			4	Date Tested														
SAE and User Requirements X: Test is Recommended D: Additional Test Desired	ם ט	User	7	Excl .														
SAE and User Requirem X: Test is Recommended D: Additional Test Desired	E: Test Excluded		ш	⊵ ທ														
sr Rec	ded	ses	<u>⊢ (</u>	၀ ၀ ၀														
s Rec	i Xclu	ECU Classes	Ć	၁ ပ														
E and	Fest F	ECU	8 0	G G														
SAE X	Э		∢.		×				×				×				×	
	_			Description	Verify behavior when receives CTS to pause	Verify DUT checks PGN	Verify behavior when CTS sent within T3 time following last packet	Verify behavior when CTS sent after more than T3 time following last packet	Verify behavior when receives CTS to pause within 500 mS (Th)	Verify behavior when receives CTS to pause exceeds 500 mS (Th)	Verify behavior when receives CTS to pause exceeds T4 Time	Verify DUT checks PGN	Verify behavior when receives TP.CM_ EndOfMsgACK within T3 Time	Verify behavior when receives TP.CM_ EndOffMsgACK after more than T3 Time	Verify ignores TP.CM_ EndOfMsgACK if received before final Data Transfer	Verify DUT checks PGN	Verify correct content in TP.Conn_Abort	Verify only sends once connection is established (i.e. after initial Accept CTS)
				Requiring Document	J1939-21 5.10.2.3	5.10.3 5.10.3.2			J1939-21 5.10.2.3	5.10.2.4 5.10.3 5.10.3.2			5.10.2.4	5.10.3.3			J1939-21	5.10.3.4
	_			v Test Name	RTS/CTS Protocol: CTS to pause or stop data flow	(DUT as Originator)			RTS/CTS Protocol: CTS to pause repeat	(DOT as Originator)			RTS/CTS Protocol: EndOffNsgACK					Abort Issued by Originator (DUT as Originator)
				Row	7				œ				6				10	

TABLE A7 - DATA LINK TRANSMIT TESTS - TP RTS/CTS (CONTINUED)

						Test Result Comments												
					Dace.	Fail												
					Date	Tested												
-	ments	ed e.e.g		User	\ PP\$	Excl												
	SAE and User Requirements V. Toot is Docommonded	A. Test is RecommendedD: Additional Test Desired	E: Test Excluded	ECU Classes		C C O S												
1	Tost is	Additic	Test E	ECU	8 0	G C												
2	₹ ;	< Ω΄	ш		∢ -		×					×	×		×	×	×	
			_			Description	Verify behavior when receives		Verify DUT checks PGN	Verify TP Data stops within 50 mS after TP.Conn_Abort	Verify TP Data sends no more than 32 packets after TP.Conn_Abort	Verify behavior (abort) with received multiple duplicate CTS (excluding CTS(0))	Verify ignores CTS for a PGN that is not part of a connection		Verify DUT does not send an RTS for another PGN to Responder while another RTS/CTS open with same Responder	Verify behavior (abort) with received multiple duplicate CTS (excluding CTS(0))		Verify remaining 7 bytes are correct data for packet
					Requiring	Document	J1939-21 5 10 2 4	5.10.3.4				J1939-21 5.10.3.2	J1939-21 5.10.3.2		J1939-21 5.10.5	J1939-21 5.10.5.1	J1939-21 5.10.1.3	5.10.2.3 5.10.4
			<u>-</u>			Test Name	RTS/CTS Protocol: Connect Abort issued by Responder	(DUT as Originator)				RTS/CTS Protocol: Multiple duplicate CTS (same SA, DA, PGN) received in short period (DUT as Originator)	RTS/CTS Protocol: CTS outside of connection is	ignored (DUT as Originator)	RTS/CTS Protocol: Another RTS with same Originator and Responder but with different PGN (DUT as Originator)	RTS/CTS Protocol: Simultaneous RTS/ CTS with different Originators (DUT as Originator)	Transport Data Packets for RTS/CTS have correct	content (DUT as Originator)
						Row	1					12	13		4	15	16	

TABLE A7 - DATA LINK TRANSMIT TESTS - TP RTS/CTS (CONTINUED)

				SAE and User Re X: Test is Recom D: Additional Test E: Test Excluded	and I	Jser Reco nal Te	SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded			
				Ш	ECU Classes	lass	sə	User			
DOW	S T T T T T T T T T T T T T T T T T T T	Requiring	Description	A – –	4 4 0	ა :	ш ∑ 0	Add./	Date Tested	Pass-	Tost Besuit Comments
17	Transpo RTS/CT sequenti (DUT as		sen S in	×)					5	
18	All Transport Data Packets for RTS/CTS have an 8 byte data field	5.10.1.3 5.2.7.2 5.10.4	number = 1 Verify DUT sends packets with 8 bytes	×							
19	Unused bytes of Last Transport Data Packets for RTS/CTS filled with "FF ₁₆ " (DUT as Originator)	- w	Verify unused bytes of last packets sent & filled properly	×							
20	Transport Data Packets for RTS/CTS start within T2 time following CTS (DUT as Originator)	J1939-21 5.10.2.3 5.10.2.4	Verify packets are sent no greater than 200 mS apart	×							
21	Time between consecutive Transport Data Packets for RTS/CTS, in which the CTS that allows more than 1 packet, are sent within T2 time of one another (DUT as Originator)	5.10.2.4	Verify packets of a CTS set are sent no greater than 200 mS apart (says T1 of 750 mS in 5.10.2.4)	×							

SAE

A.3.6 Data Link Layer Tests - RTS/CTS Transport Protocol Responder Behaviors

The Compliance Tests in Table A8 evaluate the behaviors of the DUT as the data recipient (Responder) for the SAE J1939 Transport Protocol BAM tests for the data recipient are presented in Table A6.

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS

	_			SAE X: 1 D: <i>f</i>	SAE and User Re X: Test is Recom D: Additional Test E: Test Excluded	I Us s Re onal exclu	er Recomi	SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded			
				-	ECU	ECU Classes	ses		User			
		2		⋖ -	8 6	Ć		ш	77	40	0000	
Row	/ Test Name	Document	Description	 	τ Ο	C	, O	0 S		Date Tested	rass- Fail	Test Result Comments
_	RTS/CTS Protocol: RTS is	J1939-21	Verify behavior when unsupported or	×								
	valid (content and format)	5.10.2.2	unknown PGN									
		_	Verify behavior for other reject reasons for the DUT									
7	RTS/CTS Protocol: Multiple		If DUT accepts, verify DUT only once (not	×								
	duplicate RTS (same SA, DA, PGN) received in short	5.10.3.1	to every RTS)									
	period (DUT as Responder)											
3	RTS/CTS Protocol: CTS		Verify CTS sent within 200 mS (Tr)	×								
	following RTS is valid (content and format)	5.10.2.2 5.10.3	following RTS									
	(DUT as Responder)	٥.	Verify correct PGN, next packet(= 1), number of packets (<= RTS max packets)									
4	RTS/CTS Protocol: To		Verify DUT Conn_Abort has correct PGN	×								
	reject, RTS is followed by valid Conn. Abort (content	5.10.3.4	and a valid abort reason provided and is sent withing 200 mS (Tr) following RTS									
	and format) (DUT as Responder)											
2	RTS/CTS Protocol: CTS		Verify CTS sent within T3 time following	×								
	issued after last Transport	5.10.2.2	last packet									
	Data packet of the previous CTS	5.10.3	Verify correct PGN, next packet (valid).									
	(DUT as Responder)	~1			\dashv		\dashv	\dashv				

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (CONTINUED)

			Test Result Comments						
			Pass- Fail						
			Date Tested						
	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	User	Add./ Excl						
	SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded		ш≥ѕ						
	r Re omm Fest Jed	ses	0 0 −						
	User Rec nal 1 ccluc	Clas	ပပ						
	SAE and User Re X: Test is Recom D: Additional Test E: Test Excluded	ECU Classes	44 0						
	AE (Ш	B D 0						
-	$\mathbf{o} \times \Box \Box$		4 L L	×		×	×	×	
			Description	Verify next pacl CTS is not less already confirm	Verify next packet number specified in CTS is either same as last CTS, within range of last CTS, or one greater than the next packet number plus number of packets from last CTS	Verify sends CTS (or Abort) after T2 time with no packets following CTS	Verify correct setting of PGN and number of packets (0) and all other bytes set to 1's Verify CTS sent within T3 time following last packet	Verify correct setting of PGN and number of packets (0) and all other bytes set to 1's Verify CTS pause sent within 500 mS (Th) of last CTS pause	Verify sent only after receiving all packets recently cleared (or expired receive time out)
	_		Requiring Document	J1939-21 5.10.3.2		J1939-21 5.10.3.2	J1939-21 5.10.2.3 5.10.3 5.10.3.2	J1939-21 5.10.2.3 5.10.2.4 5.10.3 5.10.3.2	
	_		Test Name	RTS/CTS Protocol: CTS next packet numbering (DUT as Responder)		RTS/CTS Protocol: CTS issued after T2 time out during the transport of data packets (DUT as Responder)	RTS/CTS Protocol: CTS to pause or stop data flow (DUT as Responder)	RTS/CTS Protocol: CTS to pause repeat (DUT as Responder)	
			Row	ဖ		7	80	6	

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (CONTINUED)

				Test Result Comments										
				Fail Fail										
			9	Tested										
ments ed	pe	User	7	Excl .										
SAE and User Requirements X: Test is Recommended	D: Additional Test Desired E: Test Excluded	ECU Classes	H 0											
δ×	<u>ы</u>		∢ -		×	last	ıst	×	kets		ort X	kets	×	CTS X
				Description	Verify correct content in TP.CM_EndOfMsgACK	Verify sends a valid TP.CM_EndOffMsgACK only after the last data packet	Verify sends a valid TP.CM_ EndOfMsgACK within T3 Time after last data packet (or CTS pause)	Verify behavior when receives TP.Conn_Abort	Verify ignores any Transport Data packets following Abort	Verify DUT checks PGN	Verify correct content in TP.Conn_Abort	Verify ignores any Transport Data packets following Abort	Verify doesn't randomly sent CTS for PGNs not in a connection	Verify doesn't send multiple duplicate CTS (excluding CTS(0))
				Document	J1939-21 5.10.2.4 5.10.3	5.10.3.3		5.10.2.4			J1939-21 5.10.2.4	5.10.3.4	J1939-21 5.10.3.2	J1939-21 5.10.3.2
	-			Test Name	RTS/CTS Protocol: EndOffMsgACK	(CO) 88 - 100 - 10		RTS/CTS Protocol: Connect Abort issued by Originator	(DO Las Responder)		RTS/CTS Protocol: Connect Abort issued by Responder	(DUT as Responder)	RTS/CTS Protocol: CTS outside of connection is ignored (DUT as Responder)	RTS/CTS Protocol: Multiple duplicate CTS (same SA, DA, PGN) received in short period (DUT as Responder)
				Row	10			7			12		13	4

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (CONTINUED)

					Test Result Comments									
				Pass-	Fail									
				Date	Tested									
ments	ر ا	D O	User	Add./										
SAE and User Requirements	X: Test is Recommended	U: Additional Test Desired E: Test Excluded	se	ш ≥	0									
d User I	is Recor	ional le Exclude	ECU Classes	Ú	S									
AE an	: Test i	. Addit	ECL	A A	G									
					Description	Verify ability of DUT to successfully manage Transport Data when RTS/CTS and BAM with same originator	Verify DUT uses/evaluates Destination Address	Verify doesn't send multiple duplicate CTS (excluding CTS(0))	Verify ability of DUT to successfully manage Transport Data when RTS/CTS and BAM with same originator	Verify DUT uses/evaluates Destination Address to distinguish TP.DT for RTS/CTS or BAM	Verify behavior (DUT rejects by sending Conn_Abort) any additional RTS from an Originator while another RTS/CTS open with same Originator	Verify behavior (DUT rejects by sending Conn_Abort) any additional RTS while DUT at Connection Limit	Verify DUT behavior when the TP Data packets for an RTS/CTS are received in order	Verify behavior when TP Data packets for an RTS/CTS are received out of order
				Requiring	Document	J1939-21 5.10.5.1			J1939-21 5.10.5.1		J1939-21 5.10.5	J1939-21 5.10.5	5.10.1.1 5.10.1.2 5.10.1.2 5.10.1.2	
					Test Name	RTS/CTS Protocol: Simultaneous RTS/ CTS with different Originators			TP Protocol: Simultaneous RTS/CTS and BAMs with same Originator (DUT as Responder)		RTS/CTS Protocol: Another RTS with same Originator and Responder but with different PGN (DUT as Responder)	RTS/CTS Protocol: RTS received when ECU at TP Connection Limit (DUT as Responder)	Transport Data Packets for RTS/CTS to be sent in ascending sequential order (DUT as Responder)	
					Row	15			16		17	18	19	

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (CONTINUED)

				Test Result Comments												
				Pass- Fail												
				Date Tested												
	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	User		Add./ Excl												
	SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded		Ш	8												
ŀ	r Re omm Fest ded	ses		0 0 0 0												
l.	SAE and User Re X: Test is Recomi D: Additional Test E: Test Excluded	ECU Classes		ပ ပ												
	and stis ditio stEy	CO	⋖	A C												
!	AE A	Ш	8	D G												
Ľ	$\mathbf{v} \times \Box \Box$		4		×				×		×					
				t Description	J1939-21 Verify behavior when receives packets	with 8 bytes	Verify behavior when receives packets	with less than 8 bytes	J1939-21 Verify behavior when packets are started 5.10.2.3 within T2 time following CTS	Verify behavior when packets are started after T2 time following CTS	J1939-21 Verify behavior when packets are sent less	than 200 mS apart (says T1 of 750 mS in 5.10.2.4)		Verify behavior when packets are sent	longer than 200 mS apart (says T1 of	750 mS in 5.10.2.4)
				Requiring Document	J1939-21	5.10.1.3 5.2.7.2	5.10.4		5.10.2.3	0.10.2.4	J1939-21	5.10.1.3 5.10.2.4				
				v Test Name		for RTS/CTS have an 8 byte data field	(DUT as Responder)		Transport Data Packets for RTS/CTS start within T2	(DUT as Responder)		Transport Data Packets for RTS/CTS, in which the CTS	that allows more than 1	packet, are sent within T2	time of one another	(DUT as Responder)
				Row	20				21		22					

TESTS OUTLINE FOR RP SAE J1939-31 RECOMMENDED PRACTICE FOR THE NETWORK LAYER **A**.4

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TABLE A9 - NETWORK LAYER TESTS

				SAE and User Requiremox: Test is Recommended D: Additional Test Desired E: Test Excluded	nd U:	Ser R Secont al Tes Iudeo	Requir Imenc St Des	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded			
				E	ECU Classes	asse	s	User			
		Requiring Document		A B	ა •	S	⊒ <u>≅</u>	Add./	Date		
Row	Test Name		Description	G		ပ		Excl	Tested	Pass-Fail	Test Result Comments
-	Address Claimed Message	J1939-31 4.4	Verify that the ECU does not go bus off due to the forwarding and contention of an Address Claimed message.	×							
7	Maximum messages forwarded	J1939-31 4.5	Verify that an ECU can forward the guaranteed maximum number of messages during average and peak busload.	×							
ო	Maximum messages filtered	J1939-31 4.5	Verify that an ECU can forward and filter the guaranteed maximum number of messages during average and peak busload with the maximum number of entries in the database.	×							
4	Maximum transit delay	J1939-31 4.5	Verify that the worst-case latency for transmitting a message from one device to another device on a different bus segment does not exceed the maximum transit delay and is less than 50ms.	×							
2	Message Forwarding	J1939-31 5.1	Verify that messages can be forwarded from one segment to another.	×							
ဖ	Higher Priority Forwarding	J1939-31 5.1	Verify that messages with higher priority are forwarded before messages with lower priority.	×							
۷	Equal Priority Forwarding	J1939-31 5.1	Verify that messages with equal priority are forwarded in the order received.	×							
80	Message Filtering	J1939-31 5.2	Verify that messages can be filtered from one segment to another.	×							

TABLE A9 - NETWORK LAYER TESTS (CONTINUED)

						ments																								
						Test Result Comments																								
						Date Tested Pass-Fail																								
					Date	Tested																								
SAE and User Requirements	led	ired		User	\ PP\$																									
quir	X: Test is Recommended	D: Additional Test Desired			ш ≥																									
er Re	comi	Test	ded	ECU Classes		က																-								
I Use	Re	onal	Sych	Cla) ပ																								
anc	esti	dditi	E: Test Excluded	ECU	8 0		×					×						_				+							Ļ	
SAE	×	. A	⊢ Ei		∀ -		^					^						×				1	×	×					'	×
						Description	Verify one of the following :	1.) Messages are fon	default, and blocked only if they exist	2.) Messages are blocked by default.	and forwarded only if they exist in the filter database.	Verify that entries added to the	filtering databases can only be	removed by the device that created	the entry, or by diagnostic tools that	have the ability to override the	address match requirement.			messages, which use a single	address to reference a particular	vernicie system.	Verify that messages can be repackaged and forwarded.	Verify that the filter database can be manipulated as follows:	- Add entries - Delete entries	- Clear database	- Set filter mode	- Create entry, specifying	Verify that general na	Verify that general parametrics can be accessed.
					Requiring		J1939-31	5.2				J1939-31	5.6					J1939-31	5.3				J1939-31 5.4	J1939-31 5.6.2					11030 31	J1939-31 5.6.5
						Test Name	Block or Pass Filtering	•				Database management)					Address Translation					Message Repackaging	Message Filter Database Manipulation					General Darametrics	General Parametrics
						Row	6					10						7				!	12	13					7	14

SAE

TABLE A9 - NETWORK LAYER TESTS (CONTINUED)

							parametrics can be accessed.	9.9.6		
						×	J1939-31 Verify that specific port pair	J1939-31	15 Port Pair Parametrics	15
l Test Result Comments	G C C C O S Excl Tested Pass-Fail	ccl Tes	S	0 0	ပ	L G	Description		Test Name	Row
	te	D A C S O M Add./ Date	M Ad	S	V	L D		Document		
		er	User	ECU Classes	SU CI	Ш				
				nded	E: Test Excluded	E: Tes				
			D: Additional Test Desired	I Test [ditiona	D: Add				
		3	ended	X: Test is Recommended	st is Re	×: ⊤e,				
		nts	SAE and User Requirements	er Red	sn pu	SAE a				

TESTS OUTLINE FOR RP SAE J1939-81 RECOMMENDED PRACTICE FOR NETWORK MANAGEMENT A.5

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TABLE A10 - NETWORK MANAGEMENT TESTS

				SAE and User Requirements X: Test is Recommended D: Additional Test Desired	Redui	irements nded			
				E: Test Excluded	<u> </u>	lleer			
R D Test Name	ב מ	Requiring Document	Description		- 0 0	M Add./ S Excl	Date Tested	Pass-Fail	Test Result Comments
	7	J1939-81 4.1	Verify the NAME contents for the ECU (DUT) align with -81						
System Initialization	7	J1939-81 4.4.3	Verify each ECU transmits a address X claim at power-up system initialization.						
Non-Configurable J	ר	J1939-81 4.1.2 4.2.2.3	Verify that a non-configurable address ECU or service configurable address ECU stops transmitting and sends a Cannot Claim Address message if it fails to claim a valid address.	~					
Commanded Addresses	٦	J1939-81 4.2.3	Verify that a command configurable address ECU can receive a Commanded Address message and either initiate an address claim procedure with the new address or, if it cannot claim the new address, issue an address claim for it's current address.	×					
Self-Configurable Address ECU	1	J1939-81 3.3.1.4 4.4.4	Verify that a self-configurable address ECU can re-calculate and claim another address if it is not successful in claiming the calculated address.	×					
Request for Address Claimed	7	J1939-81 4.2.1	Verify an ECU can send a request for address claimed and process responses.						

TABLE A10 - NETWORK MANANGEMENT TESTS (CONTINUED)

						Test Result Comments						
						Tested Pass-Fail						
			,		ote C	Tested						
	SAE and User Requirements	X: Test is Recommended D: Additional Test Desired		User	700							
ŀ		X: I est Is RecommendedD: Additional Test Desired	-			S						×
١	Ž	est	eq	S	⊢ C							
١.	Ser	a T	E: Test Excluded	ECU Classes) (၁						×
:	ַבּ בּיִּ	ition	Ě	Cla		(0						×
١.	ַ ק	Add	Fest	S	<u> </u>							×
[אַ ; אַ	ΧÖ	证	ш,	⋖ -		×	×	×	×	×	
						Description	Verify an ECU responds to a request for address claimed with an Address Claimed/Cannot Claim message (or nothing if that ECU has not yet attempted to claim an address).	Verify an ECU sends an Address Claimed message upon initialization and waits for the defined period (250 ms or 50 ms) before resuming normal network traffic.	Verify an ECU receiving an Address Claimed message with a lower priority claiming it's own source address responds with an Address Claimed Message.	Verify an ECU receiving an Address Claimed message with a higher priority claiming it's own source address either attempts to claim a new address or responds with a Cannot Claim message after a time delay.	Verify an ECU that cannot claim an address sends the Cannot Claim message in response to the Request for Address Claimed. No other messages shall be sent.	Verify an ECU does not perform network initialization with a power loss < 2ms. Verify an ECU does perform network initialization with a power loss > 1 second.
					Requiring		J1939-81 4.2.1	J1939-81 4.2.2	J1939-81 4.2.2	J1939-81 4.2.2	J1939-81 4.2.2.3	J1939-81 4.5.1
						Test Name	Request for Address Claimed	Address Claimed Cannot Claim	Address Claimed Cannot Claim	Address Claimed Cannot Claim	Address Not Claimed	Power Interruption
						Row	7	ω	6	10	11	12

TABLE A10 - NETWORK MANANEMENT TESTS (CONTINUED)

			Test Result Comments									
			Excl Tested Pass-Fail									
		46	Pate Fested									
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	User	ш 2 — С	Excl 1									
iren Ideo Isire		ш 5	S									
equ mer t De		<u> </u>	0									
er R com Tes Ided	ses	U	၁					×				
SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded	ECU Classes	ر	ာ ၁ ၁									
and stis ditic	O O	∢ <						×				
AE S	EC	m c	ם מ									
Ø×□ iii		∢ -	Ĺ	×								
			Description	J1939-81 Verify that an ECU can be	connected, disconnected, and	powered up without disrupting	network communications.	J1939-81 Verify that an ECU attempts (if	applicable) to use the same address	and addresses for ECUs that are	communicated with across power-	down and power-up cycles.
		Requiring		J1939-81	4.5.2.3			11939-81	4.5.2.4			
			Test Name	Network Disruption				Address Continuity				
			Row	13				14				

TESTS OUTLINE FOR RP SAE J1939-1X RECOMMENDED PRACTICE PHYSICAL LAYER A.6

TABLE A11 - PHYSICAL LAYER TESTS

				SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	Requirer Desire est Desire ed	ments d ed			
				ECU Classes	ses	User			
		Requiring		A B A T E L D A C S O M Add./ Date	■ M	Add./	Date		
Row	/ Test Name	Document	Description	LGCCCOS		Excl	Excl Tested Pass-Fail	ass-Fail	Test Result Comments
-	J1939-11 physical layer	J1939-11	J1939-11 Verify to requirements of SAE J1939-11 Conformance Tests.						
8	J1939-15 physical layer	J1939-15	J1939-15 Verify to requirements of SAE J1939-15 Conformance Tests.						

APPENDIX B - FORMAT FOR COMPLIANCE TEST REPORTING FORMS

The Tables herein shows the format that should be used for reporting compliance tests results. Such a form could serve for self-certifying compliance, as well as for ordering to identify what functions a given device can or must support.

B.1 COMPLIANCE TEST REPORTING FORMS

This form shows the format for reporting the results of compliance tests conducted to SAE J1939 Recommended Practice, Appendix A of SAE J1939-82 contains a set of forms listing all the compliance tests as well as this reporting formatting.

See SAE J1939-82 Appendix A Section A.2.5.2 for a definition of 'Class' for an ECU.

TABLE B1 - SAMPLE REPORTING FORM

				SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded	and lest is lidition st Ex	Jser Recc nal T	Ret omm est l	quire lende Desii	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded			
				S E	ECU Classes	asse	Ś		User			
		Requiring Document		A D	4 4	<u></u> ე	⊢ 0	ШΣ	A B B C S O M Add.	Date		
Row	Test Name		Description	LG	Ċ	S	0	S	Excl	Tested	Excl Tested Pass-Fail	Test Result Comments
-												
2												
3												
4												
2												
9												