



Forward Collision Alert Subsystem Validation Test

1 Introduction

Note: Nothing in this standard supercedes 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 Forward Collision Alert (FCA) and Following Distance Indicator (FDI) subsystems.

1.2 Applicability. This procedure applies to passenger vehicles that are equipped with a FCA/FDI subsystem and intend to comply with the applicable GM requirements. This would include camera based and radar based systems.

1.3 Remarks. This procedure covers General Motors' validation test requirements for FCA/FDI subsystems.

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.

- Anthony Best Dynamics (ABD). (abd.uk.com)
- CG2927 FCA Summary Data Sheet for GMW16624. The supplier shall work with the GM Design Responsible Engineer to comprehend this requirement.
- CG4339 Data Processing Macro for Automatic Braking Features.
- Front Impact Mitigation Feature Technical Specification (FIM FTS).
- GM specifications for Forward Collision Alert (FCA) and Following Distance Indicator (FDI) subsystems.
- imc DataWorks. (imcdataworks.com)
- Instructions for constructing simulator.
- Intrepid Control Systems. (intrepidcs.com)
- Oxford Technical Solutions (OxTS). (oxts.com)
- OxTS User Manual.
- Production or service procedure.
- SSTS.

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 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

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3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

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

3.1.4 Test Track. The roadway should be straight, flat, and at least 2 km in length, with the pavement in good condition. At the Milford Proving Ground (MPG), the Active Safety Test Area can be used for this testing.

3.1.5 Public Roads. Public road system that contains the real world road conditions outlined in the SSTs. Road details are provided in CG2927, (the supplier shall work with the GM Design Responsible Engineer to comprehend this requirement).

3.2 Equipment. Complete the Instrument Calibration Data Sheet in CG2927 (the supplier shall work with the GM Design Responsible Engineer to comprehend this requirement). Measurements required are:

- Longitudinal vehicle speed of the Subject Vehicle (SV) and Principal Other Vehicle (POV).
- Yaw rate of the SV and POV.
- Longitudinal range between the SV and POV.
- Lateral range between the SV and POV.
- Accelerations of the SV and POV.
- Time to Collision (TTC), calculated from the formula in 5.1.
- FCA system alert status and request.
- FDI (following distance and following time).

3.2.1 Global Positioning System (GPS). RT3000 series with Hunter/Target solution from Oxford Technical Solutions (OxTS), available at MPG. Other regions information will be added as testing is developed.

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

3.2.3 Data Acquisition System. Data acquisition system to log signals defined in 3.2. Laptop computer with Vehicle Spy 3 and NeoVI Fire (from Intrepid Control Systems) and CANSAS module (from imc DataWorks), available at MPG.

3.2.4 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 GMNA on the test benches at the Warren Electrical Lab. Simulators are available for both camera based and radar based systems.

3.2.5 Mid-sized Passenger Car (POV). The POV must be equipped with a programmable acceleration/braking system. A vehicle equipped with the Anthony Best Dynamics (ABD) braking robot system is available at MPG.

3.2.6 Communication Equipment. Two way communication between SV and POV during the test. Radio or cell phones.

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

3.4 Test Time.

Calendar time:	5 days
Test hours:	20 h
Coordination hours:	8 h

3.5 Test Required Information.

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

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

3.5.3 Public road driving routes for the region being tested. See CG2927 for road lists and maps (the supplier shall work with the GM Design Responsible Engineer to comprehend this requirement).

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3.5.4 CG2927 FCA Summary Data Sheet for GMW16624 (the supplier shall work with the GM Design Responsible Engineer to comprehend this requirement).

3.6 Personnel/Skills. The vehicle level tests require three (3) people to perform: The driver of the SV, the driver of the POV, and a data collector in the passenger seat of the SV. These people will need driving privileges and access to the test track being used. At MPG, contact MPG Traffic Safety to schedule test time on the Military Straightaway. Access to two (2) laptop computers running the data acquisition software, and familiarity with their use and the use of the GPS equipment is required.

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 new FCA components have been installed, align the units per the production or service procedure.

4.1.3 For the vehicle level tests, 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 CG2927 to summarize the data from each test (the supplier shall work with the GM Design Responsible Engineer to comprehend this requirement).

4.2 Conditions.

4.2.1 Environmental Conditions. (Applicable to Vehicle Level Testing.) Testing should be performed in good weather conditions.

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.

Note: For the vehicle level tests, full braking and/or swerving maneuvers may be necessary to avoid vehicle to vehicle contact while conducting these tests.

4.3 Instructions.

4.3.1 FCA/FDI Subsystem.

4.3.1.1 Follow the procedure and complete the data sheets found in CG2927 (the supplier shall work with the GM Design Responsible Engineer to comprehend this requirement).

5 Data

5.1 Calculations. Calculate TTC using the formulas defined in the Front Impact Mitigation (FIM) Feature Technical Specification (FTS) (FIM FTS). Range is defined as the distance between the SV and POV.

For the case where relative acceleration is zero:

$$TTC = \frac{Range}{(v_{SV} - v_{POV})}$$

For the case where relative acceleration is not zero:

$$TTC = \frac{-(v_{SV} - v_{POV}) + \sqrt{(v_{SV} - v_{POV})^2 + 2 * (a_{SV} - a_{POV}) * Range}}{(a_{SV} - a_{POV})}$$

5.1.1 Data Processing Macros. Use the macros in CG4339 to process the data files obtained from this procedure and calculate the Pass/Fail criteria.

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