SURFACE VEHICLE RECOMMENDED PRACTICE

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Compliance

RATIONALE

This document has been revised to include new tests for recent changes to associated SAE J1939 documents, update cross references to the document section in the associated SAE J1939 documents, and add clarification to the test descriptions. The new tests have been added to cover changes made recently to the SAE J1939-21, SAE J1939-31, and SAE J1939-81 documents. Test descriptions and test names have been update for many of the tests associated with the SAE J1939-21 and SAE J1939-31 documents primarily for clarification. The tests listed in Tables A5, A6, A7, and A8 were reordered to keep together existing and new tests for similar aspects.

FOREWORD

The SAE J1939 communications network is defined using a collection of individual SAE J1939 documents based upon the layers of the Open System Interconnect (OSI) model for computer communications architecture. The SAE J1939-82 document describes the compliance tests and procedures to verify an SAE J1939 ECU will operate correctly on a SAE J1939 network. This compliance document may be used for SAE J1939 applications.

The SAE J1939 communications network is a high speed ISO 11898-1 CAN based communications network that supports real-time closed loop control functions, simple information exchanges, and diagnostic data exchanges between Electronic Control Units (ECUs) physically distributed throughout the vehicle.

The SAE J1939 communications network is developed for use in heavy-duty environments and suitable for horizontally integrated vehicle industries. The SAE J1939 communications network is applicable for light-duty, medium-duty, and heavy-duty vehicles used on-road or off-road, and for appropriate stationary applications which use vehicle derived components (e.g., generator sets). Vehicles of interest include, but are not limited to, on-highway and off-highway trucks and their trailers, construction equipment, and agricultural equipment and implements. The physical layer aspects of SAE J1939 reflect its design goal for use in heavy-duty environments. Horizontally integrated vehicles involve the integration of different combinations of loose package components, such as engines and transmissions, that are sourced from many different component suppliers. The SAE J1939 common communication architecture strives to offer an open interconnect system that allows the ECUs associated with different component manufacturers to communicate with each other.

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SAE values your input. To provide feedback on this Technical Report, please visit
http://www.sae.org/technical/standards/J1938/82_201506

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1. SCOPE

SAE J1939-82 Compliance describes the compliance tests and procedures to verify an SAE J1939 ECU will operate correctly on a SAE J1939 network. 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 Documents

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

2.1.1 SAE Publications

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

SAE J1939 Recommended Practice for a Serial Control and Communications Vehicle Network – Top Level Document

SAE J1939-11 Physical Layer, 250 Kbps, Twisted Shielded Pair

SAE J1939-13 Off-board Diagnostic Connector

SAE J1939-14 Physical Layer, 500 Kbps

SAE J1939-15 Reduced Physical Layer, 250 Kbps, Un-Shielded Twisted Pair (UTP)

SAE J1939-21 Data Link Layer

SAE J1939-31 Network Layer

SAE J1939-81 Network Management

SAE J2403 Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 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

2.2.2 ISO Publications

Available from American National Standards Institute, 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

BAM Broadcast Announce Message
CA Controller Application
CAI Controller Application Identity
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.

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 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.

10. NOTES

10.1 Marginal Indicia

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

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

APPENDIX A - COMPLIANCE TESTS

A.1 INTRODUCTION TO TESTS

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.2.6 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 code

Code	Meaning	Specified By
X	Compliance to the test is Required by SAE for that ECU Class	SAE J1939 Committee
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

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.

A.2.7 ECU and CA Class

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

Table A2 - ECU/CA class codes

ECU/CA 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.2.8 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.2.9 Date Tested

Identifies the date the test was conducted.

A.2.10 Pass - Fail

Record the test results. The designation choices are

P for Pass
F for Fail

A.2.11 Test Result Comments

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

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

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

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded										
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl	Date Tested	Pass-Fail	Test Result Comments
1	Position and order of PGN in the 29-bit Frame Header (DUT as Source)	J1939-21 5.1.1 Table 1 5.1.2	Verify proper placement of PGN within 29-bit header of all CAN Data Frames	X										
2	Use of EDP Bit to identify PGN (DUT as Source)	J1939-21 5.2.2	Verify DUT properly sets the EDP Bit for all 29-bit CAN Data Frames.	X										
3	Use of DP Bit to identify PGN (DUT as Source)	J1939-21 5.2.3	Verify DUT properly sets the DP Bit for all 29-bit CAN Data Frames.	X										
4	Data Field Byte Length (DUT as Source)	J1939-21 5.2.7.1 5.2.7.2	Verify the length of the CAN Data field for all 29-bit CAN Data Frames (Page 1 & 2) is 8 bytes, except for PGN 59904 frames.	X										
5	Byte Ordering within Data Field (DUT as Source)	J1939-21 5.4	Verify proper byte ordering of the parameter data for multiple byte parameters. (e.g., Verify Address Claim data, PGN 60928). This verification also applies to -7X.	X										
6	Multipacket capable PGN with less than 9 bytes of data sent as single CAN Data Frame with 8 byte data field. (DUT as Source)	J1939-21 5.10.5.2 5.2.7.1 5.2.7.2	Verify DUT indeed uses single CAN Frame to send PGN under this situation. Verify any unused bytes are filled with $FF.	X										

Table A3 - Data link transmit tests - general (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
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	X										
8	Request Retries (DUT as Source)	J1939-21 5.4.2 5.12.3	Verify the DUT stops sending the same Request message after the third attempt (i.e., second retry). A Request retry is issued after failure to receive a response within 1.25 s (T3) after sending the Request.	X										
9	Correct Interpretation of 'Requested PGN' in Request (PGN 59904) (DUT as Source)	J1939-21 5.4.2 Figure 8 5.1.2	Verify correct Request message's structure Verify the 'Requested PGN' contained in the Request message that is sent by the DUT has correct Data field content (byte order and position)	X										
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	X										
11	Devices Responds to its own Global Requests (DUT as Source)	J1939-21 5.12.4 5.10.2.4	Verify DUT sends a response to its own global request within the 200 ms (Tr) Verify the DUT uses the appropriate type of response (global or no response)	X										
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)	X										

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

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
1	Standard Frame Message Tolerance	J1939-21 5.1.3	Verify DUT operation is not adversely affected by CAN Standard Frames on the network	X										
2	Device not a CAN 2.0A Device	J1939-21 5.1.3	Verify DUT is not a CAN 2.0A device by issuing 29-bit (CAN 2.0B) Extended CAN Frames	X										
3	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.	X										
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 CAN Frames. (Same CAN header except for EDP bit and different data values to see if DUT acts on data values)	X										
5	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 CAN Frames. (Same CAN header except for DP bit and different data values to see if DUT acts on data values)	X										
6	Filtering on Destination Address (DUT as Recipient)	J1939-21 5.2.5.1 5.4.2 Table 5	Verify DUT evaluates the Destination Address for 29-bit CAN Frames. (Same PGN sent to different DAs containing different data values to confirm DUT acts only on data values sent to its address)	X										
7	Supports Receive of Global Destination Address (DUT as Recipient)	J1939-21 5.2.5.1	Verify DUT responds to globally addressed messages.	X										

Table A4 - Data link receive tests - general

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded										
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl	Date Tested	Pass-Fail	Test Result Comments
8	PDU Processing Capabilities (DUT as Recipient)	J1939-21 5.11	Verify device does not lose any messages when the data link is at 100 percent utilization for 10 ms.	X										
9	Capability of DUT to receive a multipacket-capable PGN that is sent as single CAN Data Frame when Data field has less than 9 bytes of data (DUT as Recipient)	J1939-21 5.10.5.2 5.2.7.1 5.2.7.2	Verify DUT can receive the multipacket PGN using the single 29-bit CAN Extended Frame format.	X										
10	Capability of the DUT to concurrently receive a multipacket-capable Destination Specific (PDU1) PGN (DUT as Recipient)	J1939-21 5.10.5.3 5.2.7.1 5.2.7.2	Verify DUT can receive both concurrent instances of same PDU1 PGN - one instance with less than 9 bytes (as a single CAN Frame) and the other instance with more than 9 bytes (through RTS/CTS).	X										
11	Capability of the DUT to receive a multipacket-capable Broadcast (PDU2) PGN(DUT as Recipient)	J1939-21 5.10.5.3 5.2.7.1 5.2.7.2	Verify DUT can receive both concurrent instances of same PDU 2 PGN - one instance with less than 9 bytes (as a single CAN Frame) and the other instance with more than 9 bytes (through BAM)	X										
12	Correct Interpretation of 'Requested PGN' in Request (PGN 59904) (DUT as Recipient)	J1939-21 5.4.2 Figure 8	Verify DUT properly interprets 'Requested PGN' in Request message by monitoring for correct PGN response	X										

13	Proper Response to Destination Specific Request for Single Packet Destination Specific (PDU1) PGN (DUT as Recipient)	J1939-21 5.4.2 Table 5 5.2.7 5.12.3	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	X										
14	Proper Response to Global Request for Single Packet Destination Specific (PDU1) PGN (DUT as Recipient)	J1939-21 5.4.2 Table 5 5.2.7 5.12.3	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	X										
15	Proper Response to Destination Specific Request for multipacket Destination Specific (PDU1) PGN containing 9 bytes of data or more (DUT as Recipient)	J1939-21 5.4.2 Table 5 5.12.3	Verify DUT uses the SAE J1939 Transport Protocol RTS/CTS to send the Requested PGN to the Source Address from the Request message Verify DUT sends the TP.CM_RTS response within 200 ms (Tr) after the Request	X										
16	Proper Response to Global Request for Multipacket Destination Specific (PDU1) PGN containing 9 bytes of data or more (DUT as Recipient)	J1939-21 5.4.2 Table 5 5.12.3	Verify DUT uses the SAE J1939 Transport Protocol BAM to send the Requested PGN Verify DUT sends the TP.CM_BAM response within 200 ms (Tr) after the Request											
17	Proper Response to Destination Specific Request for Single Packet Broadcast (PDU2) PGN (DUT as Recipient)	J1939-21 5.4.2 Table 5 5.12.3	Verify DUT sends the Requested PGN Verify DUT sends response within 200 ms (Tr) after the Request	X										
18	Proper Response to Global Request for Single Packet Broadcast (PDU2) PGN (DUT as Recipient)	J1939-21 5.4.2 Table 5 5.12.3	Verify DUT sends the Requested PGN Verify DUT sends response within 200 ms (Tr) after the Request	X										
19	Proper Response to Destination Specific Request for Multipacket Broadcast (PDU2) PGN containing 9 bytes of data or more (DUT as Recipient)	J1939-21 5.4.2 Table 5 5.12.3	Verify DUT uses the SAE J1939 Transport Protocol RTS/CTS to send the Requested PGN to the Source Address from the Request message Verify DUT sends the TP.CM_RTS response within 200 ms (Tr) after the Request	X										

20	Proper Response to Global Request for Multipacket Broadcast (PDU2) PGN containing 9 bytes of data or more (DUT as Recipient)	J1939-21 5.4.2 Table 5 5.12.3	Verify DUT uses the SAE J1939 Transport Protocol BAM to send the Requested PGN Verify DUT sends the TP.CM_BAM response within 200 ms (Tr) after the Request	X										
21	Response Timing (DUT as Recipient)	J1939-21 5.12.3	Verify DUT sends all required responses within 200 ms (Tr) after the Request	X										
22	Proper NACK Response for Destination Specific Request sent to DUT's Address for a PGN that is not supported by DUT (DUT as Recipient)	J1939-21 5.4.4 5.4.2 Table 5 5.12.3	Verify DUT sends an Acknowledgement (PGN 59392) containing the Requested PGN and indicates a Negative Acknowledgment (control Byte = 1; NACK) only if the DUT was the destination of the request. Verify DUT uses the Global Address for the Acknowledgement message. Verify the Requested PGN that was sent by DUT in Data field has the correct content (byte order and position) Verify the 'Address Negative Acknowledgement' parameter contains a valid or appropriate address value Verify DUT sends NACK within 200 ms (Tr) after the Request	X										
23	No Response for Globally Addressed Request for a PGN not supported by DUT (DUT as Recipient)	J1939-21 5.4.4 5.4.2 Table 5 5.12.3	Verify DUT does not send any Acknowledgement message (PGN 59392) Monitor for DUT messages for at least 1.25 s (T3) to verify the DUT does not send an Acknowledgement for the requested PGN	X										

24	Proper use of ACK Response when Applicable (DUT as Recipient)	J1939-21 5.4.4 5.4.2 Table 5	Examples of messages fitting the Test Name description: DM3 and DM11 Verify DUT sends an Acknowledgement (PGN 59392) containing the Requested PGN and indicates a Positive Acknowledgment (control byte =0; ACK) only if the DUT was the destination of the triggering message. Verify DUT uses the Global Address for the Acknowledgement message. Verify the Requested PGN that was sent by DUT in Data field has the correct content (byte order and position) Verify the 'Address Acknowledged' parameter contains a valid or appropriate address value Verify DUT sends ACK within 200 ms (Tr)	X									
25	Proper use of Access Denied Response for Destination Specific Request sent to DUT Address (DUT as Recipient)	J1939-21 5.4.4 5.4.2 Table 5	Verify DUT sends an Acknowledgement (PGN 59392) containing the Requested PGN and and indicates Access Denied (control byte =2; PGN supported but security denied access) only if the DUT was the destination of the triggering message Verify DUT uses the Global Address for the Acknowledgement message Verify the Requested PGN that was sent by DUT in Data field has the correct content (byte order and position) Verify the 'Address Access Denied' parameter contains a valid or appropriate address value Verify DUT sends ACK within 200 ms (Tr)	X									

26	Proper use of Cannot Respond Response for Destination Specific Request sent to DUT Address (DUT as Recipient)	J1939-21 5.4.4 5.4.2 Table 5	Verify DUT sends an Acknowledgement (PGN 59392) containing the Requested PGN and indicates Cannot Respond (control byte =3; PGN supported but ECU is busy and cannot respond now. Re-request the data at a later time) only if the DUT was the destination of the request Verify DUT uses the Global Address for the Acknowledgement message Verify the Requested PGN that was sent by DUT in Data field has the correct content (byte order and position) Verify the 'Address Access Denied' parameter contains a valid or appropriate address value Verify DUT sends ACK within 200 ms (Tr)	X										
27	Support of the Address Acknowledge data byte for each Acknowledge message type (DUT as Recipient)	J1939-21 5.4.4	Verify the Address Acknowledge' parameter (ACK), Address Negative Acknowledge parameter (NACK), Address Access Denied (Access Denied) parameter and Address Busy parameter (Cannot Respond) contains a valid or appropriate address value	X										
28	Correct Response to Request2 with 'yes' for the "Use Transfer PGN" Option (DUT as Recipient)	J1939-21 5.4.6 5.4.7	Verify the response data field byte contains a valid or appropriate address value. Verify the device responding to the request shall report the same information it would with PGN 59904 as the first data set in this response. If a device only has one data set, then it shall respond with the one data set utilizing the Transfer PG.	X										
29	Correct Response to Request2 with 'no' for the "Use Transfer PGN" Option (DUT as Recipient)	J1939-21 5.4.6	Verify the response data field byte contains a valid or appropriate address value	X										
30	Proper NACK Response for Request2 for Unsupported PGN (DUT as Recipient)	J1939-21 5.4.6	Verify the response data field byte contains a valid or appropriate address value	X										

31	Proper Acknowledgement Behavior for Destination Specific Request (PGN 59904) sent to a different Address (DUT as Recipient)	J1939-21 5.4.4 5.4.2 Table 5	Verify DUT does not respond to the Request message since the Request message was not addressed to the DUT	X										

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 tests - TP BAM (originator)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
1	BAM Transport: Ensure the Broadcast Announce message and its resulting Data Transfer data packets are valid (content and format) (DUT as Originator)	J1939-21 5.10.3 Figure 15 5.10.2.1 5.10.3.5	Verify the TP.CM_BAM message has correct values for the PGN, 'Total message size' & 'Number of packets' parameters. Verify the 'Total message size' and 'Number of packets' from the original TP.CM_BAM message matches what is actually sent in the resulting TP.DT data packets transmitted by the DUT. Verify the TP.CM_BAM message is sent to the Global Address.	X										
2	BAM Transport: Ensure the Broadcast Announce Message is sent prior to Data Transfer data packets (DUT as Originator)	J1939-21 5.10.2.1 5.10.1.3 5.10.3.5	Verify DUT transmits the TP.CM_BAM message prior to sending any TP.DT data packets (5.10.2.1). Verify time between the TP.CM_BAM message and first TP.DT data packet is between 50 ms and 200ms (Tr) .	X										
3	BAM Transport: Ensure the timing between the Data Transfer data packets for a BAM transport is within defined bounds (DUT as Originator)	J1939-21 5.10.1.3 5.12.3	Verify that consecutive, sequential TP.DT data packets for BAM transport are sent with a minimum 50 ms and maximum 200 ms (Tr) between one another (i.e., all TP.DT data packets except for the first TP.DT data packet following the TP.CM_BAM message).	X										

Table A5 - Data link transmit tests - TP BAM (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
4	BAM Transport: Ensure DUT does not send a Connection Abort for the BAM Transport (DUT as Originator)	J1939-21 5.10.2.4	Verify DUT does not transmit a TP.Conn_Abort message for any reason for its own BAM transport. Verify DUT ignores a received TP.Conn_Abort message for the PGN being transported using a BAM transport.	X										
5	BAM Transport: Ensure the Data Transfer data packets for a BAM transport contain the correct content (DUT as Originator)	J1939-21 5.10.4 Figure 16 5.10.1.3 5.10.2.3	Verify the first data byte of each TP.DT data packet for a BAM transport is a valid Sequence Number (1-255). Verify remaining 7 bytes of each TP.DT data packet for the BAM are correct data for the given packet. Verify the TP.DT Data Packets for the BAM transport are sent to the Global Address.	X										
6	BAM Transport: Ensure the Data Transfer data packets for a BAM transport are sent in sequential order (DUT as Originator)	J1939-21 5.10.1.2 5.10.1.1 5.10.1.4	Verify DUT transmits the TP.DT data packets for a BAM transport in ascending sequential order (beginning with Sequence Number = '1', and counting up).	X										
7	BAM Transport: Ensure every Data Transfer data packet contains 8 data bytes (DUT as Originator)	J1939-21 5.10.1.3 5.2.7.2 5.10.4 Figure 16	Verify DUT transmits each TP.DT data packet for a BAM transport with 8 bytes in the data field .	X										

Table A5 - Data link transmit tests - TP BAM (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
8	BAM Transport: Ensure extra (unused) bytes of last Data Transfer data packet is/are filled-in correctly. (DUT as Originator)	J1939-21 5.10.1.3 5.10.4 Figure 16 5.2.7.2	Verify last TP.DT data packet for a BAM transport is sent with an 8 byte data field and the unused bytes of this packet are filled with FF_{16}.	X										
9	BAM Transport: Ensure Priority of Data Transfer data packets is set to correct value(DUT as Originator)	J1939-21 5.10.4 Figure 16	Verify DUT sends each TP.DT data packet for any BAM transport using a Priority of 7 (Priority 7 is used regardless of the PGN being transported).	X										
10	BAM Transport: Ensure only one active BAM transport per Originator at a time (DUT as Originator)	J1939-21 5.10.5.1	Verify DUT doesn't start another BAM transport until it completes a previous BAM transport.	X										
11	BAM Transport: Ensure simultaneous BAM transports with different Originators (DUT as Originator)	J1939-21 5.10.5.1	Verify DUT is able to use a BAM transport to send a PGN while another Controller Application is also using a BAM transport to transport a PGN.	X										

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 A3 - Data link receive tests - TP BAM (responder)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded — ECU Classes: ALL	BDG	AAC	CC	SC	TOO	EMS	User Add./ Excl	Date Tested	Pass-Fail	Test Result Comments
1	Verify DUT inspects the PGN (including DP and EDP) in the TP.CM_BAM message	J1939-21 5.10.3 Figure 15 5.10.2.1 5.10.3.5	Verify DUT successfully receives a BAM transport when the PGN, 'Total message size' & 'Number of packets' parameters reported in the TP.CM_BAM message are of correct size and format. Verify DUT inspects the DP and EDP for the PGN in the TP.CM_BAM message. Verify the sender of TP.CM_BAM message is sent to the Global Address. Verify the sender's overall message size matches the 'Total message size' indicated in the TP.CM_BAM message. Verify the sender's number of TP.DT packets matches the 'Number of packets' indicated in the TP.CM_BAM message.	X										

Table A4 - Data link receive tests - TP BAM (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
2	BAM Transport: Ensure DUT validates TP.CM_BAM message parameter values (content and format) (DUT as Responder)	J1939-21 5.10.3 Figure 15 5.10.2.1 5.10.3.5	Verify DUT discards the BAM transport and doesn't send a TP.Conn_Abort message when it receives a TP.CM_BAM message with invalid or incorrect parameter values Examples: 'total message size' is outside defined bounds (i.e. reported value is less than 9 or greater than 1785 [bytes]), the specified 'number of packets' is incorrect for the overall message size (i.e. 17 byte PGN data size sent in 4 data packets), etc.	X										
3	BAM Transport: Ensure DUT discards BAM transport for an unsupported PGN (content and format) (DUT as Responder)	J1939-21 5.10.3 Figure 15 5.10.2.1 5.10.3.5	Verify DUT discards the BAM transport and doesn't send a TP.Conn_Abort message when it receives a TP.CM_BAM message for a PGN not supported by the DUT	X										

Table A4 - Data link receive tests - TP BAM (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
4	BAM Transport: Ensure the time between BAM transport messages meets the timing requirements (DUT as Responder)	J1939-21 5.10.2.1 5.10.1.3 Appendix C, C.1, Figure C3	Verify DUT receives a BAM transport when the time between the TP.CM_BAM message and the first TP.DT data packet is between 50 ms and 750 ms (T1). Verify DUT does not send a TP.Conn_Abort or a NACK when the time between the TP.CM_BAM message and the first TP.DT data packet is less than 50 ms. Verify DUT receives a BAM transport when the time between the TP.CM_BAM message and the first TP.DT data packet is less than or equal to 750 ms (T1). Verify DUT ignores a BAM transport when the time between the TP.CM_BAM message and the first TP.DT packet is greater than 750 ms (T1).	X									

Table A4 - Data link receive tests - TP BAM (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
5	BAM Transport: Ensure DUT receives TP.DT data packets for BAM transport when received within timing requirements (DUT as Responder)	J1939-21 5.10.1.3 5.10.2.4 5.12.3 Figure C3	Verify DUT successfully receives the BAM transport when the time between consecutive TP.DT data packets is between 50 ms and 200 ms (Tr) Verify DUT's does not send a TP.Conn_Abort or a NACK when the time between consecutive TP.DT data packets is less than 50 ms Verify DUT successfully receives the BAM transport when the time between consecutive TP.DT data packets is more than 200 ms (Tr) but less than 750 ms (T1) Verify DUT discards the BAM transport when the time between consecutive TP.DT data packets is more than 750 ms (T1)	X										
6	BAM Transport: Receiving BAM transport data packets in sequential order (DUT as Responder)	J1939-21 5.10.1.2 5.10.1.1 5.10.1.4	Verify DUT successfully receives the BAM transport when the TP.DT data packets are sent in sequential order. Verify DUT discards the BAM transport when the TP.DT data packets are sent out of sequential order. Verify the sender's TP.DT Data Packets for the BAM transport are sent to the Global Address.	X										

Table A4 - Data link receive tests - TP BAM (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
7	BAM Transport: Ensure DUT discards BAM transport when TP.DT data packets are not correct size (DUT as Responder)	J1939-21 5.10.1.3 5.10.4 Figure 16 5.2.7.2	Verify DUT discards the BAM transport if any TP.DT data packet has less than 8 bytes	X										
8	BAM Transport: Ensure DUT accepts BAM transport when Priority of TP.DT data packets are not correct value (DUT as Responder)	J1939-21 5.10.4 Figure 16	Verify DUT receives TP.DT data packets even if the TP.DT messages use a Priority other than 7	X										
9	BAM Transport: Ensure DUT properly reassembles received TP.DT data packets(DUT as Responder)	J1939-21 5.10.1.4 5.10.3 5.10.4	Verify DUT correctly ignores any unused bytes of last TP.DT packet (reference the 'Total message size, number of bytes' from TP.CM_BAM message)	X										
10	BAM Transport: Ensure DUT doesn't transmit an End of Message Acknowledge following the reception of the final Data Transfer data packet (DUT as Responder)	J1939-21 5.10.2.4	Verify DUT does not transmit a TP.CM_EndOfMsgACK message after the final TP.DT data packet of a BAM transport	X										
11	BAM Transport: Ensure DUT never transmits a Connection Abort (DUT as Responder)	J1939-21 5.10.2.4	Verify DUT does not send a TP. Conn_Abort message for any reason for a BAM transport (e.g., out of sequence data packets, missing data packets, etc.)	X										

Table A4 - Data link receive tests - TP BAM (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
12	BAM Transport: Ensure DUT supports only one BAM transport from a Controller Application at any given time (DUT as Responder)	J1939-21 5.10.5.1	Verify DUT discards a TP.CM_BAM message from a Controller Application (Source Address) when received before the previous TP.CM_BAM message's associated TP.DT data packets (from the same Controller Application) have been completely transmitted	X										
13	BAM Transport: Ensure DUT supports multiple BAM transports from different Controller Applications (DUT as Responder)	J1939-21 5.10.5.1	Verify DUT can handle receiving TP.CM_BAM messages from different Controller Applications (multiple Source Addresses	X										
14	BAM Transport: Ensure the ability to send the Component ID PGN for more than one device	J1939-21	Verify DUT formatting of Controller Application Identity for each iteration of the applicable PGN received from a source address.	X										

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 A5 - Data link transmit tests - TP RTS/CTS (originator)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
1	RTS/CTS Transport: TP.CM_RTS message is transmitted before starting the associated TP.DT data transfer (DUT as Originator)	J1939-21 5.10.2.2 5.10.3.1 5.10.1.3	Verify DUT sends a TP.CM_RTS message to initiate an RTS/CTS transport connection prior to sending any associated TP.DT data packets	X										

2	RTS/CTS Transport: TP.CM_RTS message is valid (content and format) (DUT as Originator)	J1939-21 5.10.3 Figure 15 5.10.2.2 5.10.3.1	Verify the TP.CM_RTS message sent by the DUT has correct content for PGN, 'Total message size', 'Total number of packets' & 'max packets' and these parameters are of correct size and format Verify the 'Total message size' matches the overall message size Verify the 'Total number of packets' matches the actual number of TP.DT packets Verify the DUT sends the TP.CM_RTS message to a specific Address (i.e., TP.CM_RTS message should never be sent to the Global Address - $FF_{16)}$ Verify the DUT does not send a value less than 1 in the 'max packets' parameter. Verify the TP.CM_RTS message data bytes match what is actually sent with the corresponding TP.DT data packets from the DUT	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
3	RTS/CTS Transport: Behavior to CTS response to RTS (content and format) (DUT as Originator)	J1939-21 5.10.2.2 5.10.2.3 5.10.2.4 5.10.3 Figure 15 5.10.3.2 5.10.5.1 Figure C1	Verify DUT transmits the appropriate TP.DT data packets after it receives a valid first TP.CM_CTS message (e.g., 'Next packet number to be sent' is '1') within 1250 ms (T3) following TP.CM_RTS Verify DUT inspects the PGN (including DP and EDP) in TP.CM_CTS Verify the DUT does not send TP.DT data packets until the associated TP.CM_CTS message has been received. Verify DUT does not send TP.Conn_Abort if a TP.CM_CTS is not received within 1250 ms (T3) following the TP.CM_RTS (i.e. connection was never established) Verify DUT transmits a TP.Conn_Abort when the TP.CM_CTS message's 'Number of packets that can be sent' is greater than the smallest value of either 'Total number of packets' or 'Maximum number of packets' sent in the TP.CM_RTS . Verify DUT transmits a TP.Conn_Abort when the TP.CM_CTS following the TP.CM_RTS contains 'Next packet number to be sent' with any value other than '1'	X									

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
4	RTS/CTS Transport: Response to TP.Conn_Abort for its RTS (DUT as Originator)	J1939-21 5.10.2.2 5.10.3.4	Verify DUT terminates or stops the RTS/CTS transport connection when it receives the TP.Conn_Abort with the correct PGN from the responder of the RTS/CTS transport connection.	X										
5	RTS/CTS Transport: Behavior to CTS message following last TP.DT data packet for previous CTS message (DUT as Originator)	J1939-21 5.10.2.4 5.10.2.2 5.10.3 5.10.3.2 Appendix C	Verify DUT transmits the appropriate TP.DT messages when a valid TP.CM_CTS message is received within 1250 ms (T3)after sending the last TP.DT data packet for the last received TP.CM_CTS message Verify DUT transmits a TP.Conn_Abort if it does not receive a CTS within 1250 ms (T3) following last TP.DT data packet indicated by the last received TP.CM_CTS message Verify DUT inspects the PGN (including DP and EDP) in the TP.CM_CTS. Verify DUT transmits a TP.Conn_Abort when the TP.CM_CTS message's 'Number of packets that can be sent' is greater than the smallest value of either 'Total number of packets' or 'Maximum number of packets' which was sent in the TP.CM_RTS.	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
6	RTS/CTS Transport: Behavior to next packet numbering in CTS message following the last Transport Data Packet for previous CTS message (non-'hold connection' TP.CM_CTS message) (DUT as Originator)	J1939-21 5.10.3.2 5.10.2.4 Appendix C	Verify DUT transmits the appropriate TP.DT data packets when 'Next packet number to be sent' parameter in the last TP.CM_CTS message… - is the same as 'Next packet number to be sent' in the previous TP.CM_CTS message (data retransmission) - is within the range of packets in previous TP.CM_CTS message (partial data retransmission) - equals the sum of 'Next packet number to be sent' plus 'Number of packets that can be sent' in last TP.CM_CTS message Verify DUT transmits a TP.Conn_Abort when 'Next packet number to be sent' in TP.CM_CTS message: - is less than the 'Next packet number to be sent' in previous TP.CM_CTS - is greater than the sum of 'Next packet number to be sent' plus 'Number of packets that can be sent' in last TP.CM_CTS message	X									

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
7	RTS/CTS Transport: Ensure DUT correctly handles first 'hold connection' TP.CM_CTS message immediately following last TP.DT data packet indicated in previous TP.CM_CTS message (DUT as Originator)	J1939-21 5.10.2.3 5.10.3 5.10.3.2 Appendix C1	Verify DUT pauses data flow when it receives a 'hold connection' TP.CM_CTS message (request to momentarily stop data flow). In other words, TP.CM_CTS message containing 'Number of packets that can be sent' parameter set to '0'. Verify DUT inspects the PGN (including DP and EDP) in the TP.CM_CTS message.	X										
8	RTS/CTS Transport: Ensure DUT correctly handles consecutive 'hold connection' TP.CM_CTS messages (DUT as Originator)	J1939-21 5.10.2.3 5.10.2.4 5.10.3 5.10.3.2 Figure C1	Verify DUT continues to pause data flow when it receives another 'hold connection' TP.CM_CTS messages within 500 ms (Th) following the previous 'hold connection' TP.CM_CTS message. Verify DUT continues to pause data flow when it receives another 'hold connection' TP.CM_CTS messages after 500 ms (Th) has expired but before 1050 ms (T4) has expired following the previous 'hold connection' CTS. Verify DUT transmits a TP.Conn_Abort if it does not receive any TP.CM_CTS messages within 1050 ms (T4) following previous 'hold connection' TP.CM_CTS message. Verify DUT inspects the PGN (including DP and EDP) in the TP.CM_CTS .	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
9	RTS/CTS Transport: CTS following 'hold connection' CTS (DUT as Originator)	J1939-21 5.10.3.2 Appendix C 5.10.2.4	Verify DUT sends the appropriate packets in TP.DT when it receives a valid CTS within 1050 ms (T4) following the previous 'hold connection' CTS Verify DUT sends the appropriate packets in TP.DT when 'Next packet number to be sent' in CTS: - is the same as 'Next packet number to be sent' in last CTS before CTS pause started - is within the range of packets in last CTS before CTS pause started - equals the sum of 'Next packet number to be sent' plus 'Number of packets that can be sent' in last CTS just before CTS pause started Verify DUT sends a TP.Conn_Abort when 'Next packet number to be sent' in CTS: - is less than the 'Next packet number to be sent' in last CTS before CTS pause started - is one or more greater than the sum of 'Next packet number to be sent' plus 'Number of packets that can be sent' in last CTS before CTS pause started										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
10	RTS/CTS Transport: Ensure DUT correctly handles multiple Clear to Send messages (for same RTS/CTS transport connection) received in a short time period (DUT as Originator)	J1939-21 5.10.3.2	Verify DUT transmits a TP.Conn_Abort after it receives a second TP.CM_CTS for the same RTS/CTS connection within 750 ms (T1) of a previous TP.CM_CTS when the second TP.CM_CTS is not part of normal transport protocol procedure. In other words the second TP.CM_CTS message is … - not the expected TP.CM_CTS message that should follow the last TP.DT data packet for the previous TP.CM_CTS message. - not the result of a 750 ms (T1) timeout (which occurs due to missing TP.DT data packet). Verify DUT transmits a TP.Conn_Abort after it receives a second TP.CM_CTS for the same RTS/CTS connection within 1250 ms (T2) of a previous TP.CM_CTS when the second TP.CM_CTS is not part of normal transport protocol procedure. In other words the second TP.CM_CTS is … - not the expected TP.CM_CTS message which should follow the last TP.DT data packet associated with the first TP.CM_CTS message. - not the result of a 1250 ms (T2) time out (due to no TP.DT data packet following the last TP.CM_CTS). - not the result of a 750 ms (T1) time out (due to missing TP.DT data packet).	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
11	RTS/CTS Transport: Ensure DUT ignores a Clear to Send outside of an RTS/CTS transport connection (DUT as Originator)	RTS/CTS Transport: Ensure DUT ignores a Clear to Send outside of an RTS/CTS transport connection (DUT as Originator)	J1939-21 5.10.3.2	X										
12	RTS/CTS Transport: Timing of first Transport Data Packets for RTS/CTS following CTS (DUT as Originator)	J1939-21 5.10.2.3 5.10.2.4 Figure C1	Verify DUT sends the first TP.DT data packet within 200 ms (Tr) after receiving the CTS	X										
13	RTS/CTS Transport: Only sends TP.DT Data Packets cleared by CTS (DUT as Originator)	J1939-21 5.10.1.3 5.10.4	Verify DUT only sends the TP.DT data packets beginning with the packet specified by 'Next packet number to be sent' and continuing through the number of packets specified in 'Number of packets that can be sent' in the last CTS	X										
14	RTS/CTS Transport: Ensure DUT transmits Transport Data Packets for RTS/CTS transport connection which have correct data content (DUT as Originator)	J1939-21 5.10.1.3 5.10.4	Verify first data byte is Sequence Number in each TP.DT data packet for the RTS/CTS transport connection. Verify remaining 7 bytes of each TP.DT data packet for the RTS/CTS transport connection contain the correct data for the packet.	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
15	RTS/CTS Transport: Ensure DUT sends Transport Data Packets for RTS/CTS transport connection in sequential order (DUT as Originator)	J1939-21 5.10.1.2 5.10.1.3	Verify DUT sends the TP.DT data packets for the RTS/CTS transport connection in ascending sequential order (beginning with Sequence Number = '1', and counting up).	X										
16	RTS/CTS Transport: Time between consecutive Transport Data Packets for RTS/CTS when CTS allows more than 1 packet (DUT as Originator)	J1939-21 5.10.1.3 5.10.2.4 Figure C1	Verify DUT sends each consecutive TP.DT data packet for a CTS no more than 200 ms (Tr) after the previous TP.DT data packet	X										
17	RTS/CTS Transport: Ensure DUT transmits all Transport Data Packets with an 8-byte data field (DUT as Originator)	J1939-21 5.10.1.3 5.2.7.2 5.10.4	Verify DUT transmits all TP.DT data packets for an RTS/CTS transport connection with a Data Length Code of 8 bytes	X										
18	RTS/CTS Transport: Unused bytes of Last Transport Data Packets for RTS/CTS filled with "FF_{16}" (DUT as Originator)	J1939-21 5.10.1.3 5.10.4 5.2.7.2	Verify last TP.DT data packet for RTS/CTS is sent with an 8 byte data field and the unused bytes of that packet are filled with FF_{16}	X										
19	RTS/CTS Transport: Priority of Data Transfer messages for RTS/CTS (DUT as Originator)	J1939-21 5.10.4, Figure 16	Verify DUT sends each TP.DT message for RTS/CTS using a priority of 7.	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
20	RTS/CTS Transport: Ensure DUT receives TP.CM_EndOfMsgACK message and acts appropriately (DUT as Originator); and Ensure DUT T4 timing following the last 'hold connection' message.	J1939-21 5.10.2.4 5.10.3 5.10.3.3 Appendix C1	Verify DUT behavior when it receives TP.CM_EndOfMsgACK message within 1250 ms (T3) following the final TP.DT data packet. Verify DUT sends a TP.Conn_Abort when it does not receive TP.CM_EndOfMsgACK message within 1250 ms (T3) following the final TP.DT data packet. If Responder transmits any 'hold connection' TP.CM_CTS messages after the final TP.DT data packet, verify DUT sends a TP.Conn_Abort if it does not receive a TP.CM_EndOfMsgACK message within 1050 ms (T4) following the last 'hold connection' TP.CM_CTS message. Verify DUT ignores a TP.CM_EndOfMsgACK message when it is received prior to the final TP.DT data packet. Verify DUT inspects PGN (including DP and EDP) in the TP.CM_EndOfMsgACK .	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
21	RTS/CTS Transport: Ensure DUT properly issues a RTS/CTS Connection Abort (DUT as Originator)	J1939-21 5.10.2.2 5.10.2.4 5.10.3.4	Verify DUT transmits a TP.Conn_Abort for the correct PGN containing a valid 'Connection Abort Reason' parameter and sends it to the correct Destination Address (must be a specific address; cannot be sent to the Global Address FF_{16}) Verify DUT does not send a TP.Conn_Abort if it does not receive a TP.CM_CTS for the DUT's first TP.CM_RTS prior to 1250 ms (T3) expiring (i.e. connection never established).	X										
22	RTS/CTS Transport: Ensure DUT receives Connection Abort which is issued by RTS/CTS Receiver after DUT's initial Clear to Send (also see Row 4) (DUT as Originator)	J1939-21 5.10.2.4 5.10.3.4	Verify DUT's behavior when it receives a TP.Conn_Abort message after the first TP.CM_CTS message (in response to the first TP.CM_RTS message) and before the TP.CM_EndOfMsgACK message Verify DUT inspects the PGN (including DP and EDP) in the TP.Conn_Abort. Verify DUT stops transmitting TP.DT data packets within 50 ms following the TP.Conn_Abort message Verify DUT transmits no more than 32 TP.DT data packets following the TP.Conn_Abort	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
23	RTS/CTS Transport: Ensure DUT doesn't attempt to create two RTS/CTS transport connections with a single Controller Application (DUT as Originator)	J1939-21 5.10.5	Verify DUT does not send a TP.CM_RTS message to the same Responder (based on Destination Address) for any PGN while the DUT currently has another RTS/CTS transport connection open with same Responder.	X										
24	RTS/CTS Transport: Ensure the DUT can support multiple RTS/CTS transport connections with different Responders (DUT as Originator)	J1939-21 5.10.5.1	Verify DUT can support simultaneous RTS/CTS transport connections with different Responders (based on Source Address and Destination Address combination).	X										
25	RTS/CTS Transport: Simultaneous RTS/CTS As Originator and Responder (DUT as Originator)	J1939-21 5.10.5.1	Verify ability of DUT to support simultaneous RTS/CTS transports with different ECUs where DUT is Originator in one RTS/CTS and DUT is Responder in the other RTS/CTS	X										
26	RTS/CTS Transport: Simultaneous RTS/CTS And BAM with DUT as Originator of each Transport (DUT as Originator)	J1939-21 5.10.5.1	Verify ability of DUT to support simultaneous RTS/CTS and BAM transports where the DUT is the Originator of both the RTS/CTS and the BAM transports	X										
27	RTS/CTS Transport: Simultaneous RTS/CTS And BAM As RTS/CTS Originator and BAM Responder (DUT as Originator)	J1939-21 5.10.5.1	Verify ability of DUT to support simultaneous RTS/CTS and BAM transports where the DUT is the Originator of the RTS/CTS transport and DUT is the Responder of the BAM transport	X										

Table A7 - Data link transmit tests - TP RTS/CTS (originator) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
28	CTS/RTS Transport: Ensure the ability to send the Component ID PGN for more than one device	J1939-21	Verify DUT formatting of Controller Application Identity for each iteration of the applicable PGN received from a source address.	X										

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 A6 - Data link receive tests - TP RTS/CTS (responder)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded — ECU Classes: ALL	BDG	AAC	CC	SC	TOO	EMS	User Add./ Excl	Date Tested	Pass-Fail	Test Result Comments
1	RTS/CTS Transport: Successfully receives a valid RTS (content and format) (DUT as Responder)	J1939-21 5.10.2.2 5.10.3 5.10.3.4	Verify DUT sends a valid TP.CM_CTS when it receives a valid TP.CM_RTS sent specifically to DUT, i.e. the PGN in the TP.CM_RTS is supported, and the total message size & Number of packets reported in the TP.CM_RTS are correct, and DUT is able to handle transport at the time Verify DUT checks the PGN (including DP and EDP) in the RTS Verify DUT responds with TP.Conn_Abort if unable to handle transport at the time or other reject reasons	X										
2	RTS/CTS Transport: CTS following RTS is valid (content and format) (DUT as Responder)	J1939-21 5.12.3 5.10.2.2 5.10.3 Figure 15 5.10.3.2	Verify DUT sends the TP.CM_CTS within 200 ms (Tr) following TP.CM_RTS Verify DUT sends TP.CM_CTS with correct PGN, 'Next packet number to be sent' equal to 1, and the 'Number of packets that can be sent' is less than or equal to the smaller of the 'Total number of packets' and 'Maximum number of packets' specified in TP.CM_RTS Verify DUT sends TP.CM_CTS to specific address (never sent to global address).	X										

Table A7 - Data link receive tests - TP RTS/CTS (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
3	RTS/CTS Transport: Multiple RTS received from same SA for the same PGN within short period (DUT as Responder)	J1939-21 5.10.3.1	If DUT accepts the transport, verify DUT responds with only one TP.CM_CTS (not to every RTS), and verify DUT does not send TP.Conn_Abort for the other RTS instances.	X										
4	RTS/CTS Transport: Rejects connection request with valid Conn_Abort (content and format) (DUT as Responder)	J1939-21 5.10.2.2 5.10.3 5.10.3.4	Verify DUT sends a TP.Conn_Abort in response to the TP.CM_RTS to reject the RTS request. Verify DUT sends the TP.Conn_Abort within 200 ms (Tr) following TP.CM_RTS Verify DUT sends the TP.Conn_Abort with correct PGN and a valid connection abort reason Verify DUT sends the TP.Conn_Abort to specific address (never sent to global address).	X										
5	RTS/CTS Transport: Receiving an TP.CM_RTS for an unsupported PGN (content and format) (DUT as Responder	J1939-21 5.10.2.2 5.10.3 5.10.3.4	Verify DUT sends a TP.Conn_Abort when it receives a TP.CM_RTS for a PGN not supported by the DUT	X										

Table A7 - Data link receive tests - TP RTS/CTS (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
6	RTS/CTS Transport: Receiving an invalid TP.CM_RTS (content and format) (DUT as Responder)	J1939-21 5.10.2.2 5.10.3 5.10.3.4	Verify DUT sends a TP.Conn_Abort when it receives a TP.CM_RTS with invalid or incorrect content, e.g., data size incorrect for PGN, total message size is outside valid limits (i.e. less than 9, greater than 1785), specified number of packets incorrect for total message size, etc. Verify DUT ignores the TP.CM_RTS and doesn't send a TP.Conn_Abort when the TP.CM_RTS is sent to the global address	X										
7	RTS/CTS Transport: CTS next packet numbering (DUT as Responder)	J1939-21 5.10.3.2 Appendix C 5.10.1.3	Verify DUT sends only valid values for the 'Next packet number to be sent value' in each TP.CM_CTS, i.e. - same as 'Next packet number to be sent' in the last CTS - greater than 'Next packet number to be sent' in the last CTS and less than the sum of 'Next packet number to be sent' in the last CTS plus 'Number of packets that can be sent' in the last CTS - equal to the sum of 'Next packet number to be sent' plus 'Number of packets that can be sent' in the last CTS	X										
8	RTS/CTS Transport: Does not send CTS outside of connection (DUT as Responder)	J1939-21 5.10.3.2	Verify DUT does not send TP.CM_CTS for PGNs not in a connection	X										

Table A7 - Data link receive tests - TP RTS/CTS (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
9	RTS/CTS Transport: Multiple CTS (same SA, DA, PGN) transmitted in short period (DUT as Responder)	J1939-21 5.10.2.4 5.10.3.2 Appendix C1	Verify DUT does not send multiple instances of TP.CM_CTS unless one of the following conditions have occurred: - a T1 timeout (750 ms) for missing TP.DT data packets - a T2 timeout (1250 ms) after last TP.CM_CTS - received the last TP.DT packet for previous CTS - sending consecutive 'hold connection' TP.CM_CTS to pause data flow	X										
10	RTS/CTS Transport: Transmitting first 'hold connection' CTS to pause data flow (DUT as Responder)	J1939-21 5.10.2.3 5.10.3 5.10.3.2 Appendix C1	Verify DUT uses the correct settings when it sends a 'hold connection' TP.CM_CTS, i.e. correct PGN, 'Number of packets that can be sent' = 0, and all other data field bits set to 1's Verify DUT sends the 'hold connection' TP.CM_CTS sent within 200 ms (Tr) following the reception of the last TP.DT packet for previous CTS	X										
11	RTS/CTS Transport: Transmitting consecutive 'hold connection' CTS to continue to pause data flow (DUT as Responder)	J1939-21 5.10.2.3 5.10.2.4 5.10.3 5.10.3.2 Appendix C1	Verify DUT uses the correct settings when it sends a consecutive 'hold connection' TP.CM_CTS, i.e. correct PGN, 'Number of packets that can be sent' = 0, and all other data field bits set to 1's Verify DUT sends the consecutive 'hold connection' TP.CM_CTS within 500 ms (Th) of last 'hold connection' TP.CM_CTS	X										

Table A7 - Data link receive tests - TP RTS/CTS (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
12	RTS/CTS Transport: CTS following 'hold connection' CTS (DUT as Responder)	J1939-21 5.10.2.3 5.10.2.4 5.10.3 5.10.3.2 Appendix C1	Verify DUT sends an appropriate TP.CM_CTS within 500 ms (Th) following the last 'hold connection' TP.CM_CTS Verify the TP.CM_CTS has correct PGN, a valid 'Next packet number to be sent', and a valid 'Number of data packets that can be sent'. A valid 'Next packet number to be sent' value is: - same as 'Next packet number to be sent' in the last CTS before CTS pause started - greater than 'Next packet number to be sent' in the last CTS and less than the sum of 'Next packet number to be sent' in the last CTS plus 'Number of packets that can be sent' in the last CTS before CTS pause started - equal to the sum of 'Next packet number to be sent' plus 'Number of packets that can be sent' in the last CTS before CTS pause started A valid 'Next packet number to be sent' value is: - less than or equal to the smaller of the 'Total number of packets' and 'Maximum number of packets' specified in TP.CM_RTS	X										

Table A7 - Data link receive tests - TP RTS/CTS (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
13	RTS/CTS Transport: Timing of first TP.DT for RTS/CTS following CTS (DUT as Responder)	J1939-21 5.10.2.3 5.10.2.4 Appendix C	Verify DUT behavior when the first TP.DT packet is received within 1250 ms (T2) after the CTS Verify DUT behavior, e.g., sends a TP.CM_CTS to have packets resent or sends a TP.Conn_Abort, when DUT does not receive a TP.DT within 1250 ms (T2) after the CTS	X										
14	RTS/CTS Transport: CTS issued after last Transport Data packet of the previous CTS (DUT as Responder)	J1939-21 5.12.3 Appendix C 5.10.2.2 5.10.2.4 5.10.3 5.10.3.2	Verify DUT sends an appropriate TP.CM_CTS within 200 ms (Tr) following the reception of the last TP.DT data packet for previous CTS Verify DUT sends a valid TP.CM_CTS, i.e. correct PGN, 'Next packet number to be sent' is valid, and 'Number of data packets that can be sent' is less than or equal to the smaller of the 'Total number of packets' and 'Maximum number of packets' specified in TP.CM_RTS	X										
15	RTS/CTS Transport: TP.DT Data Transport timing following CTS (DUT as Responder)	J1939-21 5.10.3.2 5.10.2.4 Appendix C	Verify DUT retransmits the TP.CM_CTS or sends a TP.Conn_Abort when it does not receive a TP.DT within 1250 ms (T2) following the CTS If DUT does retransmit the TP.CM_CTS when it does not receive a TP.DT within 1250 ms (T2), then verify the DUT sends a TP.Conn_Abort by the third consecutive time it does not receive a TP.DT within 1250 ms (T2) following the CTS	X										

Table A7 - Data link receive tests - TP RTS/CTS (responder) (continued)

Row	Test Name	Requiring Document	Description	SAE and User Requirements X: Test is Recommended D: Additional Test Desired E: Test Excluded								Date Tested	Pass-Fail	Test Result Comments
				ECU Classes							User			
				ALL	BDG	AAC	CC	SC	TOO	EMS	Add./ Excl			
16	RTS/CTS Transport: Time between consecutive Transport Data Packets for RTS/CTS when the CTS allows more than 1 packet (DUT as Responder)	J1939-21 5.10.1.3 5.10.2.4 Appendix C1	Verify DUT successfully receives the RTS/CTS data when the time between consecutive TP.DT packets is less than 200 ms (Tr) Verify DUT behavior, e.g., sends a TP.CM_CTS to have packets resent or sends a TP.Conn_Abort, when the time between consecutive TP.DT packets is longer than 200 ms (Tr) but less than 750 ms (T1) Verify DUT behavior, e.g., sends a TP.CM_CTS to have packets resent or sends a TP.Conn_Abort, when the time between any consecutive TP.DT packets is longer than 750 ms (T1)	X										
17	RTS/CTS Transport: Sequential order of Transport Data Packets for RTS/CTS (DUT as Responder)	J1939-21 5.10.1.3 5.10.1.2 5.10.1.4 5.10.2.4 5.10.3.2 5.10.3.4	Verify DUT successfully receives the RTS/CTS data when the TP.DT Data packets for the RTS/CTS are sent in sequential order Verify behavior, e.g., sends a TP.CM_CTS to have packets resent or sends a TP.Conn_Abort, when TP.DT Data packets for the RTS/CTS are received out of order	X										