



Lane Departure Warning Subsystem Validation Test

1 Scope

Note: Nothing in this standard supersedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To define the tests that will determine if a vehicle meets the performance requirements of applicable GM specifications for Lane Departure Warning (LDW) Subsystems.

1.2 Foreword. This procedure covers GM's validation test requirements for LDW subsystems.

1.3 Applicability. This procedure applies to passenger vehicles that are equipped with a LDW subsystem and intend to comply with the applicable GM requirements.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

None

2.2 GM Standards/Specifications.

None

2.3 Additional References.

CG2332 LDW Summary Data Sheet for GMW16071

Front Camera Module (FCM) Component Technical Specification (CTS)

LDW Subsystem Technical Specification (SSTS)

Manual of Uniform Traffic Control Devices (MUTCD), E9-28322 <http://www.mutcd.fhwa.dot.gov/>

Video Simulator Setup Manual, from the component supplier.

3 Resources

3.1 Facilities. Portions of this test may be run on the electrical test bench or at a vehicle level.

3.1.1 Electrical test bench. Contact the validation representative in the desired region to determine the location of the appropriate test bench.

3.1.2 Test roads that have had the lane markings surveyed by Global Positioning System (GPS) ground truth equipment for accuracy testing. Road details in CG2332.

3.1.3 Test roads that contain the various road markings outlined in the CTS/SSTS. Road details in CG2332.

3.1.4 Public road system that contains the real world road markings outlined in the SSTS. Road details in CG2332.

3.2 Equipment. Complete the Instrument Calibration Data Sheet in Appendix B. Measurements required are:

- Longitudinal vehicle speed
- Yaw Rate
- Lateral Position (with respect to the road markings)
- Lateral Velocity (with respect to the road markings)

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Documents
Document Sharing Hub

- LDW System Alert Request

3.2.1 GPS for the Warning Accuracy Test. RT3000 series with Hunter solution from Oxford Technical Solutions (OxTS) available at Milford Proving Ground (MPG). (See Section 4.3.) Other regions' information will be added as testing is developed.

3.2.2 GPS Base Station. Compatible with GPS in paragraph 3.2.1. Available at MPG.

3.2.3 Data Acquisition System. Data acquisition system to log signals defined above. Laptop computer with Vehicle Spy 3 (VS3) and NeoVI Fire (from Intrepid Control Systems) and CANSas Distributed I/O (from IMC Dataworks), available at MPG.

3.2.4 Simulator for Test Bench. Video camera simulator for test bench, for use on the test bench to simulate various road conditions. Instructions for constructing this simulator can be obtained from the component supplier. Simulators are available in GM North America on the test benches at the Warren (Michigan) Electrical Lab.

3.3 Test Vehicle/Test Piece. The test vehicle should be equipped with the LDW system to be tested, and should be selected as being representative of the group of vehicles for which compliance to the GM Standards is being demonstrated. For validation, all LDW related components should have the latest production intent released hardware, software, and calibrations.

3.4 Test Time.

Calendar time: 5 days

Test hours: 20 hours

Coordination hours: 8 hours

3.5 Test Required Information.

3.5.1 Production alignment procedure or service point calibration procedure for LDW system.

3.5.2 Setup information for GPS equipment and data acquisition instrumentation being used.

3.5.3 GPS files for the road marking lines (types and directions) to be tested. At MPG, these are available from the Active Safety Development and Validation (Dev/Val) group.

3.5.4 Public road driving routes for the region being tested. See CG2332 for road lists and maps.

3.5.5 CG2332, LDW Summary Data Sheet for GMW16071.

3.6 Personnel/Skills. The test engineer or technician will need driving privileges and access to the road system at MPG or other GM regional test site. Access to a laptop computer running the data acquisition software, and familiarity with use of the software and equipment, is required. A second person to monitor the laptop and collect/save the data will also be needed.

4 Procedure

4.1 Preparation.

4.1.1 Determine which sections of the test will be run on the test bench and at a vehicle level.

4.1.2 If a new LDW system has been installed, align the unit per the production or service procedure.

4.1.3 For the Warning Accuracy Test, install the GPS test equipment and the data acquisition equipment into the vehicle. Set up the GPS base station if a permanently mounted one is not available. See Appendix A for using the equipment at MPG.

4.1.4 Set up CG2332 to summarize the data from each test.

4.2 Conditions.

4.2.1 Environmental Conditions. (Vehicle Level Testing) "Benign" conditions as defined in the SSTs, refers to a combination of environmental conditions and conditions of lane markings and road surfaces. Benign conditions shall be defined as the following situations. Under benign conditions the LDW subsystem shall detect all types of well-maintained public roadway lane markings (e.g., solid, dashed, white, yellow, etc.) within its detection zone. Under benign conditions, the system shall detect visible lane markings which meet European or North American traffic standards regarding color, size and visibility. If the driver can clearly see

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the lane markings, it is expected that the LDW system can as well. If the driver cannot clearly and consistently see the lane markings then the LDW system will probably not be able to either.

4.2.1.1 Daytime. Clement weather or light rain or light snow (no obscuration of lane markings by accumulated snow) with lane markings which meet the traffic standards regarding color, size and visibility for the region being tested.

4.2.1.2 Nighttime. Clement weather, dry road and good lane marking contrast.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Operating Status (Test Bench or Vehicle).

4.3.1.1 Follow the procedure and answer the questions in the Operating Status tab of CG2332.

4.3.1.2 Complete the data sheets of CG2332 for inclusion in the test report.

4.3.2 Diagnostics (Test Bench or Vehicle).

4.3.2.1 Follow the procedure and answer the questions in the Diagnostics tab of CG2332.

4.3.2.2 Complete the data sheets of CG2332 for inclusion in the test report.

4.3.3 LDW Performance (Vehicle).

4.3.3.1 Follow the procedure and answer the questions in the LDW Performance tab of CG2332.

4.3.3.2 Complete the data sheets in Appendix B for inclusion in the test report.

4.3.3.3 Complete the data sheets of CG2332 for inclusion in the test report.

5 Data

5.1 Calculations.

5.2 Interpretation of Results. Pass/Fail criteria are from the CTS. Forward the results of this test to the appropriate Validation Engineer. All questions shall be answered "Meets Requirements".

5.3 Test Documentation. See Appendix B and CG2332 for data sheets.

6 Safety

This standard may involve hazardous materials, operations, and equipment. This standard does not propose to address all the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

7 Notes

7.1 Glossary.

DBC File: A file type primarily associated with CANdb, by Vector Informatik GmbH.

Figure Eight Maneuver: A driving maneuver in which the vehicle is driven in a complete circle in one direction, followed immediately by a complete circle in the opposite direction.

IMC Datworks: Source of CANsas Distributed I/O test software.

Intrepid Control Systems: Source of Vehicle Spy 3 and NeoVI Fire test software.

Lane Departure Warning (LDW) System: A driver assistance system that alerts the driver when the vehicle is about to drift beyond a delineated edge line of the current travel lane.

NeoVI: A vehicle diagnostic and testing hardware package, used with Vehicle Spy software.

OxTS: Oxford Technical Solutions, a manufacturer of GPS-aided Inertial Navigation systems.

RT3000: An Inertial + GPS Navigation System product from Oxford Technical Solutions.

Vehicle Spy: A vehicle diagnostic and testing software package, used with NeoVI hardware.

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7.2 Acronyms, Abbreviations, and Symbols.

ALDL	Assembly Line Diagnostic Link
CAN	Controller Area Network
CTS	Component Technical Specification
Dev/Val	Development and Validation
FCM	Front Camera Module
GMLAN	General Motors Local Area Network
GPS	Global Positioning System
GVWR	Gross Vehicle Weight Rating
IP	Internet Protocol
IVER	Integration Vehicle Engineering Release
LDW	Lane Departure Warning
LF	Left Front
LR	Left Rear
MPG	Milford Proving Ground
MVB_NS	Manufacturing Validation Build, Non-Salable
MVB_S	Manufacturing Validation Build, Salable
OxTS	Oxford Technical Solutions
PER	Procedure Execution Request
PPV	Product/Process Validation (Vehicle)
RF	Right Front
RR	Right Rear
SSTS	Subsystem Technical Specification
TCP	Transmission Control Protocol
WLAN	Wireless Local Area Network

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW16071

9 Release and Revisions

This standard was originated in September 2008. It was first approved by Electrical Function, Safety and Avoidance in January 2009. It was first published in January 2009.

Issue	Publication Date	Description (Organization)
1	JAN 2009	Initial publication.
2	JUL 2012	Revised per requirements of FCM CTS version 3.0. (Active Safety Dev/Val)

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