

SURFACE VEHICLE RECOMMENDED PRACTICE

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Issued 2008-08

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.

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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.

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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.

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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
E	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
TOO	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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SAE

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

			Test Result Comments																
		Dace																	
		ote ote	Tested																
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	User	7	Excl																
SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded			S																
er Re comr Test	ECU Classes		C																
SAE and User Re X: Test is Recom D: Additional Test E: Test Excluded	Cla	J	c																
and est is dditi	ECU	4 <																	
SAE X: T D: A E: T		A B		×		×		×		×		×				×			
			Description	Verify proper placement of PGN within	Z9-Dit lieadel Ol all lialies	Verify DUT properly sets the EDP Bit for all 29-bit frames.		Verify DUT properly sets the DP Bit for all	29-bit frames.		29-bit Frames (Page 1 & 2) is 8 bytes, except for PGN 59904 frames.		parameter data for multiple byte	parameters. (e.g. verny Address Claim data, PGN 60928). This verification also	applies to -7X.	Verify DUT indeed uses single CAN Frame to send PGN under this situation.		Verify any unused bytes are filled with	
		Dogmiring	Document	J1939-21	Table 1	J1939-21 5.2.2		J1939-21	5.2.3	J1939-21	5.2.7.1	J1939-21	5.4			J1939-21 5.10.5.2	5.2.7.1	5.2.7.2	
			Test Name	Position and order of PGN	(DUT as Source)	Use of EDP Bit to identify PGN	(DUT as Source)	Use of DP Bit to identify	PGN (DUT as Source)	Data Field Byte Length	(DUT as Source)	Byte Ordering within Data	Field	(DOT as source)		Multipacket capable PGN with less than 9 bytes of	data sent as single CAN	Data Frame with 8 byte data	(DUT as Source)
			Row	1		2		က		4		2				9			

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

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

				SAE X: Te	and L	Jser R Recom	equire mende	SAE and User Requirements X: Test is Recommended			
	_	-		D: Ac E: Te	ddition st Exc	D: Additional Test Desired E: Test Excluded	t Desir	eq			
				Ш	S NO	ECU Classes	.	User			
				A A	4		Ш				
Row	Test Name	Requiring Document	Description	L D L G	C O	လ သ သ	⊗ ⊗ 0 0	Add./ Excl	Date Tested	Pass- Fail	Test Result Comments
7	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)	J1939-21 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)	×							
ည	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.	×							
ဖ	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						
						Pass- Fail						
					i	Date Tested						
	SAE and User Requirements	p 0	5	User		Add./ Excl						
	uire	X: Lest Is RecommendedD: Additional Test Desired			ш;	≥ ഗ						
	Req	mme	o o	es		0						
	ser	(eco	E: Test Excluded	ECU Classes		S C						
	ا م ا	ition i	Ě	O C		A O						
	Ear	l est Add	Test	EC		ວ ບ						
l	S S	× ::	ш				×		×	×	×	×
						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
					:	Requiring 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
			<u>-</u>			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	∞		6	10	7	12

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

						Test Result Comments									
						Pass- Fail									
						Date Tested									
SAE and User Requirements	2	, p		User	,	Add./ Excl									
iro	X. Test is Becommended	D: Additional Test Desired				S S									
Pod		st D	p	es		00									
P			E: Test Excluded	ECU Classes		တ ပ									
	<u>.</u>	tion	ă	บ ก		C C C									
T Z	1	Addi	Test	EC		0 0									
V	; ;	; ;	讪	•			×		×		×			×	×
			_			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 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 (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 Toble 6	l able 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)	PGN (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		41		15		16	11	18

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

			Test Result Comments					
			Pass- Fail					
			Date Tested					
SAE and User Requirements X: Test is Recommended	red	User	Add./ Excl					
SAE and User Requirem X: Test is Recommended	D: Additional Test Desired E: Test Excluded	S	⊞ Σ ∅					
Jser R	D: Additional Tesi E: Test Excluded	ECU Classes	၈ ပ					
and L	dditior	င်ပ င	440					
SAE X: Te	D: Ac E: Te	_	A L G G	×	×	×	×	×
	_		Description	Verify DUT sen RTS for the Re Address from th Verify DUT sen within 200 mS (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 all required responses within 200 mS (Tr)	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 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
	_		Requiring 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, 5.4.2 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 (DUT as Recipient)	Proper NACK Response for Globally Addressed Request for Unsupported PGN (DUT as Recipient)
	_		Row	19	20	21	22	23

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

				SAE and User Requirements	rements			
				A. Test is reconfinenced D: Additional Test Desired F: Test Excluded	sired			
				FCII Classos	Hear			
		Requiring		A B A C S O T C C S O T	Add./	Date	Pass-	
Row	w Test Name	Document	Description	G C C C O	Excl	Tested	Fail	Test Result Comments
24	Proper use of ACK Response when Applicable (DUT as Recipient)	5.4.4, 5.4.2 5.4.2	Verify DUT sends an Acknowledgement (PGN 59392) with Requested PGN and Control Byte of ACK (= 0)	×				
			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)	ı	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

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

			Test Result Comments										
		1	Pass- Fail										
			Date Tested										
ments ed ed	User		Add./ Excl										
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	ECU Classes	4	D A C S O M G C C O S										
SAE .:		∢.		×		×		×		×	×	×	
			Description	Verify correct PGN, data size, & # packets.	Verify all match the BAM TP.DT from the DUT.	Verify DUT sends BAM prior to Data Packets	Verify time between BAM and first Data Packet is is between 50 and 200 mS (5.10.1.3)	Verify DUT does not send a TP.Conn_Abort for any reason for a BAM	Verify DUT ignores a TP.Conn_Abort received for the PGN of the BAM	Verify DUT doesn't start a BAM a previous BAM data transferred	Verify DUT doesn't start a BAM a previous BAM data transferred	Verify first data byte is sequence number	Verify remaining 7 bytes are correct data for packet
		:	Requiring Document	J1939-21	5.10.3 5.10.3 5.10.3.5	J1939-21 5.10.2.1 5.10.1.3		J1939-21 5.10.2.4		J1939-21 5.10.5.1	J1939-21 5.10.5.1	J1939-21	5.10.2.3 5.10.4
-			Test Name	BAM Protocol: BAM is valid	(DUT as Originator)	BAM Protocol: BAM is sent before Data Packets (DUT as Originator)		BAM Protocol: Verify no Conn_Abort is sent	(DOT as Originator)	BAM Protocol: Only one per Originator at a time (DUT as Originator)	BAM Protocol: Simultaneous BAMs with different Originators (DUT as Originator)	Transport Data Packets	(DUT as Originator)
			Row	-		2		က		4	5	9	

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

				SAE X: T D: A E: T	SAE and User Re X: Test is Recomi D: Additional Tesl E: Test Excluded	User Reco nal T∈	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	S			
				_	ECU Classes	Slass	es	User				
ı		Requiring	:	L A	44	S	-0				ģ:	
Row	v Test Name	Document	Description	L C	ပ	ပ	0	S Excl	Tested	d Fail	=	Test Result Comments
7	7 BAM Transport Data	J1939-21	Data Packets for	×								
	Packets sent in ascending sequential order	5.10.1.2	BAM in sequential order									
	(DUT as Originator)		Verify the first TP.DT packet is sequence									
			number = 1									
∞	All Transport Data packets	J1939-21	J1939-21 Verify DUT sends packets with 8 bytes	×								
	(PGN 60160) have an 8	5.10.1.3										
	byte data field (DUT as Originator)	5.10.4										
6	Unused bytes of Last	J1939-21	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)											
	(:3:::::6:::5::5::5::5::5::5::5::5::5::5::5				+	+	\downarrow					
9	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

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

				SAE al	ž	ser Rec	SAE and User Requirements	ents				
_	-	-		X: Test is Recommended D: Additional Test Desired E: Test Excluded	t is Ry litiona t Excl	ecommecommers In Test Inded	X: Test is Recommended D: Additional Test Desired E: Test Excluded	_				
				E	i Ci	ECU Classes	<u>د</u> 	User				
		Reanirina		A D	ں ۷ ۷		ш≥	Add./	Date	Pass-		
Row	Test Name	Document	Description	Ğ	cc	c	S		_	Fail	Test Result Comments	
BA (co (DL	BAM Protocol: BAM is valid (content and format) (DUT as Responder)	5.10.2.1 v 5.10.2.1 v 5.10.3 l	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, & Number of Data packets									
2 BAI bef	BAM Protocol: BAM is sent before Data Packets	5.10.2.1	Verify behavior when time between BAM and first packet is between 50 and 200 mS	×								
<u>j</u>	לי מא המשטים ממי		Verify behavior when time between BAM and first packet is faster than 50 mS									
		7 0	Verify behavior when time between BAM and first packet is longer than 200 mS									
3 BAI Enc fina (DU	BAM Protocol: Verify no EndOfMsgACK is sent after final Data Packet (DUT as Responder)	J1939-21 V	Verify DUT does not sent an TP.CM_EndOfMsgACK after the final data packet of the BAM	×								
4 BAI Cor (DL	BAM Protocol: Verify no Conn_Abort is sent (DUT as Responder)	J1939-21 V	Verify DUT does not sent an TP.Conn_Abort for any reason for a BAM	×								
5 BAI per (DU	BAM Protocol: Only one per Originator at a time (DUT as Responder)	J1939-21 V 5.10.5.1 c	Verify behavior when sees a BAM from an originator before previous BAM data transferred	×								

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

			Tost Bosult Commonts													
			Pass-	┸												
			Date Tested													
ed ed red	User		Add./													
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	ECU Classes	В	Σ (C (C) (C) (C) (C) (C) (C) (C) (C) (C) (C))))												
м × □ Ш		4	Description 1	:: :: :: :: :: :: :: :: :: :: :: :: ::	5.10.5.1 receive multiple simultaneous BAMs from		Verify DUT behavior			Verify behavior when TP Data packets for	a BAM are received out of sequential order	Verify behavior when packets are sent		Verify behavior when packets are sent	faster than 50 mS apart	Verify behavior when packets are sent longer than 200 mS apart
			Requiring		5.10.5.1	; ; ;	J1939-21	5.10.1.1	5.10.1.2 5.10.1.4			J1939-21	5.10.1.3			
			Toet Namo	2	BAIN Protocol: Simultaneous BAMs with	different Originators (DUT as Responder)	BAM Transport Data	Packets sent in ascending	sequential order (DUT as Responder)			BAM Data Packets: Time	between Transport Data Packets for BAM	(DUT as Responder)		
			Š	•	٥		7					8				

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	Nse	Redu	SAE and User Requirements	uts		
				× :	est is	Rec	X: Test is Recommended	nded			
				E:7	D: Additional Test E: Test Excluded	xcluo	D. Additional Test Desired E. Test Excluded	esired			
					ECU	ECU Classes	ses	Ns	User		
		Requiring		A J	B A D A	C	- O			Pass-	
Row	v Test Name	Document	Description) 		ပ	0	S Excl	cl Tested	Fail	Test Result Comments
1	RTS/CTS Protocol: RTS is		Verify DUT sends RTS to initiate	×							
	sent before starting Data	5.10.2.2	connection								
	I ranster (DUT as Originator)										
7	RTS/CTS Protocol: RTS is	J1939-21	Verify correct PGN, data size, & total #	×							
	valid (content and format)	5.10.2.2	packets, max packets.								
	(DUT as Originator)										
		5.10.3.1	Verify all match the RTS/CTS TP.DT from the DUT								
က	RTS/CTS Protocol: CTS response to RTS is valid	J1939-21 5.10.2.2	Verify behavior when CTS sent within 200 mS (Tr) following RTS	×							
	(content and format)										
	(DUT as Originator)	5.10.3.2	Verify behavior when CTS sent after more than 200 mS (Tr) following RTS								
			Verify DUT checks PGN								
			Verify behavior when # packets (CTS) > max packets (RTS)								
			Verify behavior for wrong/invalid next packet								
4	RTS/CTS Protocol: To reject, RTS is followed by		Verify DUT terminates or stops in response to reject (Abort)	×							
	valid Conn_Abort (content and format) (DUT as Originator)	5.10.3.4	Verify DUT checks PGN								

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

							Test Result Comments											
•						ı	Pass- Fail											
						,	Date Tested											
	SAE and User Requirements	eq	ired		User		Add./ Excl											
	quir	X: Test is Recommended	D: Additional Test Desired				≥ ທ											
	Re	nmc	est	eq	ses	— (၀ ၀ ၀ ၀											
	Jser	Rec	lal T	clud	ECU Classes		<u>ပ ပ</u>											
	nd l	st is	ditio	X E	ວດເ		۷ ۷											
	Ä	Ë	Υď	ĕ	Ĕ	В	0 ت											
ļ	ŝ	×		Ш		∀ .		×						×				
				_			Description	Verify behavior when CTS sent within T3 time following last packet	Verify behavior when CTS sent after more	tnan 13 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	5.10.3	5.10.3.2				J1939-21 5.10.3.2				
				_			Test Name	RTS/CTS Protocol: CTS issued after last Transport	Data packet or previous CTS	(DOT as Originator)				RTS/CTS Protocol: CTS next packet numbering (DUT as Originator)				
							Row	သ						9				

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

					Test Result Comments														
				1	Pass- Fail														
				,	Date Tested														
SAE and Hear Bogniramente	SIID T	eq	User		Add./ Excl														
oning	X. Test is Recommended	D: Additional Test Desired E: Test Excluded		ш;	S S														
or Po		Test	ECU Classes		s c 0														
100	֓֞֝֝֓֜֝֓֟֝֓֟֝֓֓֓֓֓֟ ֓֓֓֓֓֓֓֞֓֓֞֓֞֓֓֞֓֞֩֞֓֓֓֓֞֡֓֓֓֓֡	tional	J Cla		CC														
T a	Text	Addi Test	EC	В	G C D														
ď	×	<u>;</u> ;; ;;		⋖ .	L	×				×				×				×	
					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			J1939-21 5.10.2.4	5.10.3.3			J1939-21	5.10.3.4
					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: EndOffMsgACK				RTS/CTS Protocol: Connect	(DUT as Originator)
					Row	7				ω				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
			-			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 L	Ser R	guire	SAE and User Requirements			
				×	est is F	X: Test is Recommended	mende	g			
				E D	ddition est Ex	D: Additional Test Desired E: Test Excluded	t Desir	pe			
				_	SCU C	ECU Classes		User			
		Requiring		A L D	∢ ∢	ر د	Ш ∑	Add./	Date	Pass-	
Row	Test Name	Document	Description	LG	ပ	ပ		Excl	Tested	Fail	Test Result Comments
17	Transport Data Packets for		Verify DUT sends the TP Data Packets for	×							
	RTS/CTS sent in ascending	5.10.1.1	an RTS/CTS in sequential order								
	(DUT as Originator)		Verify the first TP.DT packet is sequence number = 1								
18	All Transport Data Packets		Verify DUT sends packets with 8 bytes	×							
	for RTS/CTS have an 8 byte	5.10.1.3									
	data neld (DUT as Originator)	5.2.7.2									
19	Unused bytes of Last	J1939-21	Verify unused bytes of last packets sent &	×							
	Transport Data Packets for	5.10.1.3	filled properly								
	(DUT as Originator)	5.10.4									
20	Transport Data Packets for	J1939-21	Verify packets are sent no greater than	×							
	time following CTS (DUT as Originator)	5.10.2.4	Add III apair								
21	Time between consecutive		Verify packets of a CTS set are sent no	×							
	Transport Data Packets for RTS/CTS, in which the CTS	5.10.1.3	greater than 200 mS apart (says T1 of 750 mS in 5.10.2.4)								
	that allows more than 1										
	packet, are sent within T2										
	time of one another (DUT as Originator)										
				1	1	1	1	1	1		

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 RTS/CTS service. 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

				SA - : : : : : : : : : : : : : : : : : : :	SAE and User Re X: Test is Recom D: Additional Test E: Test Excluded	User Recc In Trans	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			
		Dogrining		∢ -	8 0	Ĺ	– C	ш 2	400	Dage	
Row	w Test Name	Document	Description			CC	0		_	Fail	Test Result Comments
7	RTS/CTS Protocol: RTS is	J1939-21	Verify behavior when unsupported or	×							
	valid (content and format)	5.10.2.2	unknown PGN								
	(DOI as responder)	5.10.3.1	Verify behavior for other reject reasons for the DUT								
7	RTS/CTS Protocol: Multiple	J1939-21	If DUT accepts, verify DUT only once (not	×							
	duplicate RTS (same SA, DA, PGN) received in short		to every RTS)								
	period (DUT as Responder)										
က	RTS/CTS Protocol: CTS following RTS is valid	J1939-21 5 10 2 2	Verify CTS sent within 200 mS (Tr)	×							
	(content and format)	5.10.3									
	(DUT as Responder)	5.10.3.2	Verify correct PGN, next packet(= 1), number of packets (<= RTS max packets)								
4	RTS/CTS Protocol: To	J1939-21 5 10 2 2	Verify DUT Conn_Abort has correct PGN and a valid abort reason provided and is	×							
	valid Conn_Abort (content	5.10.3.4	sent withing 200 mS (Tr) following RTS								
	and format) (DUT as Responder)										
ις.	RTS/CTS Protocol: CTS	J1939-21	Verify CTS sent within T3 time following	×							
	Data packet of the previous	5.10.2.4	idst packet								
	CTS (DLIT as Responder)	5.10.3	Verify correct PGN, next packet (valid),								
	(PO) da (cabolida)	7.0.0.		1	1	$\frac{1}{2}$					

TABLE A8 - DATA LINK RECEIVE TESTS - TP RTS/CTS (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	es	⊢ 0 0 S M									
	SAE and User Re X: Test is Recom D: Additional Test E: Test Excluded	ECU Classes	0 U									
	AE and Test i Addit Test I	ECL	B D D C C									
ļ	% ☆ □ □		L L A	×			×	×		×		
			Description	Verify next packet number specified in CTS is not less than packet number already confirmed	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	11939-21 5.10.2.3 5.10.3	2.0.0	5.10.2.3	5.10.3	
	_		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	9			7	8		6		

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

Test Result Comments					
Pass-					
Date Tested					
ments ed ed User Add./					
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded ECU Classes A B A T E L D A C S O M Add./ L G C C C S S Excl					
SAE a SAE	×	×	×	×	×
Description	Verify correct content in TP.CM_EndOfMsgACK Verify sends a valid TP.CM_EndOfMsgACK 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 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))
Requiring Document	J1939-21 5.10.2.4 5.10.3 5.10.3.3	J1939-21 5.10.2.4 5.10.3.4	J1939-21 5.10.2.4 5.10.3.4	J1939-21 5.10.3.2	J1939-21 5.10.3.2
	RTS/CTS Protocol: EndOffMsgACK (DUT as Responder)	RTS/CTS Protocol: Connect Abort issued by Originator (DUT as 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	-	12	13	4

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

		Test Recult Comments								
		Pass-								
		Date Tested								
ements ed red	User	Add./								
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	Se	□ ≥ 0								
User F Recor nal Te	ECU Classes	s 0								
and est is additio	ECU (8 D A C								
SAE X: T D: A E: T		A 1			×		×	×	×	
		Description	Verify ability of manage Trans, and BAM with s Verify DUT use 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	J1939-21 5.10.5.1		J1939-21 5.10.5.1		J1939-21 5.10.5	J1939-21 5.10.5	11939-21 5.10.1.1 5.10.1.2 5.10.1.4	
		Tost Name	RTS/CT Simultan with diffe (DUT as		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)	
		Ř	15		16		17	8	19	

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

				Test Result Comments												
			0													
			400	Tested												
	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	User	7	Excl												
	SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded		Ш	S												
	Recommunity Rest	ses	⊢ (0												
	SAE and User Re X: Test is Recom D: Additional Test E: Test Excluded	ECU Classes	- 0	၈ ပ ၃ ပ ၃ ပ												
	nd L t is F litior t Ex	ΰ	< <	ξ υ												
	Tes Add Tes	Б	m c	ם כ												
l	$\mathbf{Q} \times \Box \Box$		۷.	L	×				×			×				
				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	within 12 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	0.10	Verify behavior when packets are sent	longer than 200 mS apart (says T1 of
			3	Document	J1939-21	5.10.1.3 5.2.7.2	5.10.4		J1939-21	5.10.2.3 5.10.2.4		J1939-21	5.10.1.3	J. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50		
	-			/ Test Name		for RTS/CTS have an 8 byte data field	(DUT as Responder)			K1S/C1S start within 12 time following CTS	(DUT as Responder)	Time between consecutive	Transport Data Packets for	that allows more than 1	packet, are sent within T2	time of one another
				Row	20				21			22				

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

TABLE A9 - NETWORK LAYER TESTS

SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded		A C S O M Add./ Date C C O S Excl Tested Pass-Fail Test Result Comments								
SAE and X: Test i D: Additi E: Test I	ECU Classes	L A B C A C C A C	×	×	×	×	×	×	×	×
/\$ ∴ □ □		i t Description	Verify that the ECU does not go bus off due to the forwarding and contention of an Address Claimed message.	Verify that an ECU can forward the guaranteed maximum number of messages during average and peak busload.	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.	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.	Verify that messages can be forwarded from one segment to another.	Verify that messages with higher priority are forwarded before messages with lower priority.	Verify that messages with equal priority are forwarded in the order received.	Verify that messages can be filtered
		Requiring Document	J1939-31 4.4	J1939-31 4.5	J1939-31 4.5	J1939-31 4.5	J1939-31 5.1	J1939-31 5.1	J1939-31 5.1	J1939-31
		Test Name	Address Claimed Message	Maximum messages forwarded	Maximum messages filtered	Maximum transit delay	Message Forwarding	Higher Priority Forwarding	Equal Priority Forwarding	Message Filtering
		Row	-	2	က	4	2	9	7	8

TABLE A9 - NETWORK LAYER TESTS (CONTINUED)

				ail Test Result Comments																				
				Pass-Fa																				
			Date	Tested Pass-Fail																				
	nents	User	Add./	Excl																				
	uiren ndec esire		<u>"</u> ≥																					
	Request Description	es es	Ţ	0																				
	Secol Recol	lass	Ø																					
	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded ECU Classes A B A C S O M Add/																							
			_	×				×					×				×	×					×	
L			_																					
				Description	Verify one of the following: 1.) Messages are forwarded by	default, and blocked only if they exist in the filter database	2.) Messages are blocked by default,	and rorwarded 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.	Verify that source/destination	addresses can be substituted in	messages, which use a single	address to reference a particular vehicle system.	Verify that messages can be repackaged and forwarded.	Verify that the filter database can be manipulated as follows:	- Request entries	- Delete entries	- Crear database - Set filter mode	 Create entry, specifying filter mode 	Verify be acc
			Requiring Document		J1939-31 5.2				J1939-31	5.6				J1939-31	5.3			J1939-31 5.4	J1939-31 5.6.2					J1939-31 5.6.5
				Test Name	Block or Pass Filtering				Database management					Address Translation				Message Repackaging	Message Filter Database Manipulation					General Parametrics
				Row	6				10					7				12	13					4

TABLE A9 - NETWORK LAYER TESTS (CONTINUED)

				SAE X: Te D: Ac E: Te	SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded	Jser Secoral Terrial	Requi nmen st Dea	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	γ			
				ш	ECU Classes	lasse	SE	User	s =			
		Requiring		AB	ВА		∃					
		Document		L D	4	S	0	D A C S O M Add./	./ Date			
Row	Test Name		Description	L G	G C C C O S	ပ ပ	0	Excl	Teste	Tested Pass-Fail	Test Result Comments	nts
15	15 Port Pair Parametrics	J1939-31 5.6.6	J1939-31 Verify that specific port pair 5.6.6 parametrics can be accessed.	×								
16	16 Network Topology	J1939-31	J1939-31 Verify that network topology	×								

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 E: Test Excluded	d Use s Rec ional Exclu	er Re comr Test ded	quir nend Desi	ements led ired			
				ECU Classes	Slass	es		User			
		Requiring Document		L A B	ပ	⊢ 0 ⊗	Ш∑	Add./	Date		
Row	w Test Name		Description	G	ပ			Excl	Tested	Pass-Fail	Test Result Comments
-	ECU NAME	J1939-81 4.1	Verify the NAME contents for the ECU (DUT) align with -81	×							
8	System Initialization	J1939-81 4.4.3	Verify each ECU transmits a address claim at power-up system initialization.	×							
ဗ	Non-Configurable Address ECU	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.	×							
4	Commanded Addresses	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.		×						
2	Self-Configurable Address ECU	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.			×					
9	Request for Address Claimed	J1939-81 4.2.1	Verify an ECU can send a request for address claimed and process responses.								

TABLE A10 - NETWORK MANANGEMENT TESTS (CONTINUED)

	ail Test Result Comments						
	ass-Fa						
	Date Tested Pass-Fail						
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded ECU Classes User	Add./ Excl 1						
SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded ECU Classes	≡ Σ σ						×
Request Distance of the second	⊢00						
SAE and User Re X: Test is Recomi D: Additional Test E: Test Excluded ECU Classes	S						×
d Us is Re iona iona Excl	00						×
ddit est	G D B						×
SAE X: T E: T E: T	L L E	×	×	×	×	×	
	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.	with a higher with a higher own source mpts to claim a sponds with a sage after a time	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 Document	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	œ	6	10	11	12

TABLE A10 - NETWORK MANANEMENT TESTS (CONTINUED)

			Test Result Comments									
			Add./ Date Excl Tested Pass-Fail									
ts	_		./ Date									
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	User											
SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded		ш;	GCCCOS									
r Re omn est led	S	<u> </u>	0 0					×				
Jser Reconsal T	SSE		c c c					^				
SAE and User Re X: Test is Recomr D: Additional Test E: Test Excluded	ECU Classes	۷٠	ر ک ک					×				
Tes Add Tes	ECL	ω (D G C									
% ∴ ∷ iii		⋖.	Ĺ	×								
			Description	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	Document	J1939-81	4.5.2.3			J1939-81	4.5.2.4			
			Test Name	Network Disruption				Address Continuity				
			Row	13				14				

SAE

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

TABLE A11 - PHYSICAL LAYER TESTS

		: L	Tested Pass-Fail Test Result Comments		
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	User	A B A T E L D A C S O M Add./ Date	Exc		
SAE and User Requireme X: Test is Recommended D: Additional Test Desired E: Test Excluded		ш≥о	S		
· Re omn est ed	ses	⊢ 0	;; O		
SAE and User Re X: Test is Recomn D: Additional Test E: Test Excluded	lass	0 0	· ·		
is First	ECU Classes	44	<u>ر</u>		
≡ an Γest \ddi est	Ö	90	<u>ა</u>		
SAE X: 1 D: A		A !	_		
		,	Description	J1939-11 Verify to requirements of SAE J1939-11 Conformance Tests.	J1939-15 Verify to requirements of SAE J1939-15 Conformance Tests.
		Requiring	Document	J1939-11	J1939-15
			Test Name	J1939-11 physical layer	J1939-15 physical layer
		Ĺ	Row	-	7

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

			Test Result Comments						
			Excl Tested Pass-Fail						
		Date	Tested						
SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded	User	/dd./	Excl						
uire ande esir		ш⋝	S						
leq i nme st D		D B A C S O ¬	0						
er R con Tes Idec	ECU Classes	S	C						
Us Re Inal XCL	lass	ပ	C						
ind st is ditio	C	4 4	C						
Tes Tes Tes	ECL	В	G						
$\mathbf{S} \times \Box \Box$		۲ A	L						
		£ +	Description						
		Requiring Document							
			Test Name						
			Row	-	7	3	4	2	9