



Direct Tire Pressure Monitoring System Test

1 Scope

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 provide a uniform method to verify and validate the functionality of the direct Tire Pressure Monitor System (TPMS). This specification validates the direct TPMS to the associated General Motors (GM) or Supplier Subsystem Technical Specification (SSTS). This specification does not validate to any Federal Motor Vehicle Safety Standard (FMVSS).

1.2 Foreword. The direct TPMS measures actual tire pressure through the use of a sensor in each tire. The TPMS receiver then collects the sensor data and has provisions to transmit the tire pressure information to the appropriate driver display module.

1.3 Applicability. This specification applies to all GM light-duty passenger vehicles equipped with a direct TPMS as described above and can be applied for development and validation purposes.

Note: This specification does not apply to vehicles equipped with an indirect TPMS, also known as Tire Inflation Monitor System (TIMS). The FMVSS 138 requirements for TPMS are validated in the GMW15752 test procedure.

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.

- TPMS SSTS

3 Resources

3.1 Facilities. A test track capable of running constant speeds for extended periods of time and safe stopping areas to record data and adjust tire pressures. Examples include the GM Milford Proving Ground (MPG) Circle Test Track and Oval Test Track.

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

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.

3.2 Equipment. Complete Data Sheet A1 - Instrument Calibration in Appendix A.

3.2.1 Laptop computer with interface hardware and software (Vehicle Spy, Computer Aided Test (CAT), Vehicle Link Tester (VLT), Vehicle Serial Interface (VSI), etc.) to collect data from the serial data bus.

3.2.2 Tire pressure gauge with an operating pressure of 0 kPa to 700 kPa (0 psi to 100 psi) and graduated increments of 1 kPa (0.1 psi) and an accuracy of $\pm 0.5\%$ of applied pressure.

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3.2.3 Timepiece (wrist watch or stop watch) with graduated increments of 1 s and an accuracy of at least 1 s.

3.2.4 TPMS sensor reprogramming tool (J-46079 Kent-Moore or equivalent).

3.3 Test Vehicle/Test Piece. Test vehicle equipped with TPMS to be tested and representative of the group of vehicles whose compliance is being demonstrated.

3.3.1 Representative set(s) of wheels and tires (excluding spare) equipped with the appropriate TPMS hardware for testing.

3.3.2 TPMS parts to be tested shall have passed component level testing prior to performing these vehicle level tests. If required, test parts should be sorted and the limit samples chosen for vehicle level testing.

3.4 Test Time.

Calendar time: 1 day per tire/wheel set

Test hours: 6 hours per tire/wheel set

Coordination hours: 4 hours

3.5 Test Required Information. Obtain from the Design Release Engineer (DRE), TPMS Lead Engineer or Requesting Engineer.

3.5.1 TPMS reset procedure, if applicable.

3.5.2 TPMS sensor learn procedure.

3.5.3 TPMS receiver development mode and plant mode instructions, if applicable.

3.5.4 Placard pressure for Lightly Loaded Vehicle Weight (LLVW). If the pressure is not specified for the LLVW condition, then use the placard pressure specified for the gross vehicle weight rating (GVWR) vehicle load. Obtain ballast conditions to be tested from requesting engineer.

3.5.5 TPMS sensor accuracy specification.

3.5.6 Tire pressure at which warnings (low and high pressure) will be displayed.

3.5.7 Data collection files for the interface software being used. These files will record or count the TPM messages being transmitted on the serial data bus.

3.6 Personnel/Skills. The tester must have the ability to use the laptop computer, serial data interface software and have access to a test track as described in 3.1.

4 Procedure

4.1 Preparation. Reference Data Sheet A2 - Test Information in Appendix A.

4.1.1 Determine with the Requesting Engineer the proper component hardware, software and calibration configurations required for this test and update the test vehicle as required. This includes, but is not limited to the TPMS receiver, i.e., Remote Function Actuation (RFA) module, TPMS sensor, Driver Display Module, i.e., Instrument Panel Cluster (IPC), and Body Computer Module (BCM).

4.1.2 Mount the set of wheels/tires/sensors to be tested.

4.1.3 Perform the sensor learn procedure.

4.1.4 Ballast the vehicle to the desired test weight condition, i.e., LLVW. Locate the ballast to minimize interference with the TPM signals, i.e., no ballast on seats. The vehicle may be tested at any weight between LLVW +50 kg, -0 kg (+110 lb, -0 lb) and GVWR +0 kg, -50 kg (+0 lb, -110 lb) without exceeding any of its Gross Axle Weight Ratings (GAWR).

4.1.5 Locate the front passenger seat in the full rearward position with seat back set to approximately the same angle as the driver seat. Locate all other passenger seats in upright, unfolded position with all headrests down.

4.1.6 No additional cargo and no passengers during testing is allowed.

4.1.7 Inflate the vehicle's tires to the placard pressure or as specified by the requesting engineer.

4.1.8 Connect the laptop computer and interface to the vehicle Assembly Line Diagnostic Link (ALDL) connector. Load the appropriate data collection file. Locate the laptop and interface on the passenger floor as far away from the TPMS receiver as possible. Route all wiring along the floor of the vehicle.

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4.1.9 Prepare the TPMS Receiver and TPMS sensors for the test. Preparation methods will vary depending on the electrical architecture of the test vehicle. Consult the receiver DRE or Lead Engineer for direction. This may include development or manufacturing modes that need to be considered. Verify that there are no TPMS warnings or fault codes present.

Note: If there is a Receiver Plant Mode, refer to 7.1 Glossary, the receiver must not be in this mode for this test.

4.2 Conditions.

4.2.1 Environmental Conditions. This procedure can be performed under all safe driving conditions. Refrain from cell phone usage during testing as this may alter the results. While driving, choose a driving lane at least one lane distance from guard rails or large structures and keep away from other vehicles as much as possible. Avoid tracking another vehicle for more than 1 minute.

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.

Perform the following tests for each set of wheels and tires specified by the requesting engineer. Also perform for each sensor transmission frequency approved for the program, i.e., domestic US 315 MHz and Europe export 433 MHz.

4.2.2.1 Transmission and Reception Test. Perform in development mode for receivers that require it to transmit all TPMS frames, i.e., class 2 Remote Control Door Lock Receiver (RCDLR).

4.2.2.2 Jamming Test. Perform in development mode for receivers that require it to transmit all TPMS frames, i.e., Class 2 RCDLR.

4.2.2.3 Sensor Accuracy Test. For vehicles with a numerical display for tire pressures.

4.2.2.4 Warnings Test.

4.3 Instructions.

4.3.1 Transmission and Reception Test. Reference Data Sheet A3 in Appendix A.

4.3.1.1 Prepare the receiver. See 4.1.9.

4.3.1.2 Begin the data collection program using the laptop computer.

4.3.1.3 Accelerate the vehicle to 55 km/h (35 mph) and continue driving for 30 minutes. Start collecting data and the stop watch when the vehicle reaches the test speed.

4.3.1.4 Save the recorded data file for later analysis. **Note:** The data collection program may do this automatically.

4.3.1.5 Repeat steps 4.3.1.3 and 4.3.1.4 for test speeds of 80 km/h (50 mph), 105 km/h (65 mph) and 130 km/h (80 mph). Use separate file names.

4.3.2 Jamming Test. Again reference Data Sheet A3 in Appendix A.

4.3.2.1 Turn on as many of the vehicle's continuously running Electromagnetic Interference (EMI) sources as possible. See examples in Table 1.

Table 1: EMI Noise Sources ^{Note 1}

Engine running at idle	Interior lights: Pulse Width Modulated (PWM)
Engine cooling fan	Rear defogger grid
Heating Ventilation and Air Conditioning (HVAC) blower (front)	Radio tune to 105.1 FM
HVAC blower (rear)	Rear entertainment
Wipers (front and rear)	Displays: Driver Information Center (DIC), Heads-Up Device (HUD)
Seat heat/message	Video screens
Ventilated seat fan	Headlights: High Intensity Discharge (HID)

Note 1: Use the highest speed settings unless another speed is known to be worst case or specified by the requesting engineer.

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