



SURFACE VEHICLE RECOMMENDED PRACTICE

J1699®-5

JUL2026

Issued

2026-07

Vehicle OBD II Compliance Test Cases for
SAE J1979-2/J1979-3

RATIONALE

This document has been created to provide compliance test cases for SAE J1979-2 and SAE 1979-3, as reflected in the latest California Air Resources Board legislation: Title 13, CCR Section 1968.2. Malfunction and Diagnostic System Requirements -- 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines, Section 1971.1. On-Board Diagnostic System Requirements -- 2010 and Subsequent Model-Year Heavy-Duty Engines, and Section 1962.5. Data Standardization Requirements for 2026 and Subsequent Model-Year Light-Duty Zero Emission Vehicles and Plug-in Hybrid Electric Vehicles.

FOREWORD

SAE International generated this document to serve as a guide for testing vehicles for compliance with U.S. Federal and CARB requirements for emission-related on-board diagnostic functions (OBD II) and propulsion-related functions on Unified Diagnostics Services (UDS). SAE J1699-5 and test software release versions will be aligned.

SAE Executive Standards Committee Rules provide that: "This report is published by SAE to advance the state of technical and engineering sciences. The use of this report is entirely voluntary, and its applicability and suitability for any particular use, including any patent infringement arising therefrom, is the sole responsibility of the user."

SAE reviews each technical report at least every five years at which time it may be revised, reaffirmed, stabilized, or cancelled. SAE invites your written comments and suggestions.

Copyright © 2026 SAE International

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, or used for text and data mining, AI training, or similar technologies, without the prior written permission of SAE.

TO PLACE A DOCUMENT ORDER: Tel: 1-877-606-7323 (U.S. and Canada only)
Tel: 1-724-776-4970 (outside U.S. and Canada)
Fax: 724-776-0790
Email: CustomerService@sae.org
http://www.sae.org

SAE WEB ADDRESS:

Full document details: SAE J1699_5_202607

For more information on this standard, visit
https://www.sae.org/standards/content/J1699/5_202607/

Documents

Standard, visit Sharing Hub

TABLE OF CONTENTS

1.	SCOPE.....	9
2.	REFERENCES.....	9
3.	OVERVIEW OF SAE J1699-5 TEST CASES.....	14
4.	VEHICLE CONNECTION AND COMMUNICATION REQUIREMENTS	24
5.	TEST VEHICLE WITH NO MALFUNCTIONS, NO DTCS SET	44
6.	TEST VEHICLE AND SET A PENDING CODE BY INDUCING A FAULT	122
7.	TEST VEHICLE AND SET A CONFIRMED CODE AND MIL BY RETAINING A FAULT	129
8.	TEST VEHICLE WITH FAULT REPAIRED	136
9.	TEST VEHICLE WITH NO FAULT AFTER THREE OR FOUR DRIVING CYCLES COMPLETED	144
10.	TEST VEHICLE WITH NO FAULTS TO VERIFY IUMPR COUNTERS, SERVICE \$19 \$06 DTC \$92(TEST RESULTS) AND SERVICE \$22 \$F4/F5XX (DATA STREAM).....	166
11.	TEST VEHICLE WITH NO FAULTS TO VERIFY IUMPR COUNTERS, TEST RESULTS, AND I/M READINESS	194
12.	COMPLIANCE TEST CASES FOR ZEVS AND SAE J979-3 REQUIREMENTS.....	217
13.	NOTES.....	239
Figure 1	Conditions and services tested	17
Figure 2	Diagnostic message format for ISO 15765-4.....	24
Figure 3	CAN 11-bit identifiers	25
Figure 4	CAN 29-bit identifiers	25
Figure 5	Functional OBD communication - default response timing.....	26
Figure 6	Functional OBD communication - enhanced response timing.....	27
Figure 7	Physical OBD communication - default response timing	28
Figure 8	Physical OBD communication - enhanced response timing	29
Figure 9	DoIP connection process	36
Figure 10	Determination of usage of Byte B in addition to Byte A for service \$22 DIDs \$F406 to \$F409 and DIDs \$F455 to \$F458.....	70
Table 1	Proper response from server/ECU on functional or physical requests for CAN and ethernet connection to OBDonUDS ECUs	31
Table 2	Functional addressed vehicle discovery request message	39
Table 3	ECUx vehicle discovery response message without VIN/GID sync. status.....	39
Table 4	ECUx vehicle discovery response message with VIN/GID sync. status.....	39
Table 5	Functional addressed power mode request message	40
Table 6	ECUx power mode response message	40
Table 7	Functional addressed entity status request message.....	41
Table 8	ECUx entity status response message	41
Table 9	Functional addressed routing activation request message.....	42
Table 10	ECUx routing activation response message	42
Table 11	Functional addressed diagnostic request message.....	43
Table 12	ECUx diagnostic response message	43
Table 13	Request current powertrain diagnostic data request message.....	45
Table 14	Functional request current powertrain diagnostic data request message	45
Table 15	Request current powertrain diagnostic data response message.....	46

Table 16	Request clear/reset emission-related diagnostic information request message	46
Table 17	Functional request clear/reset emission-related diagnostic information request message	47
Table 18	ECU#1 request clear/reset emission-related diagnostic information response message	47
Table 19	Request current powertrain diagnostic data request message	48
Table 20	Functional request current powertrain diagnostic data request message	48
Table 21	Request current powertrain diagnostic data response message	49
Table 22	Request emission-related diagnostic trouble codes with permanent status	50
Table 23	Functional request emission-related diagnostic trouble codes with permanent status	50
Table 24	ECU#n request emission-related diagnostic trouble codes with permanent status response message with no confirmed DTCs available	50
Table 25	Physical request emission-related diagnostic trouble codes with permanent status	51
Table 26	ECU#n request emission-related diagnostic trouble codes with permanent status response message with no confirmed DTCs available	51
Table 27	Request on-board-monitoring test result data request message	52
Table 28	Physical request supportedDTCextendedrecord information request message	53
Table 29	ECU#n request supportedDTCextendedrecord information response message	53
Table 30	Physical request DTCExtendedDataRecord request message	54
Table 31	ECU#n request DTCExtendedDataRecord response message	54
Table 32	Functional request current powertrain diagnostic data request message	55
Table 33	ECU#1 request current powertrain diagnostic data response message	56
Table 34	ECU#2 request current powertrain diagnostic data response message	56
Table 35	Functional request current powertrain diagnostic data request message	57
Table 36	ECU#1 request current powertrain diagnostic data response message	57
Table 37	ECU#2 request current powertrain diagnostic data response message	57
Table 38	Functional request current powertrain diagnostic data request message	58
Table 39	ECU#2 request current powertrain diagnostic data response message	58
Table 40	Physical request current powertrain diagnostic data request message	59
Table 41	ECU#2 request current powertrain diagnostic data response message	59
Table 42	Engine off service \$22 DID validation	60
Table 43	Request routine control support information request message	70
Table 44	Functional request routine control support information request message	70
Table 45	ECU#n request routine control support information response message	71
Table 46	Request current powertrain diagnostic data request message	72
Table 47	Functional request current powertrain diagnostic data request message	73
Table 48	ECU#n request current powertrain diagnostic data response message	73
Table 49	Request clear/reset emission-related diagnostic information request message	74
Table 50	Functional request clear/reset emission-related diagnostic information request message	74
Table 51	ECU#n request clear/reset emission-related diagnostic information response message	74
Table 52	ECU#2 request clear/reset emission-related diagnostic information negative response message condition not correct	75
Table 53	Request current powertrain diagnostic data request message	75
Table 54	Functional request current powertrain diagnostic data request message	76
Table 55	ECU#1 request current powertrain diagnostic data response message	76
Table 56	ECU#2 request current powertrain diagnostic data response message	76
Table 57	Functional request current powertrain diagnostic data request message	77
Table 58	ECU#1 request current powertrain diagnostic data response message	77
Table 59	ECU#2 request current powertrain diagnostic data response message	78
Table 60	Functional request current powertrain diagnostic data request message	78
Table 61	ECU#n request current powertrain diagnostic data response message	78
Table 62	Physical request current powertrain diagnostic data request message	79
Table 63	ECU#n request current powertrain diagnostic data response message	79
Table 64	Engine idle service \$22 DID validation	80
Table 65	Functional request current powertrain diagnostic data request message	91
Table 66	ECU#1 request current powertrain diagnostic data response message	91
Table 67	Request emission-related diagnostic trouble codes with confirmed status	91
Table 68	Functional request emission-related diagnostic trouble codes with confirmed status	92
Table 69	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with no confirmed DTCs available	92
Table 70	Physical request emission-related diagnostic trouble codes with confirmed status	92

Table 71	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with no confirmed DTCs available	93
Table 72	Physical request supportedDTCextendedrecord information request message	94
Table 73	ECU#n request supportedDTCextendedrecord information response message	95
Table 74	Physical request DTCExtendedDataRecord request message	95
Table 75	ECU#n request DTCExtendedDataRecord response message	96
Table 76	Request emission-related diagnostic trouble codes with pending status	97
Table 77	Functional request emission-related diagnostic trouble codes with pending status	97
Table 78	ECU#n request emission-related diagnostic trouble codes with pending status response message with no confirmed DTCs available	98
Table 79	Physical request emission-related diagnostic trouble codes with pending status	98
Table 80	ECU#n request emission-related diagnostic trouble codes with pending status response message with no confirmed DTCs available	99
Table 81	Request routine control support information request message	99
Table 82	Functional request routine control support information request message	100
Table 83	ECU#n request routine control support information response message	100
Table 84	Request vehicle information request message	101
Table 85	Functional request current powertrain diagnostic data request message	102
Table 86	ECU#n request current powertrain diagnostic data response message	102
Table 87	Functional request current powertrain diagnostic data request message	103
Table 88	ECU#n request current powertrain diagnostic data response message	103
Table 89	Physical request current powertrain diagnostic data request message	104
Table 90	ECU#n request current powertrain diagnostic data response message	104
Table 91	Engine idle vehicle information service \$22 ITID validation.....	105
Table 92	NOx bin structure	118
Table 93	Service \$19 06 DTC – Extended Data Record	119
Table 94	VIN year character	120
Table 95	Functional request current powertrain diagnostic data request message	120
Table 96	ECU#n request current powertrain diagnostic data response message	121
Table 97	Functional request emission-related diagnostic trouble codes with pending status request message	122
Table 98	ECU#n request emission-related diagnostic trouble codes with pending status response message with pending DTCs available	123
Table 99	Functional request emission-related diagnostic trouble codes with confirmed status request message.....	124
Table 100	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with no confirmed DTCs available	124
Table 101	Physical request powertrain snapshot data request message	125
Table 102	ECU#n request powertrain snapshot data response message	126
Table 103	Physical request powertrain snapshot data request message	127
Table 104	ECU#n request powertrain snapshot data response message	127
Table 105	Functional request emission-related diagnostic trouble codes with pending status request message	129
Table 106	ECU#n request emission-related diagnostic trouble codes with pending status response message with pending DTCs available	130
Table 107	Functional request emission-related diagnostic trouble codes with confirmed status request message.....	131
Table 108	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with confirmed DTCs available	132
Table 109	Physical request powertrain snapshot data request message	133
Table 110	ECU#n request powertrain snapshot data response message	133
Table 111	Physical request powertrain snapshot data request message	134
Table 112	ECU#n request powertrain snapshot data response message	135
Table 113	Functional request emission-related diagnostic trouble codes with pending status request message	137
Table 114	ECU#n request emission-related diagnostic trouble codes with pending status response message with no pending DTCs available	137
Table 115	Functional request emission-related diagnostic trouble codes with confirmed status request message.....	138

Table 116	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with confirmed DTCs available	138
Table 117	Physical request powertrain snapshot data request message	139
Table 118	ECU#n request powertrain snapshot data response message	140
Table 119	Physical request powertrain snapshot data request message	141
Table 120	ECU#n powertrain snapshot data response message	141
Table 121	Functional request emission-related diagnostic trouble codes with permanent status request message	143
Table 122	ECU#n request emission-related diagnostic trouble codes with permanent status response message with permanent DTCs available	143
Table 123	Functional request emission-related diagnostic trouble codes with pending status request message	144
Table 124	ECU#n request emission-related diagnostic trouble codes with pending status response message with no pending DTCs available	145
Table 125	Functional request emission-related diagnostic trouble codes with confirmed status request message .	145
Table 126	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with confirmed DTCs available	146
Table 127	Physical request powertrain snapshot data request message	147
Table 128	ECU#n request powertrain snapshot data response message	147
Table 129	Physical request powertrain snapshot data request message	148
Table 130	ECU#n request powertrain snapshot data response message	149
Table 131	Functional request emission-related diagnostic trouble codes with permanent status request message	150
Table 132	ECU#n request emission-related diagnostic trouble codes with permanent status response message with no permanent DTCs available	150
Table 133	Functional request emission-related diagnostic trouble codes with confirmed status request message	152
Table 134	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with confirmed DTCs available	152
Table 135	Functional request emission-related diagnostic trouble codes with permanent status request message	153
Table 136	ECU#n request emission-related diagnostic trouble codes with permanent status response message with permanent DTCs available	154
Table 137	Functional request clear/reset emission-related diagnostic information request message	155
Table 138	ECU#n request clear/reset emission-related diagnostic information response message	155
Table 139	Functional request current powertrain diagnostic data request message	156
Table 140	ECU#n request current powertrain diagnostic data response message	156
Table 141	Functional request emission-related diagnostic trouble codes with permanent status request message	157
Table 142	ECU#n request emission-related diagnostic trouble codes with permanent status response message with permanent DTCs available	157
Table 143	Functional request emission-related diagnostic trouble codes with permanent status request message	158
Table 144	ECU#n request emission-related diagnostic trouble codes with permanent status response message with permanent DTCs available	159
Table 145	Functional request emission-related diagnostic trouble codes with permanent status request message	160
Table 146	ECU#n request emission-related diagnostic trouble codes with permanent status response message with permanent DTCs available	160
Table 147	Functional request current powertrain diagnostic data request message	161
Table 148	ECU#n request current powertrain diagnostic data response message	162
Table 149	Functional request current powertrain diagnostic data request message	162
Table 150	ECU#n request current powertrain diagnostic data response message	162
Table 151	Functional request emission-related diagnostic trouble codes with permanent status request message	163
Table 152	ECU#n request emission-related diagnostic trouble codes with permanent status response message with no permanent DTCs available	164
Table 153	Functional request clear/reset emission-related diagnostic information request message	164
Table 154	ECU#n request clear/reset emission-related diagnostic information response message	164
Table 155	Functional request current powertrain diagnostic data request message	165

Table 156	ECU#n request current powertrain diagnostic data response message	165
Table 157	Functional request current powertrain diagnostic data request message	166
Table 158	ECU#n request current powertrain diagnostic data response message	166
Table 159	Functional request current powertrain diagnostic data request message	166
Table 160	ECU#n request current powertrain diagnostic data response message	166
Table 161	Engine off service \$22 DID \$F501 validation.....	167
Table 162	Functional request current powertrain diagnostic data request message	170
Table 163	ECU#n request current powertrain diagnostic data response message	170
Table 164	Functional request current powertrain diagnostic data request message	171
Table 165	ECU#n request current powertrain diagnostic data response message	171
Table 166	Physical request supportedDTCextendedrecord information request message	172
Table 167	ECU#n request supportedDTCextendedrecord information response message	173
Table 168	Functional request current powertrain diagnostic data request message	174
Table 169	ECU#n request current powertrain diagnostic data response message	174
Table 170	Functional request clear/reset emission-related diagnostic information request message	175
Table 171	ECU#n request clear/reset emission-related diagnostic information response message	175
Table 172	Functional request current powertrain diagnostic data request message	175
Table 173	ECU#n request current powertrain diagnostic data response message	176
Table 174	Engine off service \$22 DID \$F501 validation.....	176
Table 175	Physical request DTCExtendedDataRecord request message	179
Table 176	ECU#n request DTCExtendedDataRecord response message	179
Table 177	Functional request emission-related diagnostic trouble codes with pending status request message	180
Table 178	ECU#n request emission-related diagnostic trouble codes with pending status response message with no pending DTCs available	180
Table 179	Functional request emission-related diagnostic trouble codes with confirmed status request message.....	181
Table 180	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with no confirmed DTCs available	181
Table 181	Physical request DTCExtendedDataRecord request message	182
Table 182	ECU#n request DTCExtendedDataRecord response message	182
Table 183	Readiness group identifiers	183
Table 184	Physical request DTCExtendedDataRecord request message	184
Table 185	ECU#n request DTCExtendedDataRecord response message	184
Table 186	Physical request DTCExtendedDataRecord request message	185
Table 187	ECU#n request DTCExtendedDataRecord response message	185
Table 188	Functional request current powertrain diagnostic data request message	186
Table 189	ECU#n request current powertrain diagnostic data response message	186
Table 190	Functional request current powertrain diagnostic data request message	186
Table 191	ECU#n request current powertrain diagnostic data response message	186
Table 192	General denominator requirements	187
Table 193	Functional request current powertrain diagnostic data request message	188
Table 194	ECU#n request current powertrain diagnostic data response message	188
Table 195	Functional request current powertrain diagnostic data request message	189
Table 196	ECU#n request current powertrain diagnostic data response message	189
Table 197	Functional request current powertrain diagnostic data request message	190
Table 198	ECU#1 request current powertrain diagnostic data response message	190
Table 199	ECU#2 request current powertrain diagnostic data response message	190
Table 200	Functional request current powertrain diagnostic data request message	191
Table 201	ECU#n request current powertrain diagnostic data response message	191
Table 202	Physical request DTCExtendedDataRecord request message	192
Table 203	ECU#n request DTCExtendedDataRecord response message	192
Table 204	Functional request current powertrain diagnostic data request message	192
Table 205	ECU#n request current powertrain diagnostic data response message	193
Table 206	Physical request DTCExtendedDataRecord request message	193
Table 207	ECU#n request DTCExtendedDataRecord response message	194
Table 208	Functional request current powertrain diagnostic data request message	194
Table 209	ECU#n request current powertrain diagnostic data response message	195
Table 210	Physical request DTCExtendedDataRecord request message	195

Table 211	ECU#n request DTCExtendedDataRecord response message	196
Table 212	Physical request DTCExtendedDataRecord request message	196
Table 213	ECU#n request DTCExtendedDataRecord response message	197
Table 214	Functional request current powertrain diagnostic data request message	197
Table 215	ECU#n request current powertrain diagnostic data response message	197
Table 216	Functional request current powertrain diagnostic data request message	198
Table 217	ECU#n request current powertrain diagnostic data response message	198
Table 218	Functional request current powertrain diagnostic data request message	199
Table 219	ECU#n request current powertrain diagnostic data response message	200
Table 220	Physical request DTCExtendedDataRecord request message	200
Table 221	ECU#n request DTCExtendedDataRecord response message	201
Table 222	Physical request DTCExtendedDataRecord request message	201
Table 223	ECU#n request DTCExtendedDataRecord response message	202
Table 224	Request current powertrain diagnostic data request message	203
Table 225	Functional request current powertrain diagnostic data request message	203
Table 226	ECU#n request current powertrain diagnostic data response message	203
Table 227	Physical request current powertrain diagnostic data request message	204
Table 228	ECU#n request current powertrain diagnostic data response message	204
Table 229	Functional request current powertrain diagnostic data request message	205
Table 230	ECU#n request current powertrain diagnostic data response message	205
Table 231	Engine off service \$22 DID \$F501 validation	205
Table 232	Physical request DTCExtendedDataRecord request message	206
Table 233	ECU#n request DTCExtendedDataRecord response message	206
Table 234	Physical request DTCExtendedDataRecord request message	207
Table 235	ECU#n request DTCExtendedDataRecord response message	208
Table 236	Physical request DTCExtendedDataRecord request message	208
Table 237	ECU#n request DTCExtendedDataRecord response message	208
Table 238	Functional request current powertrain diagnostic data request message	209
Table 239	ECU#n request current powertrain diagnostic data response message	209
Table 240	Functional request current powertrain diagnostic data request message	210
Table 241	ECU#n request current powertrain diagnostic data response message	210
Table 242	Functional request current powertrain diagnostic data request message	211
Table 243	ECU#n request current powertrain diagnostic data response message	211
Table 244	Engine off service \$22 DID \$F501 validation	212
Table 245	Functional request emission-related diagnostic trouble codes with confirmed status request message	212
Table 246	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with no confirmed DTCs available	213
Table 247	Functional request emission-related diagnostic trouble codes with pending status request message	213
Table 248	ECU#n request emission-related diagnostic trouble codes with pending status response message with no pending DTCs available	214
Table 249	Functional request clear/reset emission-related diagnostic information request message	214
Table 250	ECU#n request clear/reset emission-related diagnostic information response message	214
Table 251	Physical request DTCExtendedDataRecord request message	215
Table 252	ECU#n request DTCExtendedDataRecord response message	215
Table 253	Physical request DTCExtendedDataRecord request message	216
Table 254	ECU#n request DTCExtendedDataRecord response message	216
Table 255	Functional request current powertrain diagnostic data request message	216
Table 256	ECU#n request current powertrain diagnostic data response message	216
Table 257	Functional/physical request clear/reset emission-related diagnostic information request message	219
Table 258	ECU#1 request clear/reset emission-related diagnostic information response message	219
Table 259	Physical request current powertrain diagnostic data request message	220
Table 260	ECU#1 request current powertrain diagnostic data response message	220
Table 261	Physical request current powertrain diagnostic data request message	220
Table 262	ECU#2 request current powertrain diagnostic data response message	220
Table 263	PSA = FALSE Service \$22 DID validation	222
Table 264	Functional/physical request clear/reset emission-related diagnostic information request message	223
Table 265	ECU#1 request clear/reset emission-related diagnostic information response message	224

Table 266	PSA = TRUE Service \$22 DID validation	224
Table 267	Physical request current powertrain diagnostic data request message	226
Table 268	ECU#1 request current powertrain diagnostic data response message	226
Table 269	Physical request current powertrain diagnostic data request message	227
Table 270	ECU#2 request current powertrain diagnostic data response message	227
Table 271	PSA=TRUE Vehicle Information Service \$22 ITID validation	228
Table 272	Physical request propulsion-related diagnostic trouble codes with pending status request message	232
Table 273	ECU#n request propulsion-related diagnostic trouble codes with pending status response message with pending DTCs available	232
Table 274	Physical request propulsion-related diagnostic trouble codes with confirmed status request message	234
Table 275	ECU#n request emission-related diagnostic trouble codes with confirmed status response message with no confirmed DTCs available	234
Table 276	Physical request propulsion-related diagnostic trouble codes with pending status request message	235
Table 277	ECU#n request propulsion-related diagnostic trouble codes with pending status response message with pending DTCs available	235
Table 278	Physical request propulsion-related diagnostic trouble codes with confirmed status request message	237
Table 279	ECU#n request propulsion-related diagnostic trouble codes with confirmed status response message with no confirmed DTCs available	237
Table 280	Physical request propulsion-related diagnostic trouble codes with pending status request message	238
Table 281	ECU#n request propulsion-related diagnostic trouble codes with pending status response message with no pending DTCs available	239

1. SCOPE

The primary objective of this recommended practice is to confirm that vehicles can communicate a minimum set of information in accordance with diagnostic test services specified in SAE J1979-2, or the equivalent ISO 14229-1:2013 (Ed. 2) and SAE J1979-3 documents. A successful result using the SAE J1699-5 Automotive Alliance for Innovation (AAI) software for OBD-II testing indicates that the main aspects of UDS communication have been examined, but it does not provide assurance of complete compliance with all aspects of SAE J1979-2 or SAE J1979-3.

SAE J1699-5 tests run with a SAE J2534 device hardware and API that is not fully compliant will result in a test failure.

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

2. REFERENCES

2.1 Applicable Documents

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

2.1.1 SAE Publications

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

SAE J1930	Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms - Equivalent to ISO 15031-2
SAE J1930DA	Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet
SAE J1962	Diagnostic Connector NOTE: Equivalent to ISO 15031-3 – Communication between vehicle and external equipment for emissions-related diagnostics – Part 3: Diagnostic connector and related electrical circuits, specification and use.
SAE J1978-2	OBD II Scan Tool Second Generation Protocols
SAE J1979-2	E/E Diagnostic Test Modes: OBDOnUDS
SAE J1979-3	E/E Diagnostic Test Modes: Zero Emission Vehicle Propulsion Systems on UDS (ZEVonUDS)
SAE J1979DA	Digital Annex of E/E Diagnostic Test Modes
SAE J2012	Diagnostic Trouble Code Definitions NOTE: Equivalent to ISO 15031-6 – Communication between vehicle and external equipment for emissions-related diagnostics – Part 6: Diagnostic trouble code definitions
SAE J2012DA	Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions
SAE J2284-3	High-Speed CAN (HSC) for Vehicle Applications at 500 kbps

SAE J2534-1	Recommended Practice for Pass-Thru Vehicle Programming
SAE J2534-1_5_00	Recommended Practice for Pass-Thru Vehicle Programming
SAE J2534-2/BA_0500	Pass-Thru Extended Features - Base Document
SAE J2534-2/RE_0500	Pass-Thru Extended Features - Resource Document
SAE J2534-2/9_0500	Pass-Thru Extended Features - Ethernet NDIS

2.1.2 ISO Publications

Copies of these documents are available online at www.iso.org/store.

ISO 13400-2:2019 (Ed. 2)	Road vehicles – Diagnostic communication over Internet Protocol (DoIP) – Part 2: Transport protocol and network layer services
ISO 13400-4:2016 (Ed.1)	Road vehicles – Diagnostic communication over Internet Protocol (DoIP) – Part 4: Ethernet-based high-speed data link connector
ISO 14229-1:2020 (Ed. 3)	Road vehicles – Unified diagnostic services (UDS) – Part 1: Specifications and requirements
ISO 14229-1 Amd. 1 (Ed. 2022)	Road vehicles – Unified diagnostic services (UDS) – Part 1: Specifications and requirements
ISO 14229-2:2021 (Ed. 2)	Road vehicles – Unified diagnostic services (UDS) – Part 2: Session layer services
ISO 14229-3:2022 (Ed. 2)	Road vehicles – Unified diagnostic services (UDS) – Part 3: Unified diagnostic services on CAN implementation (UDSonCAN)
ISO 14229-5:2022 (Ed. 2)	Road vehicles – Unified diagnostic services (UDS) – Part 5: Unified diagnostic services on Internet Protocol implementation (UDSonIP)
ISO 15765-4:2021 (Ed. 4)	Road vehicles – Diagnostic communication over Controller Area Network (DoCAN) – Part 4: Requirements for emissions-related systems
ISO 27145-4:2016 (Ed. 2)	Road vehicles – Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements – Part 4: Connection between vehicle and test equipment
ISO 27145-6:2023 (Ed. 2)	Road vehicles – Implementation of World-Wide Harmonized On-Board Diagnostics (WWH-OBD) communication requirements – Part 6: External test equipment

2.2 Related Publications

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

2.2.1 SAE Publications

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

SAE J1699-2 Test Cases for OBD-II Scan Tools and I/M Test Equipment

SAE J1699-3 Vehicle OBD II Compliance Test Cases

2.2.2 ISO Publications

Copies of these documents are available online at www.iso.org/store.

ISO 11898 Road vehicles – Interchange of digital information – Controller area network (CAN) for high speed communication

2.2.3 Other Publications

2.2.3.1 CARB OBD Regulations and Rulemaking

OBD II and associated enforcement regulations, sections 1968.2 and 1968.5, title 13, California Code of Regulations

HD OBD and associated enforcement regulations, sections 1971.1 and 1971.5, title 13, California Code of Regulations

ZEV and ACC II regulations, sections 1962.3-8, title 13, California Code of Regulations

2.2.3.2 European OBD Regulation

European OBD and emission legislation is available at the following web site: <http://eur-lex.europa.eu/homepage.html>

2.2.3.3 SAE J1699 Software Licensing

The Alliance for Automotive Innovation is releasing SAE J1699-3/5 test software.

See licensing details and releases at this web address: <[OBD Certification Public Access | Alliance for Automotive Innovation \(autosinnovate.org\)](http://OBD_Certification_Public_Access_|_Alliance_for_Automotive_Innovation_(autosinnovate.org))>

2.3 Definitions

The definitions provided in SAE J1930 apply to this document as applicable.

2.3.1 Definition of Terms

The definitions of terms that are related to the use of this document may be found in the publications listed under 2.1, Applicable Documents.

2.4 Acronyms

The following are common acronyms used in this document:

A/C	Air Conditioning
ACC II	Advanced Clean Cars II
ACK	Acknowledgment (DoIP)
CAN	Controller Area Network
CALID	Calibration Identification
CI	Compression Ignition
CID	Component ID
CNOBD	China OBD
CVN	Calibration Verification Number
D/CI	Diesel/Compression Ignition
DEC ECU	Diagnostic or Emission Critical ECU
DID	Data Identification (number)
DLC	Data Length Code (also Data Link Connector, e.g., SAE J1962 connector)
DoIP	Diagnostics Over Internet Protocol
DTC	Diagnostic Trouble Code
DTM	Diagnostic Test Mode
ECU	Electronic Control Unit
EOBD	European On Board Diagnostics
G	Gasoline/Spark ignition
HD	Heavy Duty (US vehicles > 14000 pound GVWR or European vehicles > 2610 kg RW in M ₁ , M ₂ , N ₁ , and N ₂ categories or all vehicles in M ₃ and N ₃ categories)
HEV	Hybrid Electric Vehicle
HSC	High Speed CAN
ICE	Internal Combustion Engine
IOBD	India OBD
I/M	Inspection and Maintenance
ISO	International Standards Organization

Kbps	Kilobits per second
KWP	Key Word Protocol
LD	Light Duty (US passenger cars, light duty trucks, and medium duty engines $\leq$ 14000 pound GVWR or European vehicles $\leq$ 2610 kg RW in M ₁ , M ₂ , N ₁ , and N ₂ categories.
MD	Medium Duty (medium duty engines $\leq$ 14000 pound GVWR, engine dyno certified
MIL	Malfunction Indicator Lamp
NACK	Non-Acknowledgement (DoIP)
OBD-II	On Board Diagnostics (level 2) (US OBD-II for LD and MD)
OBDBr	On Board Diagnostics for Brazil
OBDM	On Board Diagnostic Monitor
PCM	Powertrain Control Module
PHEV	Plug In Hybrid Electric Vehicle
PR-ECU	Propulsion-Related ECU
PSA	Propulsion System Active
PWM	Pulse Width Modulation
RPM	Revolutions Per Minute (engine speed)
SAE	SAE International
SI	Spark Ignition
SID	Service ID
S/S	Stop/Start
TID	Test ID
VIN	Vehicle Identification Number
VPW	Variable Pulse Width (modulation)

3. OVERVIEW OF SAE J1699-5 TEST CASES

The SAE purpose of the testing is to gain confidence that communications with the vehicle can be established and maintained according to the protocols allowed in SAE J1979-2/-3 (ISO 14229-1), and further, that the test modes (diagnostic services) defined in SAE J1979-2/-3 and implemented on the vehicle adhere to the defined structure and return data which can be interpreted using the information contained in this SAE J1979 document.

Manufacturers must meet CARB Section 1968.2 (j)(1) and 1971.1 (l)(1) Production Engine/Vehicle Evaluation (PEVE/PVE) for Standardization to remain OBD II/HD OBD-compliant. China 6+ also requires PVE standardization testing and reporting. Testing and results reporting must occur within regulatory requirements. SAE J1979-2 changes will lengthen the testing time due to both increased Primary DEC ECUs testing requirements and the number of Primary DEC ECUs on vehicle networks. The compliance tests should thoroughly exercise the OBD II/HD OBD system yet not dramatically increase the required test time.

The SAE J1699-5 compliance test cases should: 1) confirm the diagnostic manager essential functions operate correctly, 2) verify all required data items for given Model Year are supported (per 1968.2, 1962.5 and 1971.1, EOBD, etc.), 3) verify all data lengths and messages are correct, and 4) display prompts/warnings for vehicle MY within a specified phase-in period. Additionally, where possible, the test cases should flag/warn potentially erroneous data, e.g., engine running when supposed to be off, Engine/test group MY character does not match VIN MY for chassis dyno-certified vehicles, etc. Support for other markets will be added in later revisions.

SAE J1699 primarily tests communication protocol valid data structure, and proper data items support. It also exercises core OBD Diagnostic Event Manager (DEM) functionality.

Out-of-Scope Functionality: Validation of in-range data output. It is not feasible for the SAE J1699-5 test, in many cases, to determine if a given data item output is correct. There are limited instances where correct response can be inferred or deduced from comparison to other legislated data, and appropriate warnings displayed. However, this is not the case for most outputs. SAE J1699-5 cannot detect vehicle software implementation errors, such as data byte clipping.

This document is structured in the following manner:

Section 3 – Provides an overview and specifies general conditions for testing.

Section 4 – Defines the required message structure and required timing for each protocol.

Sections 5 through 9 – These sections are known as the Static Test. A complete test of permanent codes requires running the CARB drive cycle. The general order of testing will be similar to SAE J1699-3, with engine-off static tests being completed first followed by engine running tests. Given SAE J1979-2 now has functional and physical addressing to each primary DEC ECU, the test order will remain the same, but functional and physical testing will be completed by test, rather than all functional tests first then all physical tests.

Sections 10 through 11 – These sections are known as the Dynamic Test. The Dynamic Tests must be run over several driving cycles and require the vehicle to be driven.

Section 12 – This section tests Zero Emission Vehicles (ZEVs) to SAE J1979-3 requirements.

Within each subsection, the Request and Response message data for each of the allowed protocols and test mode (service) that need to be conducted are defined. Evaluation criteria to judge success or failure are defined.

Figure 1 shows which services are required to be supported under each operating condition per 13 CCR 1968.2 (g)(3.4.1) and 13 CCR 1971.1 (h)(3.1.1). Required support is indicated with “X” and optional support is indicated with “Optional.”

Section	Condition	Services		Purpose
5	No Malfunctions	\$22\$F4/F5/F7xx, \$19 04 \$19 42 (04/08). \$14, \$22 \$F6xx \$31 01 \$22 \$F8/\$F9xx \$19 55		Basic test Service support
Test Item	Functional	Physical	Engine Off	Engine Running
MIL Bulb Check -Operator			X	N/A
ProtocolIdentification (Standard, Reverse Order)	X		X	X
ClearDiagnosticInformation	X	Optional	X	
ReadMILStatus	X	X	X	X
reportWWHOBDDTCWithPermanentStatus	X	X	X	X
reportWWHOBDDTCByReadinessGroup	Optional	X	X	X
reportDTCExtendedDataIdentification	Optional	X	X	X
ReadTestFailedThisOperation Cycle	X	X	X	X
reportWWHOBDDTCByMaskRecord (pending)	X	X	X	X
reportWWHOBDDTCByMaskRecord (confirmed)	X	X	X	X
RequestTestResults Svc \$19 \$06 DTC \$92)		X	X	X
RequestCurrentDiagnosticData (Svc \$22 \$F4/\$F5xx)	X	X	X	X
RequestTestRoutineSupport (Svc \$31 \$01 \$Exxx)	X	X	X	X
RequestVehicleInformation (\$F8/\$F9xx)	X	X		X
ReportDTCSnapshotRecordByDTCNumber (Svc \$19 \$04)	X	X	X	X
ReportCurrentDiagnosticDataBurstTest (\$F400/\$F501)		X		X
6	Malfunction Set - Pending Trouble Codes	\$19 04, \$19 42 (04/08)		DTC and status properly reported
Test Item	Functional	Physical	Engine Off	Engine Running
reportWWHOBDDTCByMaskRecord (pending)	X	X	X	X
reportWWHOBDDTCByMaskRecord (confirmed)	X	X	X	X
reportWWHOBDDTCWithPermanentStatus	X	X	X	X
ReportDTCSnapshotRecordByDTCNumber	X	X	X	X
reportWWHOBDDTCByReadinessGroup (Svc \$19 56)	Optional	X	X	X
reportDTCExtendedDataIdentification	Optional	X	X	X
RequestCurrentDiagnosticDataSupport (\$F400/20/40/60/80/A0/\$F500/20)	X	X	X	X
7	Malfunction Set - Confirmed DTC	\$19 04, \$19 42 (04/08), \$19 55		DTC and status properly reported
Test Item	Functional	Physical	Engine Off	Engine Running
reportWWHOBDDTCByMaskRecord (pending)	X	X	X	X
reportWWHOBDDTCByMaskRecord (confirmed)	X	X	X	X
ReportDTCSnapshotRecordByDTCNumber	X	X	X	X
reportWWHOBDDTCWithPermanentStatus	X	X	X	X
RequestCurrentDiagnosticDataSupport (\$F400/20/40/60/80/A0/\$F500/20)	X	X	X	X



Section	Condition	Services		Purpose
8	Fault Repaired	\$19 04, \$19 42 (04/08), \$19 55		DTC and status properly reported
reportWWHOBDDTCByMaskRecord (pending)	X	X	X	X
reportWWHOBDDTCByMaskRecord (confirmed)	X	X	X	X
reportDTCSnapshotRecordByDTCNumber (Svc\$19 \$04)	X	X	X	X
reportWWHOBDDTCWithPermanentStatus	X	X	X	X
RequestCurrentDiagnosticDataSupport (\$F400/20/40/60/80/A0/\$F500/20)	X	X	X	X
9	After 3 Driving Cycles	\$19 04, \$19 42 (04/08), \$19 55		DTC and status properly reported
reportWWHOBDDTCByMaskRecord (pending)	X	X	X	X
reportWWHOBDDTCByMaskRecord (confirmed)	X	X	X	X
reportDTCSnapshotRecordByDTCNumber (Svc \$19 \$04)	X	X	X	X
reportWWHOBDDTCWithPermanentStatus	X	X	X	X
RequestCurrentDiagnosticDataSupport (\$F400/20/40/60/80/A0/\$F500/20)	X	X	X	X
Test Item	Functional	Physical	Engine Off	Engine Running
10	No Malfunctions	\$19 42 (04/08), \$14, \$19 56 \$22 \$F4/F5/F7xx, \$F6xx, \$F8xx		Check in-use performance counters (all primary DEC ECUs)
ProtocolIdentification (standard)	X		X	
RequestCurrentDiagnosticDataSupport (\$F400/20/40/60/80/A0/\$F500/20)	X	X	X	X
RequestVehicleInformation (\$F8/\$F9xx)	X	X	X	
RequestCurrentDiagnosticData (\$F4/\$F5xx)	X	X	X	X
ClearDiagnosticInformation (Svc \$14)	X	Optional	X	
RequestCurrent Readiness (\$F501)	X	X	X	
RequestTestResults (Svc \$19 \$06 DTC \$92)		X	X	X
reportWWHOBDDTCByMaskRecord (pending)	X	X	X	
reportWWHOBDDTCByMaskRecord (confirmed)	X	X	X	
RequestIUMPRInformation (by DTC +SMAD)	X	X	X	
RequestPHEVIgnCtr (\$F812) (if app)	X	X	X	
CompleteCARBDriveCycle	X	X		X
reportWWHOBDDTCByReadinessGroup (Svc \$19 56)	Optional	X		X
reportDTCExtendedDataIdentification	Optional	X		X
RequestCurrentDiagnosticData (\$F40C/0D/1F) continuously for General Denominator increment determination	X	X		X
RequestIUMPRInformation (by DTC +SMAD, Svc \$19 06 DTC \$91/93) continuously, and over multiple drive cycles, indicate when all have incremented)	X	X		X
RequestCurrentDiagnosticData (\$F4/\$F5xx) (when all monitors complete)	X	X		X
RequestVehicleInformation (\$F8/\$F9xx)	X	X		X

Section	Condition	Services		Purpose
11	No Malfunctions	\$19 42 (04/08), \$14, \$19 56 \$22 \$F4/F5/F7xx, \$F6xx, \$F8xx		Check I/M readiness bits
ProtocolIdentification	X			X
RequestCurrentDiagnosticData (\$F4/\$F5xx)	X	X		X
RequestVehicleInformation (\$F8/\$F9xx)	X	X		X
reportWWHOBDDTCByReadinessGroup (Svc \$19 56)	Optional	X		
reportDTCExtendedDataIdentification	Optional	X		
CompleteCARBDriveCycle		X		X
RequestCurrentDiagnosticData (\$F401/0C/0D/1F) continuously for General Denominator increment determination	X	X		X
RequestVehicleInformation (\$F8/\$F9xx)	X	X		X
KeyCycle		X	X	
RequestCurrentDiagnosticDataSupport (\$F400/20/40/60/80/A0/\$F500)	X	X	X	
RequestCurrent Readiness (\$F501)	X	X	X	
RequestTestResults (Svc \$19 06 DTC 92)	X	X	X	
RequestVehicleInformation (\$F8/\$F9xx)	X	X	X	
reportWWHOBDDTCByMaskRecord (confirmed)	X	X	X	
reportWWHOBDDTCByMaskRecord (pending)	X	X	X	
ClearDiagnosticInformation (Svc \$14)	X	Optional	X	
RequestVehicleInformation (\$F8/\$F9xx)	X	X	X	
12 ZEVonUDS	No Malfunctions			
	Functional	Physical	PSA False	PSA True
ProtocolIdentification (includes DoIP)	X	X	X	X
ClearDiagnosticInformation	X	X	X	
RequestCurrentDiagnosticDataSupport (\$F400/20/40/60/80/A0/\$F500/20)		X	X	X
RequestCurrentDiagnosticData (Svc \$22 \$F4/\$F5xx)		X	X	X
RequestVehicleInformation (\$F8/\$F9xx)		X	X	X

Figure 1 - Conditions and services tested

3.1 Select Static Test or Dynamic Test Sequence

Purpose: Each group of tests will establish that under normal operating conditions, communication can be established and that all supported test services behave correctly. The following tests can be run in three major groups.

Sections 5 through 9 (Static Test) are run as a group to assess basic vehicle communication functionality.

Sections 10 through 11 (Dynamic Test) are run as a group to assess the proper function of the I/M Readiness bits and the in-use performance counters. Because the Dynamic Tests require driving a vehicle for as long as several days, the Dynamic Test has provisions to resume testing after the requisite monitoring cycles have been performed.

Section 12 will test required ZEVonUDS Functions as defined in SAE J1979-3.

Any software meeting these specifications must contain the following provisions for the user:

- Run Static Tests contained in Sections 5 through 9
- Run Dynamic Tests contained in Sections 10 through 11
- Resume Dynamic Tests contained in Sections 10 through 11
- Run ZEV Tests contained in Section 12

Prompt 1:

Select SAE - J2534 device to be used for test.

Screen Text: "Select tool (J2534 device) from the following list:" <Display accessible tools with a number before each one. User selects appropriate number>.

Prompt 2:

Prompt user whether to perform the static, dynamic, or ZEV test. If ZEV test is selected, ZEV must also be selected in Prompt 8.

Screen text: "Select the sections of test to be run from the following list:"

"1. Run ICE Static Tests contained in Sections 5 through 9."

"2. Run ICE Dynamic Tests contained in Section 10 through 11."

"3. Run ZEV/ACC II Tests contained in Section 12."

"4. Vehicle Report"

"E. Exit"

"Enter choice (1 to 4) (E to exit)"

Prompt 3:

Prompt user for the vehicle model year (model year as indicated by VIN) of the vehicle being tested. (Determine what info types must be supported in Service \$22 \$F8xx). The format should be 20XX. If the vehicle VIN model year in Service \$22 \$F802 does not match the user data, assume that the user is engaged in development work and use the model year input by the user to determine test criteria within this document.

Screen text: "Enter VIN Model Year of vehicle (model year is indicated by the Year character in VIN) (2024-2035):"

Prompt 4:

Screen Text: "If Static or ZEV Test selected, vehicle make and model is used to create logfile name, print prompt – "

"Enter vehicle make:"

Prompt 5:

Screen Text: "If Static or ZEV Test selected, vehicle make and model is used to create logfile name, print prompt – "

"Enter vehicle model:"

Prompt 6:

Prompt user for how many primary DEC ECUs are present in the vehicle. (Determine how many ECUs will respond to Service \$22, DID \$F400/500/700, Service \$22, \$F804/06 CALID/CVN, and Service \$22, \$F810 Protocol Identification requests from a generic scan tool.

NOTE: "Primary DEC ECU" in this standard has the same meaning as "Primary (Autonomous) ECU" in SAE J1930 DA Glossary.

"Secondary/Dependent Secondary ECUs" have the same meaning as "Secondary or Dependent ECU" in SAE J1930 DA Glossary.

Screen Text: "How many diagnostic or emission critical ECUs are on this vehicle" (1 to 8 for 11-bit CAN ID; 1-238 for 29-bit CAN ID):"

Prompt 7:

Prompt user for the type of energy: Internal combustion engine (ICE) or Zero-Emission Vehicle (ZEV). If ZEV tests selected in Prompt 2, perhaps this pick can be auto-selected by the software, or a confirm ZEV option can be displayed.

If ZEV: Select Battery Electric (BEV) or Fuel Cell Electric Vehicle (FCEV). This pick selects SAE J1979-3 requirements in Section 12. Then go to Prompt 8b to determine ZEV type.

If ICE, go to Prompt 8a for fuel type.

Screen text: "What type of energy is used by this vehicle?"

"1. Internal Combustion (ICE)"

"2. Zero Emission Vehicle (ZEV)"

"Enter selection number (1 or 2):"

Prompt 8a:

For ICE, prompt user for type of fuel. This pick selects SAE J1979-2 requirements. Select, fuel type [gasoline (G), diesel (D), compressed natural gas (CNG)/hydrogen (H2), or Other, e.g., LPG or Ammonia]

Screen text: "What type of fuel is used by this vehicle?"

"1. Gasoline (G)"

"2. Diesel (D)"

"3. Compressed Natural Gas/Hydrogen (CNG/H2)"

"4. Other"

"Enter selection number (1 to 4):"

Prompt 8b:

For ZEV, prompt user for Battery Electric Vehicle (BEV), or Fuel Cell Electric Vehicle (FCEV).

Screen text: "What kind of ZEV is being tested?"

"1. Battery (BEV)"

"2. Fuel Cell (FCEV)"

"Enter selection number (1 or 2)"

If 1 (BEV) selected, print prompt:

"NOTE: Do NOT plug-in charge the vehicle during static test."

Prompt 9:

For ICE, prompt user for type of powertrain (conventional, stop-start[S/S], hybrid [HEV] or plug-in hybrid [PHEV]) for the vehicle being tested. (Determine what DIDs and value ranges must be supported in Service \$22 \$F4xx-5xx, F6xx, F8xx and Service \$19 04.) Note that HEV, PHEV, and stop-start vehicles will typically turn off the engine at idle.

Screen text: "For ICE, what type of powertrain is in this vehicle?"

"1. Conventional"

"2. Stop/Start (S/S)"

"3. Hybrid Electric Vehicle (HEV)"

"4. Plug-In Hybrid Electric Vehicle (PHEV)"

"Enter selection number (1 to 4):"

If 4 (PHEV) selected, print prompt:

“NOTE: Do NOT plug-in charge the vehicle during static test.”

Then:

“Does this PHEV meet ACC II ZEV Credit Standardization Requirements? (Y/N)”

NOTE: 2026MY+ PHEVs that meet CCR 1962.4 (e)(1) to accrue ZEV credits must support ZEV standardization requirements in Section 12, including ZEV required DIDs and Display of Data to the Vehicle User requirements in CCR 1962.5 (c)(6).

Prompt 10:

For ICE, prompt user whether to perform a U.S. OBD test, a European OBD (EU7) test, an India OBD test without IUMPR, a Brazil OBD test without IUMPR, or a China 7 (CN7) OBD test.

Screen text: “What type of compliance test is to be performed”

“1. US OBD II”

“2. US Heavy Duty OBD (GVWR > 14,000 lb”

The following options will be added in future releases:

“3. European OBD (EU7)”

“4. European HD OBD (EU7) (GVWR > 2,610 kg)”

“5. China OBD (CN7)”

“6. India Bharat 6 Stage 3 OBD (BS 6-St. 3)”

“7. India Bharat VI Stage 3 HD (BS VI- St. 3) (GVWR>.3.5T)”

“8. Brazil OBD Phase 7 without Evap (OBDBr-P7)”

“9. Brazil OBD Phase 8 with Evap (OBDBr P8)”

“Enter selection number (1 to 9):”

Prompt 11:

If a non-heavy duty (LD or MD) was selected in Prompt 10, ask what type of vehicle is being tested; Light-duty passenger car/truck up (PC/LDT) to 8500 pound GVW, medium-duty truck or passenger vehicle (MDPV) up to 14000 pound GVW—and, if medium-duty truck/MDPV, whether the vehicle was certified on an engine dyno or a chassis dyno. (Note: All heavy-duty trucks are engine dyno-certified, so there is no need to ask the question.)

Screen text: “If a non-Heavy Duty (HD) type was selected in previous prompt -- What type of vehicle is being tested?”

“1. Light Duty Vehicle Chassis Dyno Certified (LD)”

“2. Medium Duty Truck or Passenger Vehicle Chassis Certified (8,501-14,000 lb GVWR) (MD/MDPV)”

“3. Medium Duty Truck Engine Dyno Certified (<14,000 lb GVWR) (MDE)”

“Enter selection number (1 to 3):”

Prompt 12:

If HD or MDE was selected in either of the previous two prompts – Enter Engine Certification Model Year (model year as indicated by engine certification label). This will be compared to the engine certification year (model year as indicated by first character of emission test group label in Service \$22, \$F813) of the vehicle being tested.

Screen text: “Enter Engine Certification Model Year (engine model year as indicated by the year on the engine emission label) (2023-2035):”

This creates the following categories of vehicles:

- U.S. OBD for light-duty passenger cars or trucks ≤8500 pound GVWR (LD OBD II).
- U.S. OBD for medium-duty truck/MDPV, chassis dyno-certified ≤14000 pound GVWR (MDV OBD II).
- U.S. OBD for medium-duty truck, engine dyno-certified ≤14000 pound GVWR (MDE OBD II).
- U.S. OBD for heavy-duty truck >14000 pound GVWR (HD OBD).

The following markets will be added in future releases:

- EOBD for light-duty passenger car (LD EU7).
- EOBD for light-duty truck (LD EU7).
- EOBD for heavy-duty truck (HD EU7).
- India Bharat 6 OBD Stage 3 for passenger cars and trucks below 3.5T GVW (tested as LD EOBD (EU 6d) with IUMPR).
- India Bharat VI OBD Stage 3 for trucks above 3.5T GVW (tested as HD EOBD (EU VI) with IUMPR).
- Brazil OBD Phase 7 without Evaporative monitor for light-duty passenger cars and trucks.
- Brazil OBD Phase 8 with Evaporative monitor for light-duty passenger cars and trucks.
- China OBD for light-duty passenger cars (CN7).

Formal testing must be conducted on a production vehicle containing no faults with the test equipment connected via the SAE J1962 diagnostic connector. Formal testing will follow the order defined in this document. It is assumed that these tests will also be conducted during vehicle development. If the tests are to be run off vehicle, out of order, or the initial conditions have not been controlled, then care needs to be taken when interpreting the results. It is a suggested software implementation that a logfile with test results be retained to support manufacturers' OBD-II certification efforts. There should be a separate logfile retained for the static test and for the dynamic test. In addition to recording the test results and timestamping data, the logfile should record the vehicle VIN, as well as the CALID and the CVN of all ECUs that respond with that data to help identify the specific vehicle that was tested and the level of software in each ECU.

NOTE: Some items that are tested in one section are tested again in another section. Although this is redundant from a testing standpoint, it was anticipated that software that meets these specifications would be reusing large portions of modular code. This document was structured to allow for maximum reuse of modular software.

The following notes are applicable to the vehicle testing described in this document:

1. Battery voltage at the SAE J1962 connector pin 16 must be between 11.0 and 18.0 V (i.e., nominal 12 V system with the engine off and the engine running). Any software meeting these specifications will check voltage to ensure that it is within the specified range each time the software executes the protocol determination routine. If battery voltage falls outside the specified range, the software will flag a warning and prompt the operator to determine if testing is to continue.
2. All data specified within messages are hex unless otherwise specified.
3. Multiple ECUs can respond to SAE J1979-2 (ISO 14229-1) request messages.
4. XX = valid reported hex data (data not checked/specified in this document).
5. x = valid reported bit data (data not checked/specified in this document).
6. Each OBD ECU will respond within the time defined in 4.2.
7. OBD messages on ISO 15765-4 protocol must only be received from the CAN identifiers shown in Figures 4 and 5. The maximum number of legislated OBD ECUs in an OBD compliant vehicle must not exceed eight using 11-bit CAN IDs. The maximum number of legislated OBD ECUs in an OBD compliant vehicle can exceed 200 using 29-bit CAN IDs, but even the most complex vehicles will not approach this amount. For a given vehicle, each OBD identifier must be unique. The SAE J2534 device will ignore OBD responses from CAN identifiers not shown in Figures 4 and 5. 29-bit CAN IDs are only allowed to use addresses in the range 0x00 to 0x32 0x34 to 0x52 and 0x54 to 0xEF.
8. It is assumed that any software meeting these specifications will follow the testing sequence specified in this document. Failure to do so may result in incorrect results.
9. All OBD diagnostic- or emission-critical propulsion ECUs must support Service \$22, DID \$F810.
10. Procedure to determine when the link drops out: Send Service \$22 DID \$F810. The proper response from all OBD ECUs will be verified or the diagnostic link will be flagged as being “down” and the test aborted.
11. Repeated/identical responses from a given ECU for a given request message must be flagged as a warning. Any software meeting these specifications will use the last response.
12. A failure is defined as an ECU response that does not meet the evaluation criteria described in this document and does not meet the requirements specified in the OBD-II regulations or another SAE/ISO document referenced by the OBD-II regulations. A warning is defined as an ECU response that does not meet the evaluation criteria described in this document and may or may not meet the requirements specified in the OBD-II regulations or another SAE/ISO document referenced by the OBD-II regulations. Examples include EO Approval items such as an alternate phase-in that extends after the specified model year, and a DEC ECU reporting multiple CALID/CVN pairs for secondary DEC ECUs. Warnings require the operator to evaluate whether the ECU response is correct for the particular vehicle and software application. The operator, therefore, must determine whether the vehicle meets the appropriate OBD-II requirements.
13. A “single request” refers using ISO 15765-4 to request only a single data item, e.g., a single DID, even though ISO 15765-4 allows requests for multiple data items in a single message, e.g., six DIDs.
14. Inability to meet OBD communication protocols specified in the document (e.g., Message Format, Message Timing, Data Not Available) must be logged as a failure.
15. Fail on NRC \$78 responses for Service \$22 INFOTYPE \$F802 (VIN), CALID (INFOTYPE \$F804), IPT (INFOTYPE \$F808 or INFOTYPE \$F80B), ECUNAME (INFOTYPE \$F80A), ESN (INFOTYPE \$F80D), EROTAN (INFOTYPE \$F80F). NRC \$78 is allowed for CVN for EOBD/IOBD/OBDBr.
16. The software will validate the desired engine running state during the test (engine on/engine off) to ensure the actual state (as determined by SID \$22 DID \$F40C) matches the state desired in each section of the test. If the states do not match, this will be logged as a warning.

4. VEHICLE CONNECTION AND COMMUNICATION REQUIREMENTS

4.1 Connection to the Vehicle

4.1.1 J2534 Interface Adapters

SAE J1699-5 tests are required to use a SAE J2534/1 (API Version 04.04) or SAE J2534-1_0500 (API Version 05.00) interface. The use of a SAE J2534/2 (API Version 04.04) or SAE J2534-2/BA_0500 (API Version 05.00) interface is acceptable if the following conditions are met:

- The number of 29-bit ISO 15765 OBD ECUs exceeds the capacity of the SAE J2534-1 interface.
- The SAE J2534-2 interface meets or surpasses all SAE J2534-1 requirements.
- SAE J2534 device firmware should ensure connection to the proper SAE J1962 DLC pins when the application sets the protocol ID. To perform SAE J1699-5 testing, the application should set the CAN protocol ID and the device firmware should then allow ISO 15765-4 or ISO 14229-1/ISO 14229-3 communications on pins 6 and 14. In this legislative driven use case, placement of any other CAN related protocol performed on DLC pins 6 and 14, e.g., FD, Fault Tolerant, Single Wire, may cause a test failure.

NOTE: Use of SAE J2534 API V04.04 is allowed, but may cause a test fail during extended data record requests to ECU Server(s). Failure conditions like this are likely due to the 4128-byte buffer data limit. Because of new regulatory requirements, the ECU Server(s) may respond with more data, in which case the use of SAE J2534 API V05.00. SAE J1699-5 Tests for SAE J1979-3 ZEVonUDS functionality must be run using a SAE J2534/2 (API Version 04.04) or SAE J2534-2/BA_0500 and SAE J2534-2/9 (API Version 05.00) interface.

4.1.2 Direct Connect Ethernet Cable

The Direct Connect Ethernet cable can be used for developmental testing, but because ISO 15765 cannot be checked, the vehicle will ultimately FAIL. Message format

The message format for CAN, including SAE J2284/3 (500 Kbps), and defined in ISO 15765-4 is shown in Figure 2.

Diagnostic Message Format

Header bytes	CAN frame data field							
CAN Identifier (11 or 29 bit)	#1	#2	#3	#4	#5	#6	#7	#8

Figure 2 - Diagnostic message format for ISO 15765-4

ECU responses will be verified to be properly padded per ISO 15765-4. Per ISO 15765-4, pad bytes from the ECU to the tool are not specified. Incorrect padding (i.e., lack of pad bytes) for messages from the ECU to the tool must be flagged as a one-time failure. Within this document, pad bytes from the tool to the ECU will be set to \$00.

CAN communication is required to be 500 kbps to meet OBD II requirements. EOBD India and Brazil OBD allow 250 kbps or 500 kbps.

CAN identifiers are defined in Figures 3 and 4.

CAN Identifier	Description
\$7DF	CAN Identifier for functionally addressed request messages sent by the external test equipment.
\$7E0	Physical request CAN Identifier from the external test equipment to ECU #1
\$7E8	Physical response CAN Identifier from ECU #1 to the external test equipment
\$7E1	Physical request CAN Identifier from the external test equipment to ECU #2
\$7E9	Physical response CAN Identifier from ECU #2 to the external test equipment
\$7E2	Physical request CAN Identifier from the external test equipment to ECU #3
\$7EA	Physical response CAN Identifier from ECU #3 to the external test equipment
\$7E3	Physical request CAN Identifier from the external test equipment to ECU #4
\$7EB	Physical response CAN Identifier from ECU #4 to the external test equipment
\$7E4	Physical request CAN Identifier from the external test equipment to ECU #5
\$7EC	Physical response CAN Identifier from ECU #5 to the external test equipment
\$7E5	Physical request CAN Identifier from the external test equipment to ECU #6
\$7ED	Physical response CAN Identifier from ECU #6 to the external test equipment
\$7E6	Physical request CAN Identifier from the external test equipment to ECU #7
\$7EE	Physical response CAN Identifier from ECU #7 to the external test equipment
\$7E7	Physical request CAN Identifier from the external test equipment to ECU #8
\$7EF	Physical response CAN Identifier from ECU #8 to the external test equipment

Figure 3 - CAN 11-bit identifiers

CAN Identifier	Description
\$18DB 33 F1	CAN Identifier for functionally address request messages sent by the external test equipment.
\$18DA xx F1	Physical request CAN Identifier from the external test equipment to ECU #xx
\$18DA F1 xx	Physical response CAN Identifier from ECU #xx to the external test equipment

Figure 4 - CAN 29-bit identifiers

4.2 Message Timing

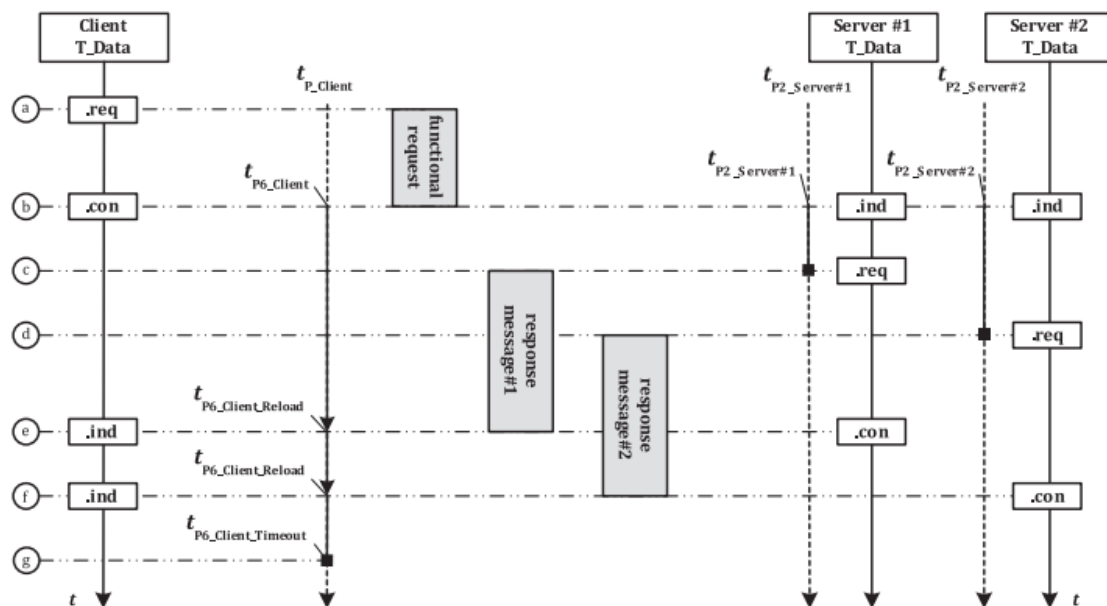
It is not the purpose of this document to test the low-level timing of each of the protocols. However, the response time to the request messages is important.

The test equipment must be capable of measuring the response time to an accuracy of at least 1 ms.

For ISO 15765-4, the time from the end of the request message to the start of the first response is 50 ms.

4.2.1 ISO 15765-4 Functional OBD Communication during Default Session

Figure 5 graphically depicts the timing handling in the client and two (2) servers for a functionally addressed request message during the default session. A description follows the figure that references the points marked in Figure 5.



Key

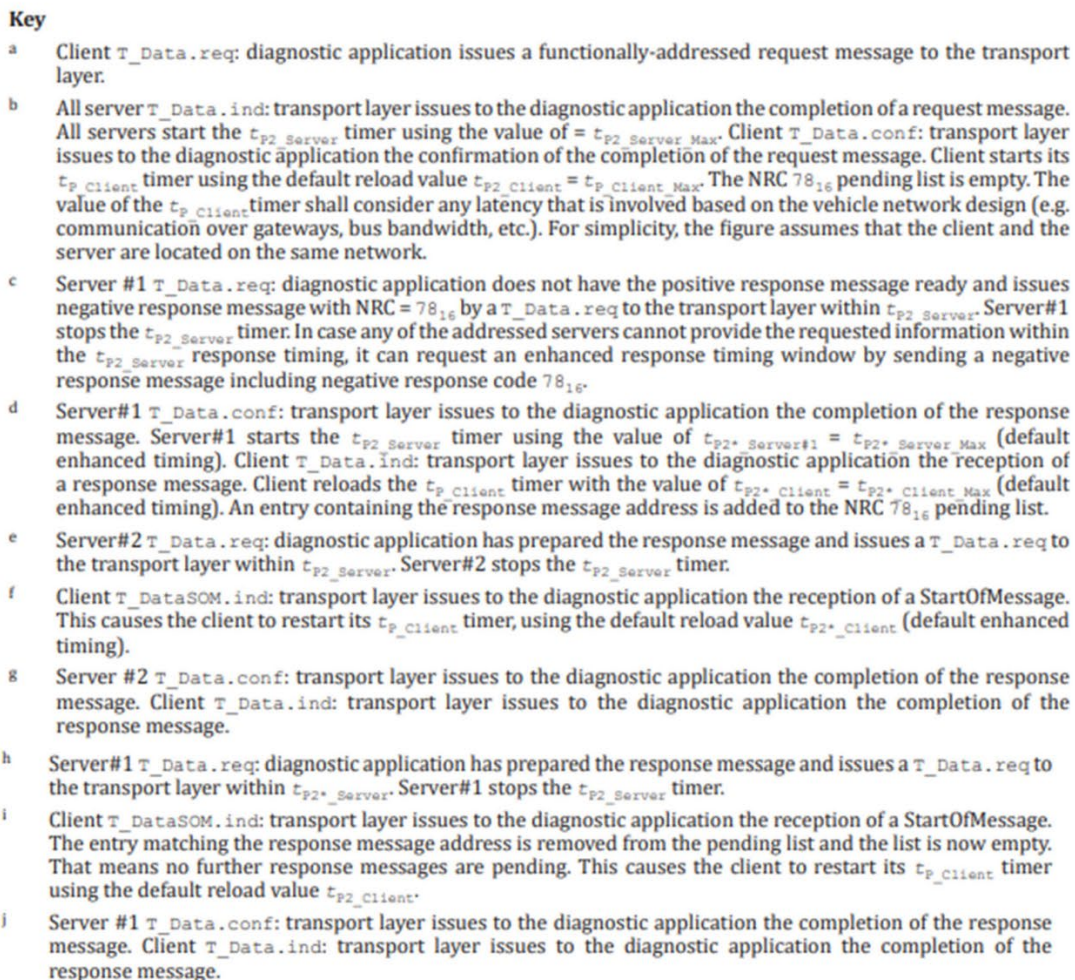
- a Client T_Data.req: diagnostic application issues a functionally-addressed request message to the transport layer.
- b All server T_Data.ind: transport layer issues to the diagnostic application the completion of a request message. All servers start the t_{P2_Server} timer using the value of $t_{P2_Server} = t_{P2_Server_Max}$. Client T_Data.conf: transport layer issues to the diagnostic application the confirmation of the completion of the request message. Client starts its t_{P_Client} timer using the default reload value $t_{P6_Client} = t_{P6_Client_Max}$. The value of the t_{P_Client} timer shall consider any latency that is involved based on the vehicle network design (e.g. communication over gateways, bus bandwidth, etc.). For simplicity, the figure assumes that the client and the server are located on the same network.
- c Server #1 T_Data.req: diagnostic application has prepared the response message and issues a T_Data.req to the transport layer within t_{P2_Server} . Server stops the t_{P2_Server} timer.
- d Server #2 T_Data.req: diagnostic application has prepared the response message and issues a T_Data.req to the transport layer within $t_{P2_Server_Max}$. Server stops the t_{P2_Server} timer.
- e Server #1 T_Data.conf: transport layer issues to the diagnostic application the completion of the response message. Client T_Data.ind: transport layer issues to the diagnostic application the completion of the response message. This causes the client to restart its t_{P_Client} timer, using the default reload value $t_{P6_Client_Max}$.
- f Server #2 T_Data.conf: transport layer issues to the diagnostic application the completion of the response message. Client T_Data.ind: transport layer issues to the diagnostic application the completion of the response message. This causes the client to restart its t_{P_Client} timer, using the default reload value $t_{P6_Client_Max}$.
- g Client: this is the indication for the client that no further response messages are expected and can continue with further requests.

Figure 5 - Functional OBD communication - default response timing

From a server point of view there is no difference in the timing handling compared to a physically addressed request message, but the client must handle the timing different compared to physical communication.

4.2.2 Functional OBD Communication during Default Session with Enhanced Response Timing

Figure 6 graphically depicts the timing handling in the client and two (2) servers for a functionally addressed request message during the default session, where one server requests an enhanced response timing via a negative response message including response code 78 hex. A description follows the figure that references the points marked in Figure 6.



Documents
Document Sharing Hub

From a server point of view there is no difference in the timing handling compared to a physically addressed request message that requires enhanced response timing, but the client must handle the timing differently compared to physical communication.

4.2.3 Physical OBD Communication during Default Session with Default Response Timing

Figure 7 graphically depicts the timing handling in the client and the server for a physically addressed request message during the default session.

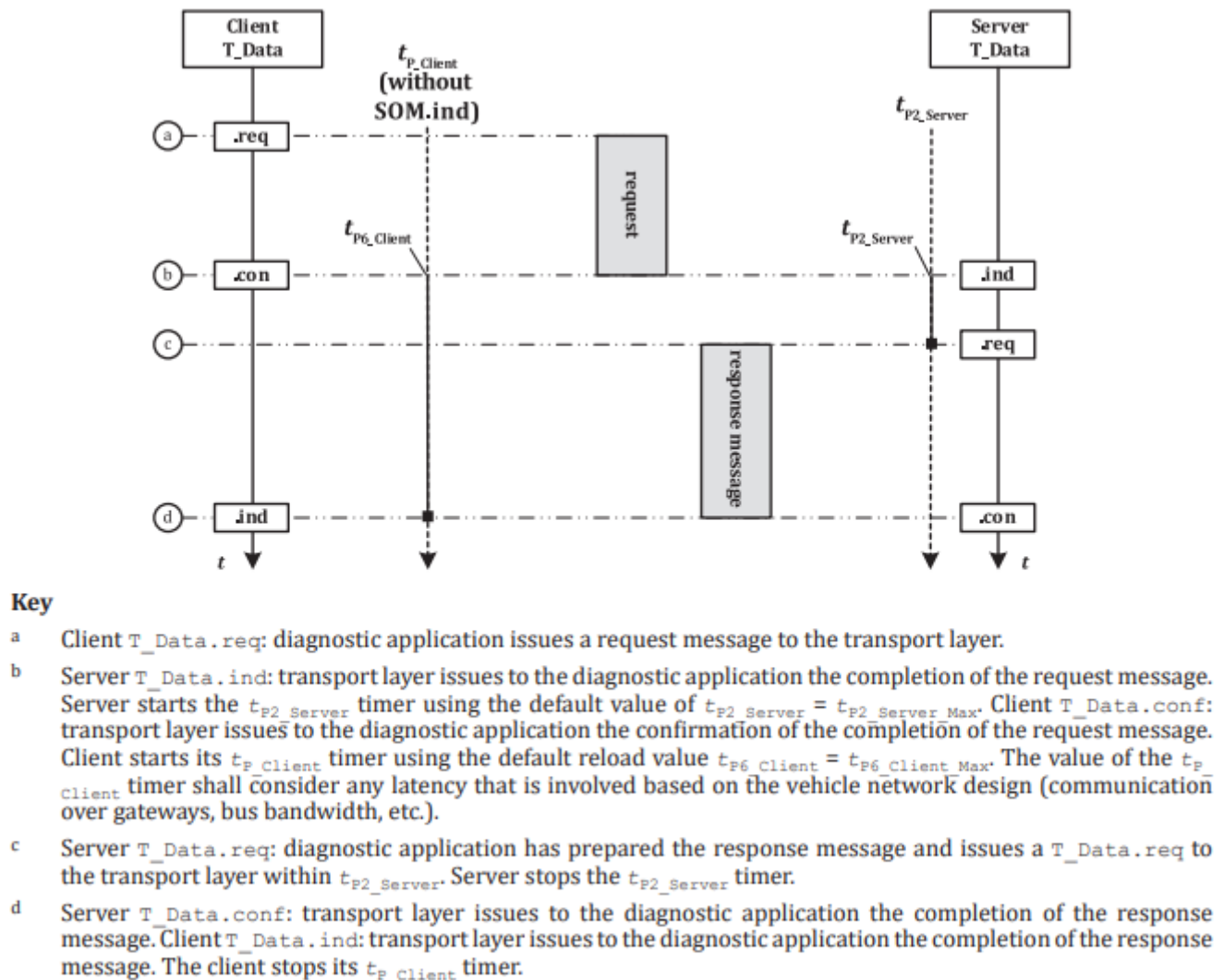
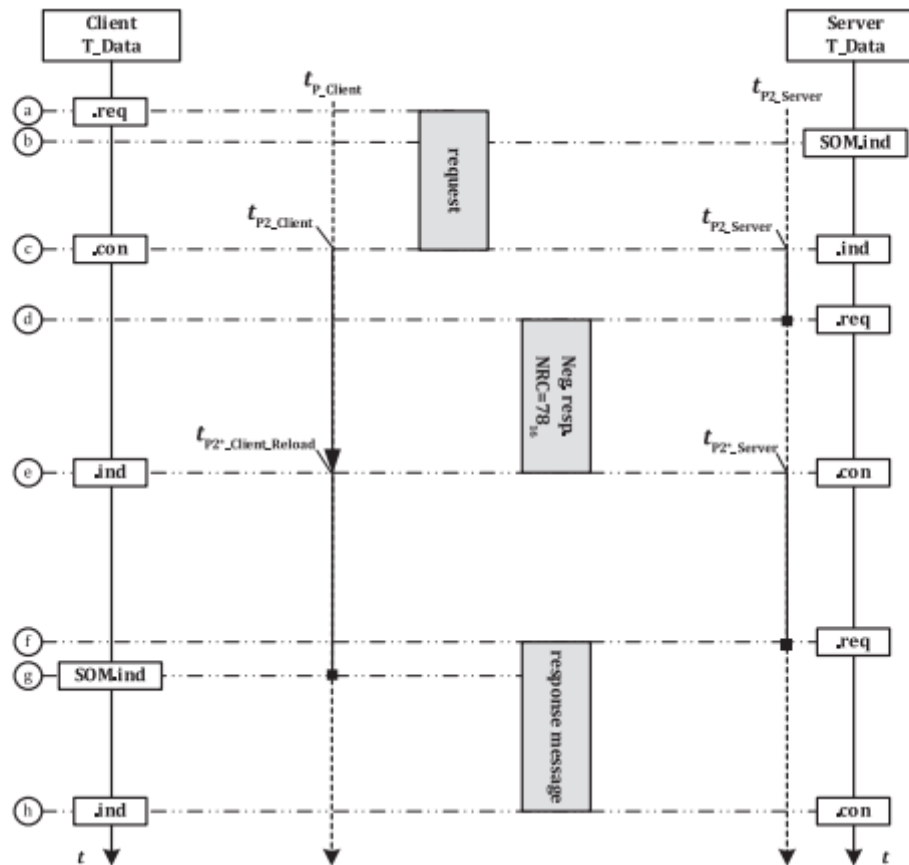


Figure 7 - Physical OBD communication - default response timing

4.2.4 Physical OBD Communication during Default Session with Enhanced Response Timing

Figure 8 graphically depicts the timing handling in the client and the server for a physically addressed request message during the default session and the request of the server for an enhanced response timing (NRC \$78 handling).



Key

- a Client T_Data.req: diagnostic application issues a request message to the transport layer.
- b Server T_DataSOM.ind: transport layer issues to the diagnostic application the reception of a StartOfMessage of a request message, if the transport layer supports the T_DataSOM.ind interfaces.
- c Server T_Data.ind: transport layer issues to the diagnostic application the completion of the request message. Server starts the t_{P2_Server} timer using the default value of $t_{P2_Server} = t_{P2_Server_Max}$. Client T_Data.conf: transport layer issues to the diagnostic application the confirmation of the completion of the request message. Client starts its t_{P_Client} timer using the default reload value $t_{P_Client} = t_{P_Client_Max}$.
- d Server T_Data.req: diagnostic application does not have the positive response message ready and issues negative response message with NRC = 78₁₆ by a T_Data.req to the transport layer within t_{P2_Server} . Server stops the t_{P2_Server} timer.
- e Server T_Data.conf: transport layer issues to the diagnostic application the completion of the response message. Server starts the t_{P2_Server} timer using the value of $t_{P2_Server} = t_{P2_Server_Max}$ (default enhanced timing). In case the server can still not provide the requested information within the enhanced t_{P2_Server} , then a further negative response message including negative response code 78₁₆ can be sent by the server. This causes the client to restart its t_{P_Client} timer, using the enhanced reload value t_{P2_Client} . For simplicity, the figure only shows a single negative response message with negative response code 78₁₆. Client T_Data.ind: transport layer issues to the diagnostic application the reception of a response message. Client stops the t_{P_Client} timer and reloads the t_{P_Client} timer with the value of $t_{P2_Client} = t_{P2_Client_Max}$ (default enhanced timing).
- f Server T_Data.req: diagnostic application issues a response message (positive or negative response other than negative response code 78₁₆) to the transport layer. Server stops the t_{P2_Server} timer.
- g Client T_DataSOM.ind: transport layer issues to the diagnostic application reception of a StartOfMessage of a response message, if the transport layer supports the T_DataSOM.ind interfaces. Client stops the t_{P_Client} timer.
- h Server T_Data.conf: transport layer issues to the diagnostic application the completion of the response message. Client T_Data.ind: transport layer issues to the diagnostic application the reception of a response message. When receiving this indication, the client stops its t_{P_Client} timer if the transport protocol does not support a T_DataSOM.ind interface.

Figure 8 - Physical OBD communication - enhanced response



4.2.5 Data Not Available Test Conditions on Functional and Physical Requests for Protocols SAE J1979-2 OBDonUDS and SAE J1979-3 ZEVonUDS for DoCAN and DoIP

There are four conditions for which data is not available:

1. Service is not supported.
2. Service is supported but data is not supported.
3. Service is supported but data is not available at the time that the request is made.
4. Service is supported but data is not available within P2 timing.

Table 1 indicates the proper ECU response as detailed in SAE J1979-2 and SAE J1979-3.

Table 1 - Proper response from server/ECU on functional or physical requests for CAN and ethernet connection to OBDOnUDS ECUs

UDS Service	Sub-Function	Data-Identifier	Condition	ISO 14229-1	Functional NRC	Physical NRC	DoCAN Client Timeout	DoIP Client Response Timing	Status Of Request ³
\$14	N/A	N/A	Service not supported	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$11	P2CAN_max	P6Client_min	Counted as negative response. FAIL if Engine OFF or if Engine On and mixed positive and negative responses (except NRC \$22) from ECUS (except China and EOBD)
			Subfunction not supported	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$12	P2CAN_max	P6Client_min	
			Conditions not correct	Negative response is required.	\$22	\$22	P2CAN_max	P6Client_min	
			Unsupported GODTC, unsupported addressing method	Negative response is required. For an incorrect FGID or if physical code clear is prohibited.	N/A	\$31	P2CAN_max	P6Client_min	
			ClearDTC not possible due to corrupt NV memory	Negative response is required.	\$72	\$72	P2CAN_max	P6Client_min	
			Supported GODTC, conditions correct	Positive response message required. Multiple negative response messages allowed within a maximum window of time until a positive response is required.	\$78 ^{abc}	\$78 ^{abc}	5000ms	P6*Client_min	If no positive response after allowed time, count as negative response (see above)

UDS Service	Sub-Function	Data-Identifier	Condition	ISO 14229-1	Functional NRC	Physical NRC	DoCAN Client Timeout	DoIP Client Response Timing	Status Of Request ³
\$19	all	all	Unsupported DTCSM, DTCSVM	Positive response indicating no DTCs is required.	N/A	N/A	P2 _{CAN_max}	P6 _{Client_min}	PASS if positive response. FAIL if no response.
			Supported FGID/DTCSVM, no DTCs stored	Positive response indicating no DTCs is required.	N/A	N/A	P2 _{CAN_max}	P6 _{Client_min}	
			Supported FGID/DTCSVM, DTCs stored	Positive response including the stored DTCs is required.	N/A	N/A	P2 _{CAN_max}	P6 _{Client_min}	
			Service not supported	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$11	P2 _{CAN_max}	P6 _{Client_min}	FAIL, Count as no response.
			Subfunction not supported	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$12	P2 _{CAN_max}	P6 _{Client_min}	
			Unsupported FGID	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$31	P2 _{CAN_max}	P6 _{Client_min}	
			Supported DTCSSRN/FGID/DTCSVM, data not available, conditions correct	Positive response message required. Multiple negative response messages allowed within a maximum window of time until a positive response is required.	\$78 ^{abc}	\$78 ^{abc}	5000ms	P6* _{Client_min}	If no positive response after allowed time, FAIL, count as no response

UDS Service	Sub-Function	Data-Identifier	Condition	ISO 14229-1	Functional NRC	Physical NRC	DoCAN Client Timeout	DoIP Client Response Timing	Status Of Request ³
\$22	N/A	all	Service not supported	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$11	P2CAN_max	P6Client_min	FAIL, Count as no response.
			Subfunction not supported	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$12	P2CAN_max	P6Client_min	
			Unsupported DID/ITID	On functional request no response is allowed. On physical request a negative response is required.	N/A ^d . except as specified in d.	\$31	P2CAN_max	P6Client_min	PASS if ECU reported DID as unsupported. FAIL if ECU reported DID as supported.
		\$F400-\$F5FF and \$F700-\$F7FF	Supported DID	Positive response is required (no negative response message with response code \$78 allowed).	N/A	N/A	P2CAN_max	P6Client_min	PASS if positive response. FAIL if no response.
			Conditions not correct	Negative response is required.	\$22	\$22	P2CAN_max	P6Client_min	FAIL, Count as no response
		\$F800-\$F8FF	Supported ITID, data available (VIN, CALID)	Positive response is required.	N/A	N/A	P2CAN_max	P6Client_min	PASS if positive response. FAIL if no response.
			Supported ITID, data not available, conditions correct (GHG Tracking)	Positive response message required. Multiple negative response messages allowed within a maximum window of time until a positive response is required.	\$78 ^{abc}	\$78 ^{abc}	5000ms	P6* _{Client_min}	If no positive response after allowed time, FAIL, count as no response
		\$F810	DID \$F810 requested during initialization	Positive response is required or Negative response for maximum of 5 times	\$21	\$21	P2CAN_max	200ms	



UDS Service	Sub-Function	Data-Identifier	Condition	ISO 14229-1	Functional NRC	Physical NRC	DoCAN Client Timeout	DoIP Client Response Timing	Status Of Request ³
\$31	\$01	\$E000-\$E1FF	Supported RID, conditions correct	Positive response is required.	N/A	N/A	P2 _{CAN_max}	P6 _{Client_min}	Not currently implemented in code, but it seems that anything other than a positive response should be a FAIL.
			Service not supported	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$11	P2 _{CAN_max}	P6 _{Client_min}	
				On functional request no response is allowed. On physical request a negative response is required.					
			Subfunction not supported	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$12	P2 _{CAN_max}	P6 _{Client_min}	
			Supported RID, conditions not correct	Negative response required.	\$22	\$22	P2 _{CAN_max}	P6 _{Client_min}	
			Routine is currently active and cannot be restarted	On physical or functional request, a negative response is required.	\$24	\$24	P2 _{CAN_max}	P6 _{Client_min}	
			Unsupported RID	On functional request no response is allowed. On physical request a negative response is required.	N/A	\$31	P2 _{CAN_max}	P6 _{Client_min}	

^a After an NRC \$78, every NRC is possible, also with functional addressing.

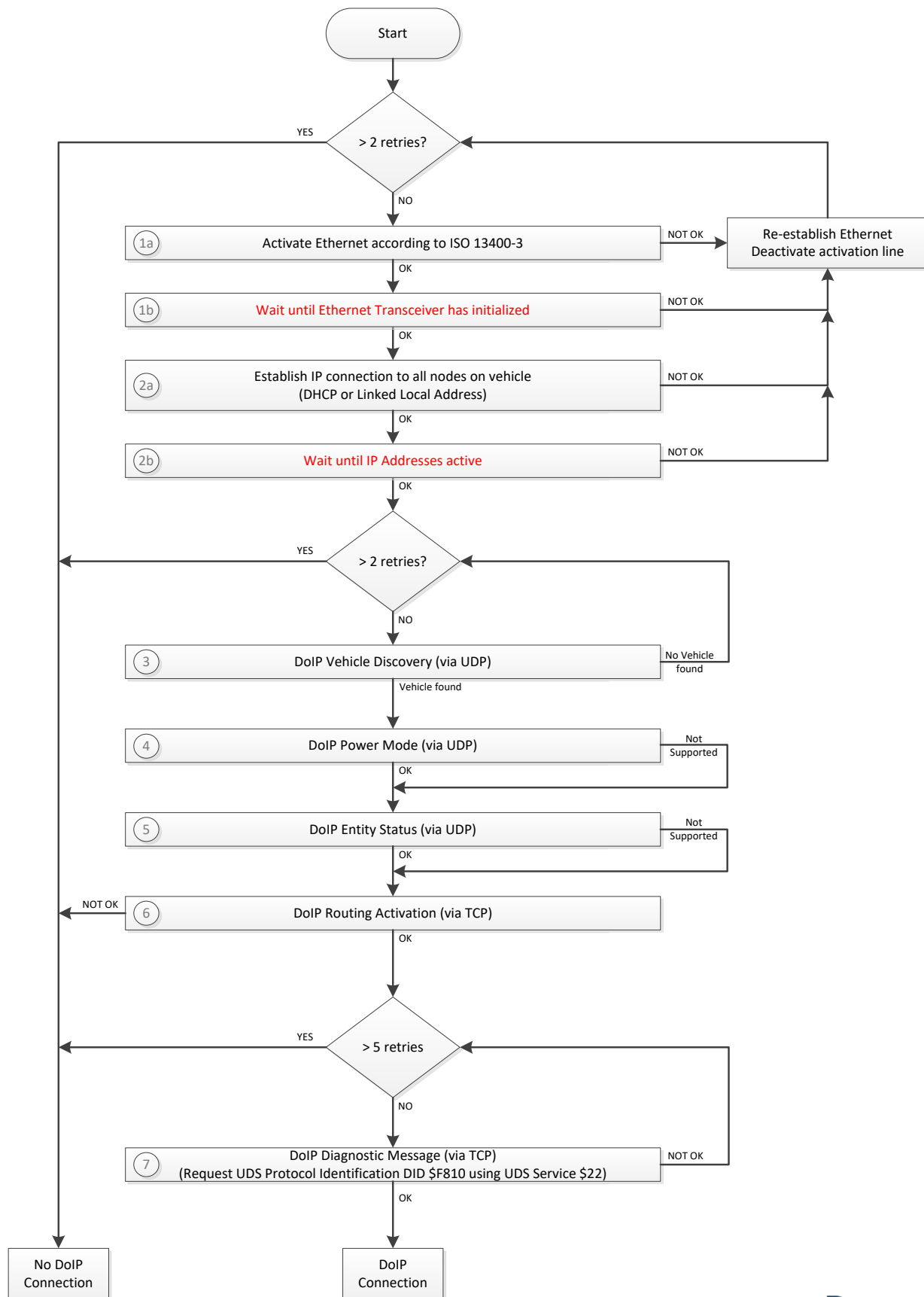
^b For DoCAN, if NRC \$78 is allowed, then P4_{Server} is either 5000ms or P4_{Server_max} (CVN calculation only). In all other cases P4_{Server} is P2_{CAN_max}. P4_{Server_max} is defined by ISO 14229-2.

^c For DoIP, if NRC \$78 is allowed, then the client should receive the complete response message within P6*_{Client_min} after the successful transmission of the corresponding request message. CVN calculation is allowed to take 600000 ms (10 minutes) before a final response must be received by the client. Note: P4_{Server} does not apply to DoIP as it does not support start of message indications (SOM.ind). For DoCAN protocol, refer to server timer parameters (i.e., P2_{CAN_max}) in SAE J1979-2. For other UDS protocol information, please refer to ISO 14229-1.

NOTES:

- These and other services or sub-functions may be supported for non-legislated purposes and therefore respond with different responses to a physical and functional request (e.g., NRC \$7F to SID \$31). This does not lead into a violation of OBD or ZEV standardization compliance.
- Negative response structure follows the scheme: \$7F, ServiceID, NRC (e.g., \$7F, \$01, \$11). -See ISO 14229-1.
- Listed Failure criteria reflects CARB regulations, which differs in some cases from base ISO 14229-1 guidance.

4.3 ISO 13400-2 / ISO 14229-5 UDSONIP Connection Process



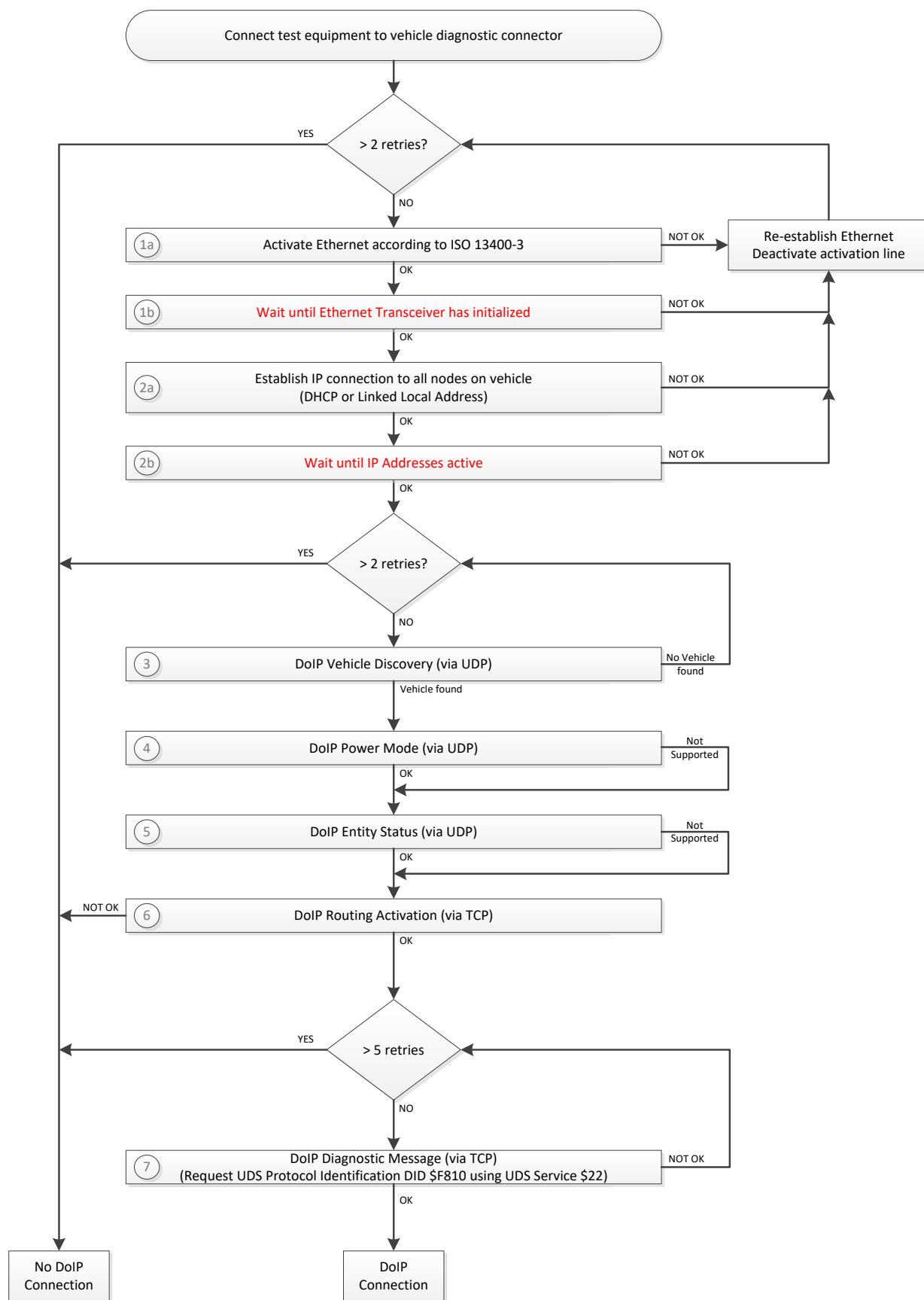


Figure 9 - DoIP connection process

Procedure:

Follow the process outlined in Figure 9. Each of the steps in the flowchart are described in the sections below.

Evaluation Criteria:

Value	Description
DoIP Connection	DoIP connection established successfully (in Figure 9).
No DoIP Connection	DoIP connection not established (in Figure 9).

4.3.1 Activate Ethernet According to ISO 13400-3

The Ethernet transceiver is assumed to be initialized when the J2534 PassThruConnect returns successfully. Per ISO 13400-3, activation shall occur within 200 ms. Retry time is 250 ms.

4.3.1.1 Automatic Pin Selection**Procedure:**

Follow the evaluation of pin 8 on the SAE J1962 connector defined in ISO 13400-2 to determine the Ethernet Pins to be used.

Evaluation Criteria:

Value	Description
success	Ethernet pins identified as either Option 1 or Option 2. Proceed to Section 4.3.2.
no success	Ethernet Pins cannot be determined. To allow evaluation to continue for development purposes, continue to Section 4.3.1.2.

4.3.1.2 Force Option 1 Pin Selection**Procedure:**

To allow testing for development purposes, force ISO 13400-2 Option 1 Ethernet pin selection

Evaluation Criteria:

Value	Description
success	Ethernet pin selection is successful. To allow evaluation to continue for development purposes, proceed to Section 4.3.2.
no success	Ethernet pin selection is unsuccessful, proceed to Section 4.3.1.3.

4.3.1.3 Force Option 2 Pin Selection

Procedure:

To allow testing for development purposes, force ISO 13400-2 Option 2 Ethernet pin selection.

Evaluation Criteria:

Value	Description
success	Ethernet pin selection is successful. To allow evaluation to continue for development purposes, exit Step 1b in Figure 9 using the 'OK' path
no success	Exit Step 1a or 1b in Figure 9 using the 'NOT OK' path

4.3.2 Establish IP Connection to All Nodes on Vehicle

The ARP message must be used to probe. ARP probes must be at least 1 second apart.

An IP address shall be activated in 20 seconds or less.

DoIP alive and TCP keep alive checks are not used.

Procedure:

Check for IPv4 first. If not successful, then check for IPv6.

For IPv4 - If the vehicle issues a DHCP Discovery message, then assign IP addresses. If no DHCP Discovery message is received, then establish Linked Local Address.

For IPv6 - If the vehicle issues a DHCP Discovery message, then assign IP addresses. If no DHCP Discovery message is received, then establish Linked Local Address.

Evaluation Criteria:

Value	Description
success	IP Addresses established/assigned. Exit Step 2b in Figure 9 using the 'OK' path
no success	IP Addresses could not be determined. Exit Step 2a or 2b in Figure 9 using the 'NOT OK' path

4.3.3 DoIP Vehicle Discovery

The delay between Vehicle Discovery Requests must be at least 500 ms.

Procedure:

Issue a DoIP Vehicle Discovery message via UDP and verify response.

Table 2 - Functional addressed vehicle discovery request message

Message Direction:	External test equipment → All ECUs		
Message Type:	Functional Request (via UDP)		
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	FF	
#2	Inverse of Protocol Version	00	
#3 - #4	Payload Type	00 01	
#5 - #8	Payload Length	00 00 00 00	

Table 3 - ECUx vehicle discovery response message without VIN/GID sync. status

Message Direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	00 04	
#5 - #8	Payload Length	00 00 00 20	
#9 - #25	VIN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	
#26 - #27	Logical Address	xx xx	
#28 - #33	EDI	xx xx xx xx xx xx	
#34 - #39	GDI	xx xx xx xx xx xx	
#40	Further Action	xx	

Table 4 - ECUx vehicle discovery response message with VIN/GID sync. status

Message Direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	00 04	
#5 - #8	Payload Length	00 00 00 21	
#9 - #25	VIN	xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx xx	
#26 - #27	Logical Address	xx xx	
#28 - #33	EDI	xx xx xx xx xx xx	
#34 - #39	GDI	xx xx xx xx xx xx	
#40	Further Action	xx	
#41	VIN/GID Sync. Status	xx	

Evaluation Criteria:

Value	Description
success	If all of the following are TRUE, exit Step 3 in Figure 9 using the 'Vehicle found' path: - If one or more ECUs provides a positive response to Vehicle Discovery with or without VIN/GID Sync. Status NOTE: The following DoIP fields are not evaluated: - o VIN - o Further Action - o VIN/GID Sync. Status (if included) - o HOW MANY ECUs ARE ALLOWED TO RESPOND
no success	If any of the following are TRUE, exit Step 3 in Figure 9 using the 'No Vehicle found' path. - Any ECU issued a DoIP Generic Header NACK - If any positive response to Vehicle Discovery was not valid - If any ECU issues more than four Vehicle Discovery responses to a single Vehicle Discovery request

4.3.4 DoIP Power Mode

Procedure:

Issue a DoIP Power Mode message via UDP and verify response. Support for DoIP Power Mode is not required.

Table 5 - Functional addressed power mode request message

Message Direction:	External test equipment → All ECUs		
Message Type:	Functional Request (via UDP)		
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	40 03	
#5 - #8	Payload Length	00 00 00 00	

Table 6 - ECUx power mode response message

Message Direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	40 04	
#5 - #8	Payload Length	00 00 00 01	
#9	Power Mode	xx	

Evaluation Criteria:

Value	Description
success	If all of the following are TRUE, exit Step 4 in Figure 9 using the 'OK' path: - A positive Power Mode response from one or more ECUs - Note: Power Mode field content is not evaluated.
Warn	If any positive response to Power Mode was not valid, exit Step 4 in Figure 9 using the 'Not Supported' path
no success	If all of the following is TRUE, exit Step 4 in Figure 9 using the 'Not Supported' path: - No DoIP Generic Header NACK from any ECUs - No ECUs responded

4.3.5 DoIP Entity Status

Procedure:

Issue a DoIP Entity Status message via UDP and verify response. Support for DoIP Entity Status is not required.

Table 7 - Functional addressed entity status request message

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request (via UDP)	
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	40 01	
#5 - #8	Payload Length	00 00 00 00	

Table 8 - ECUx entity status response message

Message Direction:		ECU#1 → External test equipment	
Message Type:		Response	
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	40 02	
#5 - #8	Payload Length	00 00 00 07	
#9	Node Type	01	
#10	Max Sockets	xx	
#11	Open Sockets	xx	
#12 - #15	Max Data Size	xx xx xx xx	

Evaluation Criteria:

Value	Description
success	If all of the following are TRUE, exit Step 5 in Figure 9 using the 'OK' path: - A positive Entity Status response from one or more ECUs NOTE: Node type field content is not evaluated.
Warn	If any positive response to Entity Status was not valid, exit Step 5 in Figure 9 using the 'Not Supported' path
no success	If all of the following is TRUE, exit Step 5 in Figure 9 using the 'Not Supported' path: - No DoIP Generic Header NACK from any ECUs - No ECUs responded

4.3.6 DoIP Routing Activation

Procedure:

Issue a DoIP Routing Activation message via TCP and verify response. The 'Reserved - VM Specific' bytes must not be included in the request or response messages.

Table 9 - Functional addressed routing activation request message

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request (via UDP)	
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	00 05	
#5 - #8	Payload Length	00 00 00 07	
#9 - #10	Source Address of DoIP Client	0E 00	
#11	Activation Type	01	
#12 - #15	Reserved	00 00 00 00	

Table 10 - ECUx routing activation response message

Message Direction:		ECU#1 → External test equipment	
Message Type:		Response	
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	00 06	
#5 - #8	Payload Length	00 00 00 09	
#9 - #10	Logical Address of DoIP Client	0E 00	
#11 - #12	Logical Address of DoIP Entity	xx xx	
#13	Routing Activation Response Code	10	
#14 - #17	Reserved	00 00 00 00	

Evaluation Criteria:

Value	Description
success	If all of the following are TRUE, exit Step 6 in Figure 9 using the 'OK' path: - If the Routing Activation response contains a Routing Activation Code = 0x10 from all ECUs
no success	If any of the following are TRUE, exit Step 6 in Figure 9 using the 'NOT OK' path: - No DoIP Generic Header NACK from any ECUs - No ECUs responded - If any positive response to Routing Activation contains a Routing Activation Code != 0x10 - If any responses include the 'Reserved – VM Specific' bytes

4.3.7 DoIP Diagnostic Message (Service \$22 \$F810)

The time delay between retries of Step 7 in Figure 9 must be 200 ms.

Procedure:

Issue a DoIP Diagnostic message via TCP for a Functionally Addressed UDS Service \$22 \$F810 request. Count and save the number of ECUs whose positive response contains Protocol Identification = 1, as these are the OBD II ECUs to be used in all subsequent evaluations for J1699-5.

Table 11 - Functional addressed diagnostic request message

Message Direction:	External test equipment → All ECUs		
Message Type:	Functional Request (via UDP)		
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	80 01	
#5 - #8	Payload Length	00 00 00 07	
#9 - #10	Source Address	0E 00	
#11 - #12	Target Address	E0 00	
#13	UDS Service	22	
#14 - #15	DID	F8 10	

Table 12 - ECUx diagnostic response message

Message Direction:	ECU#1 → External test equipment		
Message Type:	Response		
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Protocol Version	02	
#2	Inverse of Protocol Version	FD	
#3 - #4	Payload Type	80 02	
#5 - #8	Payload Length	00 00 00 09	
#9 - #10	Source Address	xx xx	
#11 - #12	Target Address	0E 00	
#13	UDS Service	62	
#14 - #15	DID	F8 10	
#16	Protocol Identification	01	

Evaluation Criteria:

Value	Description
success	If all of the following is TRUE, exit Step 7 in Figure 9 using the 'OK' path: - DoIP Diagnostic ACK from one or more ECUs - The number of ECUs that issued a positive response (with the Protocol Identification = 1) to the Service \$22 \$F810 requests matches that from Prompt #6. - UDS NRC other than \$21 shall be ignored. If any of the following are TRUE, exit Step 7 in Figure 9 using the 'NOT OK' path: - If any ECU has issued a UDS NRC \$21 responses to the Service \$22 \$F810 request
no success	If any of the following are TRUE, exit Step 7 in Figure 9 using the 'NOT OK' path: - DoIP Generic Header NACK from any ECU - DoIP Diagnostic NACK from all ECUs - No ECUs responded

5. TEST VEHICLE WITH NO MALFUNCTIONS, NO DTCS SET

Purpose: This group of tests will establish that under normal operating conditions communication can be established and that all supported test services behave correctly.

5.1 Perform MIL Bulb Check, Engine Off

Purpose: This test determines that the MIL behaves as required by OBD legislation.

Procedure:

5.1.1 Ignition off for 30 seconds or longer, as appropriate for the ECU. Connect scan tool to the J1962 connector.

5.1.2 Turn ignition on. Do not crank engine.

Evaluation: Procedure:

5.1.3 Visually verify that the MIL is on for a minimum of 15 seconds. (MIL can stay on until engine cranking, or it is allowed to turn off after a minimum of 15 seconds.)

5.2 Establish Communication (J1978-2/ISO 27145-4) Ignition On, Engine Off

Purpose: To verify the support of OBD protocol and that the vehicle sends a response message of the correct format. Only ISO 15765-4 (CAN) should be supported. DEC ECUs reporting to an external scan tool must use either a CAN 11-bit or 29-bit CAN identifier. ECU messages cannot mix CAN identifier types.

Protocol determination procedure:

5.2.1 Test tool sends Service \$01 PID \$00 functional request message for HS CAN protocol below per SAE J1978-2 in the following sequence:

ISO 15765-4 - 11-bit 500 kbps

ISO 15765-4 - 29-bit 500 kbps

--> No DEC ECU DEC ECU should respond

5.2.2 Send Service \$22 DID \$F810 functional request message in the following order:

ISO 15765-4 / ISO 14229-3 - 11-bit 500 kbps UDSonCAN

ISO 15765-4 / ISO 14229-3 - 29-bit 500 kbps UDSonCAN

Check battery voltage at the SAE J1962 connector pin 16.

Note the first protocol that responds to the OBD request. Remainder of the tests below must be run using this protocol.

Test conditions

— The Client is connected to a vehicle. The Ignition key position (or similar) must be in the Key On position, engine off (PSA = FALSE)

Configurations

Test procedure: Send Service \$01 PID \$00 Functionally addressed on the protocols listed above to ensure no response to J1979 classic services.

Table 13 - Request current powertrain diagnostic data request message

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request	
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID used to determine PID support for PIDs 01-20	00	PID

Result criteria Functional addressed

Value	Description
Pass	No response from any ECU
Fail	Any response must be flagged as a Failure

Test procedure: Send Service \$22 \$F810 Functionally on the protocols listed above

Table 14 - Functional request current powertrain diagnostic data request message

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request	
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	ReadDataByIdentifier	22	RDBI
#2	DID#1 (HB): F8	F8	DID_HB
#3	DID#1 (LB): 10	10	DID_LB

Table 15 - Request current powertrain diagnostic data response message

Message Direction:		ECU#1 → External test equipment	
Message Type:		Response	
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	ReadDataByIdentifier	62	RDBIPR
#2	DID (HB): F810 Protocol Identification	F8	DID_HB
#3	DID (LB): F810 Protocol Identification	10	DID_LB
#4	Protocol Identification: OBDonUDS or ZEVonUDS	01	

Result criteria Functional addressed request

Value	Description
Pass	Pass if all of the following criteria are met: • \$01 "OBDonUDS or ZEVonUDS" positive response from All DEC ECUs⁽¹⁾ • All DEC ECU responses are same protocol (DoCAN) • All DEC ECUCAN IDs are all 11-bit or are all 29-bit
Warn	Negative response with NRC \$21 from any primary DEC ECU
Fail	Flag as a Failure if any of the following criteria is met: • DEC ECU responding with mixed protocols (DoCAN and DoIP) • Negative response with NRC \$21 after five (5) retries, • Mixed 11-bit/29-bit CAN IDs, or • No response from a DEC ECU⁽¹⁾ Any SAE J1979-2/J1979-3 DEC ECU negative response with NRC other than \$21 WARN if any DEC ECU responds with value other than \$01. NOTE: Do not fail if adapter does not support ethernet NDIS.

⁽¹⁾ Operator Prompt 6 asks for the number of expected DEC ECUs.

Note and log all failure cases, not just the first one.**5.3 Clear DTCs (Service \$14), Engine Off**

Purpose: To verify that, with the ignition on and engine off, all ECUs provide the correct response to a Service \$14 request and that DTCs and the MIL status bit are cleared.

Transmit Service \$04 Request message**Table 16 - Request clear/reset emission-related diagnostic information request message**

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request	
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear/reset emission-related diagnostic information request SID	04	SIDRQ

Result criteria Functional addressed

Value	Description
Pass	No response from any DEC ECU
Fail	Any response must be flagged as a Failure

5.3.1 Test procedure: Transmit Service \$14 Functionally

Any software meeting these specifications must wait 2 seconds before proceeding to next step to allow for NVRAM read/write times.

Table 17 - Functional request clear/reset emission-related diagnostic information request message

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request	
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Clear diagnostic information SID	14	SIDRQ CDTCI
#2	groupOfDTC [DTCHighByte]	FF	DTCHB
#3	groupOfDTC [DTCMiddleByte]	FF	DTCMB
#4	groupOfDTC [DTCLowByte] ("Emissions-system group")	33	DTCLB

Table 18 - ECU#1 request clear/reset emission-related diagnostic information response message

Message Direction:		ECU#1 → External test equipment	
Message Type:		Response	
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	ClearDiagnosticInformation SID	54	CDTCIPR

Result criteria Functional addressed request

Value	Description
Pass	Positive response from all Primary DEC ECUs ⁽¹⁾
Fail	Flag as a Failure if any of the following criteria is met: - Negative response⁽²⁾ - Lack of response⁽¹⁾

⁽¹⁾ Operator Prompt 6 asks for the number of emission-related ECUs in the vehicle. All DEC ECUs must respond with a positive response message. If more than the specified number of DEC ECUs respond to this diagnostic message, this shall be flagged as a failure.

⁽²⁾ For ISO 15765-4, a positive response message is required. Negative response message(s) (\$7F, \$14, \$78) are allowed for up to 30 seconds maximum, until a positive response message is available. All other negative responses must be flagged as a failure.

5.4 Verify MIL Status Bit, Engine Off, Verify No Permanent DTCs

Purpose: To verify the correct response to a Service \$22, DID \$F501 request for those ECUs that support it, and that DTCs and the MIL status bit were cleared by the previous Service \$14 request.

Note to manufacturers: During bulb prove out, MIL status bit must indicate whether the MIL will be illuminated after engine is started. It should not reflect the status of the MIL bulb driver circuit, which will be turning the bulb on for the bulb prove out.

Procedure:

5.4.1 Service \$01 PID \$01 Functionally Addressed

Table 19 - Request current powertrain diagnostic data request message

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request	
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request current powertrain diagnostic data request SID	01	SIDRQ
#2	PID: Number of emission-related DTCs and MIL status	01	PID

Result criteria Functional addressed

Value	Description
Pass	No response from any DEC ECU
Fail	Any response must be flagged as a Failure

Send Service \$22 \$F501 Functionally addressed**Table 20 - Functional request current powertrain diagnostic data request message**

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request	
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	ReadDataByIdentifier	22	RDBI
#2	DID#1 (HB): F5	F5	DID_HB
#3	DID#1 (LB): 01	01	DID_LB

Table 21 - Request current powertrain diagnostic data response message

Message Direction:		ECU#1 → External test equipment	
Message Type:		Response	
Data Byte	Description (All values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	ReadDataByIdentifier	62	RDBIPR
#2	DID#2 (HB): F501: Number of emission-related DTCs and MIL status	F5	DID_HB
#3	DID#2 (LB): F501: Number of emission-related DTCs and MIL status	01	DID_LB
#4	MIL: OFF; Number of emission-related DTCs: 00	xx	DATA_A
#5	Misfire monitoring supported,..., Engine cooling system monitoring ready	xx	DATA_B
#6	Catalyst monitoring supported, ..., NOx catalyst monitoring ready	xx	DATA_C
#7	Evaporative system monitoring supported, ..., Particulate matter filter monitoring ready	xx	DATA_D
#8	Exhaust gas sensor monitoring supported,..., VVT system monitoring ready	xx	DATA_E
#9	DOR monitoring supported,..., "Other" system monitoring ready	xx	DATA_F

Result criteria functionally addressed request

Value	Description
Pass	Positive response from responding Primary DEC ECUs that have indicated DID \$F501 as supported #DTCs present in all response messages should be zero MIL should be commanded off in all response messages
Fail	No response from one or more Primary DEC ECU that has indicated DID \$F501 as supported Non-zero # of DTCs or MIL commanded on in any response message More than the expected number of Primary DEC ECUs respond ⁽¹⁾

⁽¹⁾ Operator Prompt 6 asks for the number of emission-related ECUs in the vehicle. If more than the specified number of DEC ECUs respond to this diagnostic message, this shall be flagged as a failure.

Send Service \$22 \$F501 Physically addressed

Request with physical addressing Service \$22 DID \$F501 from all ECUs that have indicated this DID as supported.

Result criteria physically addressed request

Value	Description
Pass	Positive response from All Primary DEC ECUs that are requested #DTCs present in all requested Primary DEC ECUs should be zero MIL should be commanded off in all requested Primary DEC ECUs
Fail	No response to the request from one or more Primary DEC ECUs Non-zero # of DTCs or MIL commanded on in any Primary DEC ECU

5.4.2 Transmit Service \$0A Request Message

Table 22 - Request emission-related diagnostic trouble codes with permanent status

Message Direction:		External test equipment → All ECUs	
Message Type:		Functional Request	
Data Byte	Description (All PID values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	Request emission-related diagnostic trouble codes with permanent status request SID	0A	SIDRQ

Result criteria Functional addressed

Value	Description
Pass	No response from any DEC ECU
Fail	Any response must be flagged as a Failure

Send Service \$19 Subfunction \$55 Functionally addressed (reportWWHOBDDTCWithPermanentStatus)

Transmit Service \$19 55 functionally addressed.

Table 23 - Functional request emission-related diagnostic trouble codes with permanent status

Message Direction:		External test equipment → all ECUs	
Message Type:		Functional Request	
Data Byte	Description (all values are in hexadecimal)	Byte Value (Hex)	Mnemonic
#1	ReadDTCInformation request SID	19	RDTCl
#2	DTCInformationType = reportWWHOBDDTCWithPermanentStatus	55	RWWHOBDDTCWPS
#3	FunctionalGroupIdentifier = Emissions-system Group	33	FGID

Table 24 - ECU#n request emission-related diagnostic trouble codes with permanent status response message with no confirmed DTCs available

Message Direction:		ECU#n → External test equipment	
Message Type:		Response	
Data Byte	Parameter Name	Byte Value (Hex)	Mnemonic
#1	ReadDTCInformation SID	59	RDTClPR
#2	DTCReportType = reportWWHOBDDTCWithPermanentStatus	55	RWWHOBDDTCWPS
#3	FunctionalGroupIdentifier = Emissions-system Group	33	FGID
#4	DTCStatusAvailabilityMask	FF	DTCSAM
#5	DTCFormatIdentifier	04	J2012-DADTCF04_

ECU#n responds with an empty list to indicate there is no permanent DTC stored.