REPORT NUMBER 138-STF-09-001

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 138 TIRE PRESSURE MONITORING SYSTEMS

GENERAL MOTORS CORPORATION
2009 CHEVROLET IMPALA
FOUR-DOOR PASSENGER CAR
NHTSA NO. C90100

U.S. DOT SAN ANGELO TEST FACILITY
131 COMANCHE TRAIL, BUILDING 3527
GOODFELLOW AFB, TEXAS 76908

January 29, 2009

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
NVS-220
OFFICE OF VEHICLE SAFETY COMPLIANCE
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16. Abstract Compliance tests were conducted on the subject 2009 Chevrolet Impala four-door passenger car in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-138-03 for the determination of FMVSS 138 compliance. Test failures identified were as follows: NONE.		
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INTRODUCTION

1.1 PURPOSE OF COMPLIANCE TEST

A 2009 Chevrolet Impala four-door passenger car was tested to determine if the vehicle was in compliance with the requirements of FMVSS 138. All tests were conducted in accordance with NHTSA/Office of Vehicle Safety Compliance (OVSC) Laboratory Test Procedure TP-138-03 dated July 12, 2007.

1.2 TEST VEHICLE

The test vehicle was a 2009 Chevrolet Impala four-door passenger car. Nomenclatures applicable to the test vehicle are:

A. Vehicle Identification Number: 2G1WB57K991103176

B. NHTSA Number: C90100

C Manufacturer: General Motors Corporation

D. Manufacture Date: 07/2008

1.3 TEST DATE

The test vehicle was tested during the time period December 9, 2008, through January 27, 2009.

SECTION 2

TEST PROCEDURE AND SUMMARY OF RESULTS

2.1 TEST PROCEDURE

Prior to test, the test vehicle was inspected for completeness, systems operability, and appropriate fuel and liquid levels, i.e. oil and coolant. The vehicle was then photographically documented as required by the NHTSA/OVSC Test Procedure. Tire sidewall information was recorded. The owner's manual was reviewed, and pertinent tire and TPMS information were noted. Telltale's symbol, color, location and lamp function were checked. The vehicle does not have a telltale that identifies which tire is under-inflated. There is a message center that does not show the telltale but provides messages indicating which tire(s) is (are) under-inflated. This message center indicated a TPMS system service message when the malfunction occurred during Scenario G.

Subsequent events included weighing the vehicle to establish the Unloaded Vehicle Weight (UVW) and the distribution of weight on the front and rear axles and each wheel position. The vehicle was loaded to its Lightly Loaded Vehicle Weight (LLVW) for three tire deflation scenarios. This LLVW included the weights of driver, one passenger, and test equipment. The vehicle was loaded to its Unloaded Vehicle Weight plus Vehicle Capacity Weight (VCW) for three additional tire deflation scenarios. The VCW included the weights of driver, one passenger, test equipment, ballast in the rear seat, and ballast in the rear trunk. The vehicle is required to be loaded to its maximum capacity without exceeding either the Vehicle Capacity Weight or Gross Vehicle Weight Rating (GVWR). For determination of the telltale warning activation pressure, the recommended cold inflation pressure was identified from the vehicle placard.

The vehicle was instrumented with a Racelogic VBOX III 100 Hz GPS Data Logger and brake pedal trigger. The VBOX uses GPS to measure vehicle speed, time, and distance. Test data were recorded to a compact flash card. During the test, a stopwatch was used to determine the approximate "cumulative driving time" during each test phase. Cumulative driving time does not include time during the brake application or when the vehicle speed was below 50 km/h or above 100 km/h. Upon completion of a tire deflation scenario, graphs were generated by VBOX software showing vehicle speed versus time during the test procedures. The graphs furnish a second-by-second analysis of each calibration phase. The cumulative driving time was calculated by post-processing the VBOX graph data, and is reported in Section 3 (Test Data) as 'Total Driving Time'. Driving above 50 km/h was not required for the detection or extinguishment phases.

The tire deflation test scenario consisted of four phases:

1. Calibration phase: Tires were set at vehicle placard cold inflation pressure and the vehicle was driven for at least twenty minutes of cumulative driving time between 50 and 100 km/h.

2. Detection phase: Immediately after calibration phase, the selected tire(s) were deflated to seven kPa (one psi) below the Telltale Warning Activation Pressure. After one minute, the inflation pressure(s) of only deflated tire(s) were rechecked and adjusted if necessary. The vehicle was started and driven as necessary. In all scenarios except one, illumination occurred before driving.
3. Cool down phase: Vehicle was parked in the San Angelo Test Facility (SATF) open bay shielded from direct sunlight. Tires were allowed to cool down for a minimum of one hour. After cool down, the vehicle was started and the low tire pressure telltale was checked for re-illumination.
4. Extinguishment phase: Tires were adjusted to vehicle placard cold inflation pressure. The vehicle is normally started and driven between 50 and 100 km/h to verify telltale extinguishment, but in these instances the Impala telltale extinguished before driving was required.

Two malfunction scenarios were performed on the Impala. The first scenario was performed with the vehicle loaded to its LLVW. The malfunction was simulated by placing the compact spare tire, with no TPMS sensor, on the right front wheel position. A second malfunction detection scenario was performed by disconnecting the Omron TPMS receiver. In both cases, the malfunction telltale properly operated within the requisite time period.

2.2 SUMMARY OF RESULTS

Three tire deflation scenarios were performed on the test vehicle at LLVW:

A. Right rear
B. Left front and right front
C. Left rear, right rear, and right front

Three tire deflation scenarios were performed on the test vehicle at UVW + VCW:

D. Left front
E. Left rear and right front
F. Left front, left rear, right rear, and right front

The data indicate compliance of the test vehicle's tire pressure monitoring system for the six tire deflation scenarios tested.

Two malfunction detection scenarios were performed on the test vehicle at LLVW:

G. Spare tire without TPMS sensor was applied to right front wheel position.
H. The TPMS receiver was disconnected.

In both scenarios, the vehicle's combination malfunction telltale properly operated per the standard's requirements.

SECTION 3

TEST DATA

FMVSS No. 138 – TEST DATA SUMMARY

TEST DATES: December 9 - January 27, 2009 LAB: U. S. DOT San Angelo Test Facility

VIN: 2G1WB57K991103176 VEHICLE NHTSA NUMBER: C90100

CERTIFICATION LABEL BUILD DATE: 07/2008

REQUIREMENTS	PASS/FAIL
LOW TIRE PRESSURE WARNING TELLTALE S138: S4.3.1 (a), (b); S4.3.3 (a), (b)	
Mounting	**PASS**
Symbol and color	**PASS**
Check of lamp function	**PASS**
MALFUNCTION TELLTALE S138: S4.4 (b) or (c)	
Mounting	**PASS**
Symbol and color	**PASS**
Check of lamp function	**PASS**
LOW TIRE PRESSURE WARNING - OPERATIONAL PERFORMANCE S138: S4.2, S4.3.1 (c), S4.3.2	
Telltale illumination	**PASS**
MALFUNCTION INDICATOR – OPERATIONAL PERFORMANCE S138: S4.4 (a)	
Telltale illumination	**PASS**
TPMS WRITTEN INSTRUCTIONS S138: S4.5	
Image of telltales	**PASS**
Verbatim statements	**PASS**

REMARKS: None

DATA SHEET 1 (Sheet 1 of 3)
TEST PREPARATION INFORMATION

TEST DATE: December 10, 2008 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100 VIN: 2G1WB57K991103176

CERTIFICATION LABEL BUILD DATE: 07/2008 ENGINE: 3.5 L V6

MY/MAKE/MODEL/BODY STYLE: 2009 Chevrolet Impala four-door passenger car

TIRE CONDITIONING:

(X) Tires used more than 100 km. Actual odometer reading : 108 km (67 mi)

VEHICLE ALIGNMENT AND WHEEL BALANCING:

Alignment checked: ( ) Front ( ) Rear (X) COTR waived

Wheels balanced: ( ) Front ( ) Rear (X) COTR waived

TPMS IDENTIFICATION:

TPMS MAKE/MODEL: OMRON Receiver; Schrader Pressure Sensor, model #25920615

Source: Manufacturer supplied information

TPMS TYPE: (X) Direct ( ) Indirect ( ) Other

TPMS MALFUNCTION INDICATOR TYPE:

( ) None ( ) Dedicated Telltale (X) Combination low tire pressure/malfunction telltale

Does TPMS require execution of a learning/calibration driving phase? ( )YES (X)NO

Source: Manufacturer supplied information

Does TPMS have a manual reset control? ( )YES (X)NO

Note: The Impala does not have a manual reset control. However, there is a sequence of actions that need to be taken when tires are rotated and/or a wheel sensor is replaced so the system can learn the new sensor identification numbers and exact locations (refer to Owner's Manual in Section 7).

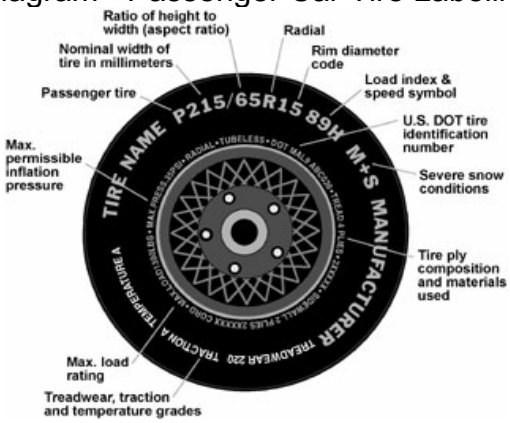
DATA SHEET 1 (Sheet 2 of 3)
TEST PREPARATION INFORMATION

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING AND OWNER'S MANUAL:

Axle	Tire Size	Recommended Cold Inflation Pressure	Source
Front	P225/60R16	210 kPa (30 psi)	Vehicle placard
Rear	P225/60R16	210 kPa (30 psi)	Vehicle placard

INSTALLED TIRE DATA

Diagram - Passenger Car Tire Labeling



Front and Rear Axles

Tire Size and Load Index / Speed Rating: P225/60R16 97S

Manufacturer/Tire Name: Goodyear Integrity

Sidewall Max Load Rating: 730 kg (1,609 lbs)

Max Inflation Pressure: 300 kPa (44 psi)

Sidewall Construction (number of plies and ply material): 1 polyester

Tread Construction (number of plies and ply material): 1 polyester, 2 steel

Do all installed tires have the same sidewall information? (X)YES ( )NO

Are all installed tires the same as designated by the vehicle manufacturer on the vehicle placard? (X)YES ( )NO

DATA SHEET 1 (Sheet 3 of 3)
TEST PREPARATION

Worksheet for Determining FMVSS No. 138 Telltale Warning Activation Pressure for Tires Installed on Vehicle		
Part	**Front Axle**	**Rear Axle**
(A) Recommended Inflation Pressure x .75	210 kPa x .75 = 157.5 kPa	210 kPa x .75 = 157.5 kPa
(B) Information from FMVSS 138 Table 1 below, Tire types are: Inflation pressure Minimum activation pressures from Table 1	(X) P-metric-Standard load ( ) P-metric-Extra Load Load Range ( ) C, ( ) D, or ( ) E (X) Maximum or ( ) Rated 300 kPa (44 psi) 140 kPa (20 psi)	(X) P-metric-Standard load ( ) P-metric-Extra Load Load Range ( ) C, ( ) D, or ( ) E (X) Maximum or ( ) Rated 300 kPa (44 psi) 140 kPa (20 psi)
(C) Telltale Warning Activation Pressure is the higher of Part (A) or (B)	157.5 kPa (22.8 psi)	157.5 kPa (22.8 psi)
(D) Pressure at which to deflate tire(s) = (C) – 7 kPa	150.5 kPa (21.8 psi)	150.5 kPa (21.8 psi)

FMVSS 138 Table 1 - Low Tire Pressure Warning Telltale - Minimum Activation Pressure

Tire Type	**Maximum or Rated Inflation Pressure**		**Minimum Activation Pressure**	
	(kPa)	**(psi)**	**(kPa)**	**(psi)**
P-metric -- Standard Load	240, 300, or 350	35, 44, or 51	140 140 140	20 20 20
P-metric - Extra Load	280 or 340	41 or 49	160 160	23 23
Load Range C	350	51	200	29
Load Range D	450	65	240	35
Load Range E	550	80	240	35

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: December 10, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 2 (Sheet 1 of 2)
LOW TIRE PRESSURE WARNING AND MALFUNCTION TELLTALE

TEST DATE: December 10, 2008 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

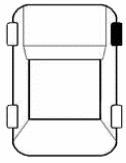
TPMS Low Tire Pressure Warning Telltale

TPMS Low Tire Pressure Warning Telltale Location: Inside lower right of tachometer

Telltale is mounted inside the occupant compartment in front of and in clear view of the driver?

(X)YES ( )NO (fail)

Identify Telltale Symbol Used (check box above figure).

[X]  [ ]  [ ] OTHER (fail) (describe below)

Note any words or additional symbols used:

See Remarks.

Telltale is part of a reconfigurable display? ( )YES (X)NO

TPMS Malfunction Telltale

( ) None ( ) Dedicated stand-alone (X) Combined with low tire pressure telltale

DATA SHEET 2 (Sheet 2 of 2)
LOW TIRE PRESSURE WARNING AND MALFUNCTION TELLTALE

Check Telltale Lamp Functions:

LOW TIRE PRESSURE TELLTALE AND MALFUNCTION INDICATION, IF COMBINED

Ignition locking system position when telltale illuminates:

[ ]	OFF/LOCK	[ ]	Between OFF/LOCK and ON/RUN
[ ]	ON/RUN	[X]	Between ON/RUN and START

Is the telltale yellow in color? (X)YES ( )NO (fail)

Time telltale remains illuminated 5.2 seconds.

Starter Interlocks:

Does vehicle have any starter, transmission or other interlocks that affect operation of the telltale lamp check function? ( )YES (X)NO

Low Tire Pressure Warning and Malfunction Telltale (PASS/FAIL) **PASS**

REMARKS: The 5.2 seconds that the telltale remains illuminated is the lamp check time. The vehicle is equipped with a message information center (MIC) that provides additional guidance in conjunction with the combined TPMS low tire pressure and malfunction warning telltale. The MIC indicates low inflation pressure and tire location, as well as service requirements when a malfunction is identified.

RECORDED BY: Jack R. Stewart DATE: December 10, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 1 of 22)
TPMS OPERATIONAL PERFORMANCE

TEST DATE: December 9, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Time:	Start:	2:04 pm	End:	2:56 pm
Ambient Temperature:	Start:	6.7°C (44.1°F)	End:	5.6°C (42.1°F)
Trip Odometer Reading:	Start:	108.3 km (67.3 mi)		
Fuel Level:	Start:	Full		
Weather Conditions:		Cloudy and damp		

Time vehicle remained with engine off and tires shielded from direct sunlight (1 hour minimum): overnight

PRE-TEST TIRE INFLATION PRESSURES AND TIRE/SURFACE TEMPERATURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Pre-test cold measurements after ambient soak: Inflation Pressure	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)
Tire Sidewall Temp	13.6°C (56.5°F)	13.4°C (56.1°F)	13.6°C (56.5°F)	13.5°C (56.3°F)

DATA SHEET 3 (Sheet 2 of 22)
TPMS OPERATIONAL PERFORMANCE

VEHICLE WEIGHT:

Vehicle Ratings from Certification Label:

GVWR: 2,066 kg (4,554 lbs)

GAWR (front): 1,118 kg (2,464 lbs)

GAWR (rear): 948 kg (2,090 lbs)

Vehicle Capacity Weight:

Vehicle Capacity Weight 428 kg (944 lbs)

Measured Unloaded Vehicle Weight:

LF	497 kg (1,096 lbs)	LR	303 kg (668 lbs)
RF	504 kg (1,112 lbs)	RR	313 kg (689 lbs)
Front Axle	1,001 kg (2,208 lbs)	Rear Axle	616 kg (1,357 lbs)

Total Vehicle 1,617 kg (3,565 lbs)

Measured Test Weight: (X) LLVW (+50, -0 kg) ( ) UVW + VCW ( ) GVWR (+0, -50 kg)

LF	551 kg (1,214 lbs)		LR	349 kg (770 lbs)	
RF	562 kg (1,240 lbs)		RR	362 kg (798 lbs)	
Front Axle	1,113 kg (2,454 lbs)	(≤ GAWR)	Rear Axle	711 kg (1,568 lbs)	(≤ GAWR)

Total Vehicle 1,824 kg (4,022 lbs) (not greater than GVWR)

Note: For scenarios A, B, C, and G, this total vehicle weight measures the vehicle loaded to Lightly Loaded Vehicle Weight (LLVW), 207 kg (457 lbs) of driver, passenger, and test equipment.

DATA SHEET 3 (Sheet 3 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation at LLVW

TEST DATE: December 10, 2008 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Note: See Data Sheet 3 (Sheet 2 of 22) for Test Weight.

TIRE INFLATION PRESSURES AND TIRE/SURFACE TEMPERATURES BEFORE CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After loading vehicle to lightly loaded vehicle weight, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 8.0°C (46.4°F) Vehicle cool down period: overnight				
Inflation Pressure	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)
Tire Sidewall Temp	7.8°C (46.0°F)	8.1°C (46.6°F)	8.1°C (46.6°F)	8.1°C (46.6°F)
San Angelo Test Facility Shop Floor Temp	8.3°C (46.9°F)	8.6°C (47.5°F)	8.3°C (46.9°F)	8.3°C (46.9°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	18:52:43 UTC	End:	19:16:50 UTC
Trip Odometer Reading:	Start:	109.0 km (67.7 mi)	End:	141.1 km (87.7 mi)
Ambient Temperature:	Start:	8.3°C (46.9°F)	End:	8.3°C (46.9°F)
Roadway Temperature:	Start:	15.0°C (59.0°F)	End:	17.2°C (63.0°F)

Driving in first direction:

Starting point: Goodfellow Air Force Base (GAFB) north gate Direction: see chart, page 63

10:11 minutes (stopwatch time) 15.9 km (9.9 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 63

10:28 minutes (stopwatch time) 16.3 km (10.1 mi) distance

Max speed: 98.8 km/h (61.4 mph)

Total Driving Time: 20:39 minutes (VBox time)

DATA SHEET 3 (Sheet 4 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation at LLVW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Immediately, after vehicle is stopped, engine off: Inflation Pressure	230.5 kPa (33.4 psi)	226.8 kPa (32.9 psi)	227.4 kPa (33.0 psi)	231.7 kPa (33.6 psi)
Tire Sidewall Temp	20.8°C (69.4°F)	16.8°C (62.2°F)	18.2°C (64.8°F)	21.6°C (70.9°F)
San Angelo Test Facility Shop Floor Temp	8.4°C (47.1°F)	8.6°C (47.5°F)	8.4°C (47.1°F)	8.0°C (46.4°F)

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURE(S) OF DEFLATED TIRE(S):

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Indicate Location of Tire(s) Deflated: ( )LF ( )LR (X)RR ( )RF Inflation Pressure	0 kPa (0.0 psi)	0 kPa (0.0 psi)	150.5 kPa (21.8 psi)	0 kPa (0.0 psi)

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: west, north

2.0 seconds after lamp check (stopwatch time – non-cumulative)

Driving was not required.

TELLTALE ILLUMINATES WITHIN 20 MINUTES: (X)YES ( )NO (fail)

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

DATA SHEET 3 (Sheet 5 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation at LLVW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After vehicle cool down period: Ambient Temperature: 10.7°C (51.3°F) Vehicle cool down period: 61 minutes				
Inflation Pressure	217.5 kPa (31.5 psi)	216.1 kPa (31.3 psi)	143.3 kPa (20.8 psi)	218.3 kPa (31.7 psi)
Tire Sidewall Temp	11.8°C (53.2°F)	13.4°C (56.1°F)	12.2°C (54.0°F)	11.6°C (52.9°F)
San Angelo Test Facility Shop Floor Temp	11.0°C (51.8°F)	11.6°C (52.9°F)	10.8°C (51.4°F)	10.2°C (50.4°F)

After the cool down period of a minimum of one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? (X)YES ( )NO (fail)

TELLTALE EXTINGUISHMENT:

RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After illumination verification: Re-adjusted Inflation Pressure:	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ( )YES (X)NO

TPMS Performance Test Results (PASS/FAIL) **PASS**
Right rear tire was deflated at LLVW.

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: December 10, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 6 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO B – Left Front, Right Front Tire Deflation at LLVW

TEST DATE: December 11, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Note: See Data Sheet 3 (Sheet 2 of 22) for Test Weight.

TIRE INFLATION PRESSURES AND TIRE/SURFACE TEMPERATURES BEFORE CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After loading vehicle to lightly loaded vehicle weight, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 5.3°C (41.5°F) Vehicle cool down period: overnight				
Inflation Pressure	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.1 kPa (30.5 psi)
Tire Sidewall Temp	5.6°C (42.1°F)	5.6°C (42.1°F)	5.4°C (41.7°F)	5.6°C (42.1°F)
San Angelo Test Facility Shop Floor Temp	7.6°C (45.7°F)	7.6°C (45.7°F)	7.6°C (45.7°F)	7.6°C (45.7°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	15:30:25 UTC	End:	15:54:28 UTC
Trip Odometer Reading:	Start:	142.6 km (88.6 mi)	End:	174.8 km (108.6 mi)
Ambient Temperature:	Start:	5.3°C (41.5°F)	End:	7.9°C (46.2°F)
Roadway Temperature:	Start:	6.2°C (43.2°F)	End:	9.6°C (49.3°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 64

10:15 minutes (stopwatch time) 15.9 km (9.9 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 64

10:21 minutes (stopwatch time) 16.3 km (10.1 mi) distance

Max speed: 98.9 km/h (61.5 mph)

Total Driving Time: 20:28 minutes (VBox time)

DATA SHEET 3 (Sheet 7 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO B – Left Front, Right Front Tire Deflation at LLVW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Immediately, after vehicle is stopped, engine off: Inflation Pressure	231.4 kPa (33.6 psi)	228.9 kPa (33.2 psi)	229.1 kPa (33.2 psi)	233.6 kPa (33.9 psi)
Tire Sidewall Temp	21.4°C (70.5°F)	18.2°C (64.8°F)	18.4°C (65.1°F)	21.2°C (70.2°F)
San Angelo Test Facility Shop Floor Temp	8.2°C (46.8°F)	8.4°C (47.1°F)	8.6°C (47.5°F)	8.4°C (47.1°F)

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURE(S) OF DEFLATED TIRE(S):

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Indicate Location of Tire(s) Deflated: (X)LF ( )LR ( )RR (X)RF Inflation Pressure	150.5 kPa (21.8 psi)			150.5 kPa (21.8 psi)

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop

0.0 seconds after lamp check (stopwatch time – non-cumulative)

Driving was not required.

TELLTALE ILLUMINATES WITHIN 20 MINUTES: (X)YES ( )NO (fail)

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

DATA SHEET 3 (Sheet 8 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO B – Left Front, Right Front Tire Deflation at LLVW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After vehicle cool down period: Ambient Temperature: 11.0°C (51.8°F) Vehicle cool down period: 60 minutes				
Inflation Pressure	145.5 kPa (21.1 psi)	219.2 kPa (31.8 psi)	218.9 kPa (31.7 psi)	145.3 kPa (21.1 psi)
Tire Sidewall Temp	12.0°C (53.6°F)	11.6°C (52.9°F)	11.8°C (53.2°F)	11.2°C (52.2°F)
San Angelo Test Facility Shop Floor Temp	10.2°C (50.4°F)	10.4°C (50.7°F)	10.2°C (50.4°F)	10.0°C (50.0°F)

After the cool down period of a minimum of one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? (X)YES ( )NO (fail)

TELLTALE EXTINGUISHMENT:
RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After illumination verification: Re-adjusted Inflation Pressure:	210.0 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.0 kPa (30.5 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ( )YES (X)NO

TPMS Performance Test Results (PASS/FAIL) **PASS**
Left front and right front tires were deflated at LLVW.

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: December 11, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 9 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TEST DATE: December 11, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Note: See Data Sheet 3 (Sheet 2 of 22) for Test Weight.

TIRE INFLATION PRESSURES AND TIRE/SURFACE TEMPERATURES BEFORE CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After loading vehicle to lightly loaded vehicle weight, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 16.2°C (61.2°F) Vehicle cool down period: 61 minutes				
Inflation Pressure	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)
Tire Sidewall Temp	12.6°C (54.7°F)	13.2°C (55.8°F)	12.8°C (55.0°F)	11.8°C (53.2°F)
San Angelo Test Facility Shop Floor Temp	10.6°C (51.1°F)	10.8°C (51.4°F)	10.6°C (51.1°F)	10.6°C (51.1°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	18:27:02 UTC	End:	18:51:16 UTC
Trip Odometer Reading:	Start:	176.4 km (109.6 mi)	End:	208.4 km (129.5 mi)
Ambient Temperature:	Start:	16.2°C (61.2°F)	End:	16.8°C (62.2°F)
Roadway Temperature:	Start:	21.2°C (70.2°F)	End:	21.2°C (70.2°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 65

10:11 minutes (stopwatch time) 16.1 km (9.8 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 65

10:24 minutes (stopwatch time) 16.3 km (10.1 mi) distance

Max speed: 98.9 km/h (61.3 mph)

Total Driving Time: 20:35 minutes (VBox time)

DATA SHEET 3 (Sheet 10 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Immediately, after vehicle is stopped, engine off: Inflation Pressure	229.7 kPa (33.3 psi)	230.0 kPa (33.4 psi)	229.6 kPa (33.3 psi)	232.0 kPa (33.6 psi)
Tire Sidewall Temp	27.8°C (82.0°F)	24.8°C (76.6°F)	24.6°C (76.3°F)	28.6°C (83.5°F)
San Angelo Test Facility Shop Floor Temp	10.2°C (50.4°F)	10.6°C (51.1°F)	10.8°C (51.4°F)	10.8°C (51.4°F)

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURE(S) OF DEFLATED TIRE(S):

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Indicate Location of Tire(s) Deflated: ( )LF (X)LR (X)RR (X)RF Inflation Pressure		150.5 kPa (21.8 psi)	150.5 kPa (21.8 psi)	150.5 kPa (21.8 psi)

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop

0.0 seconds after lamp check (stopwatch time – non-cumulative)

Driving was not required.

TELLTALE ILLUMINATES WITHIN 20 MINUTES: (X)YES ( )NO (fail)

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

DATA SHEET 3 (Sheet 11 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After vehicle cool down period: Ambient Temperature: 18.5°C (65.3°F) Vehicle cool down period: 62 minutes				
Inflation Pressure	217.5 kPa (31.5 psi)	144.3 kPa (20.9 psi)	144.9 kPa (21.0 psi)	143.9 kPa (20.9 psi)
Tire Sidewall Temp	16.8°C (62.2°F)	18.4°C (65.1°F)	17.4°C (63.3°F)	17.2°C (63.0°F)
San Angelo Test Facility Shop Floor Temp	12.2°C (54.0°F)	12.6°C (54.7°F)	12.4°C (54.3°F)	11.8°C (53.2°F)

After the cool down period of a minimum of one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? (X)YES ( )NO (fail)

TELLTALE EXTINGUISHMENT:
RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After illumination verification: Re-adjusted Inflation Pressure:	210.0 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.1 kPa (30.5 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ( )YES (X)NO

TEST RESULTS

TPMS Performance Test Results (PASS/FAIL) **PASS**
Left rear, right rear, and right front tires were deflated at LLVW.

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: December 11, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 12 of 22)
TPMS OPERATIONAL PERFORMANCE

TEST DATE: December 17, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Time:	Start:	8:15 am	End:	9:50 am
Ambient Temperature:	Start:	4.7°C (40.5°F)	End:	5.7°C (42.3°F)
Trip Odometer Reading:	Start:	259.1 km (161.0 mi)		
Fuel Level:	Start:	Full		
Weather Conditions:	Cloudy with a light breeze			

Time vehicle remained with engine off and tires shielded from direct sunlight:
(1 hour minimum): overnight

PRE-TEST TIRE INFLATION PRESSURES AND TIRE/SURFACE TEMPERATURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Pre-test cold measurements after ambient soak: Inflation Pressure	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)
Tire Sidewall Temp	6.0°C (42.8°F)	6.2°C (43.2°F)	6.6°C (43.9°F)	6.4°C (43.5°F)

DATA SHEET 3 (Sheet 13 of 22)
TPMS OPERATIONAL PERFORMANCE

VEHICLE WEIGHT:

Vehicle Ratings from Certification Label:

GVWR: 2,066 kg (4,554 lbs)

GAWR (front): 1,118 kg (2,464 lbs)

GAWR (rear): 948 kg (2,090 lbs)

Vehicle Capacity Weight:

Vehicle Capacity Weight 428 kg (944 lbs)

Measured Unloaded Vehicle Weight:

LF	494 kg (1,088 lbs)	LR	306 kg (675 lbs)
RF	505 kg (1,113 lbs)	RR	313 kg (690 lbs)
Front Axle	999 kg (2,201 lbs)	Rear Axle	619 kg (1,365 lbs)

Total Vehicle 1,618 kg (3,566 lbs)

Measured Test Weight: ( ) LLVW (+50, -0 kg) (X) UVW + VCW ( ) GVWR (+0, -50 kg)

LF	550 kg (1,212 lbs)		LR	460 kg (1,015 lbs)	
RF	564 kg (1,244 lbs)		RR	471 kg (1,039 lbs)	
Front Axle	1,114 kg (2,456 lbs)	(≤ GAWR)	Rear Axle	931 kg (2,054 lbs)	(≤ GAWR)

Total Vehicle 2,045 kg (4,510 lbs) (not greater than GVWR)

Note: For scenarios D, E, and F, this Total Vehicle Weight measures the vehicle loaded to Unloaded Vehicle Weight (UVW) and Vehicle Capacity Weight (VCW), 428 kg (944 lbs) of driver, passenger, test equipment, and ballast.

DATA SHEET 3 (Sheet 14 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO D – Left Front Tire Deflation at UVW + VCW

TEST DATE: December 17, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Note: See Data Sheet 3 (Sheet 13 of 22) for Test Weight.

TIRE INFLATION PRESSURES AND TIRE/SURFACE TEMPERATURES BEFORE CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After loading vehicle to UVW + VCW, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 6.0°C (42.8°F) Vehicle cool down period: overnight				
Inflation Pressure	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)
Tire Sidewall Temp	7.2°C (45.0°F)	7.2°C (45.0°F)	7.4°C (45.3°F)	7.4°C (45.3°F)
San Angelo Test Facility Shop Floor Temp	8.2°C (46.8°F)	8.2°C (46.8°F)	8.4°C (47.1°F)	8.0°C (46.4°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	16:18:10 UTC	End:	16:43:32 UTC
Trip Odometer Reading:	Start:	259.7 km (161.4 mi)	End:	291.9 km (181.4 mi)
Ambient Temperature:	Start:	6.0°C (42.8°F)	End:	7.1°C (44.8°F)
Roadway Temperature:	Start:	8.4°C (47.1°F)	End:	8.6°C (47.5°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 66

10:08 minutes (stopwatch time) 15.9 km (9.9 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 66

10:26 minutes (stopwatch time) 16.3 km (10.1 mi) distance

Max speed: 98.9 km/h (61.5 mph)

Total Driving Time: 20:34 minutes (VBox time)

DATA SHEET 3 (Sheet 15 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO D – Left Front Tire Deflation at UVW + VCW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Immediately, after vehicle is stopped, engine off: Inflation Pressure	230.0 kPa (33.4 psi)	232.1 kPa (33.7 psi)	232.0 kPa (33.6 psi)	229.5 kPa (33.3 psi)
Tire Sidewall Temp	19.2°C (66.6°F)	17.2°C (63.0°F)	17.4°C (63.3°F)	19.2°C (66.6°F)
San Angelo Test Facility Shop Floor Temp	7.2°C (45.0°F)	8.2°C (46.8°F)	8.2°C (46.8°F)	8.2°C (46.8°F)

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURE(S) OF DEFLATED TIRE(S):

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Indicate Location of Tire(s) Deflated: (X)LF ( )LR ( )RR ( )RF Inflation Pressure	150.5 kPa (21.8 psi)			

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: west

45.5 seconds (stopwatch time – non-cumulative) 0.3 km (0.2 mi) distance

Driving above 50 km/hr was not required.

TELLTALE ILLUMINATES WITHIN 20 MINUTES: (X)YES ( )NO (fail)

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

DATA SHEET 3 (Sheet 16 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO D – Left Front Tire Deflation at UVW + VCW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After vehicle cool down period: Ambient Temperature: 11.5°C (52.7°F) Vehicle cool down period: 74 minutes				
Inflation Pressure	145.8 kPa (21.1 psi)	220.7 kPa (32.0 psi)	220.2 kPa (31.9 psi)	219.8 kPa (31.9 psi)
Tire Sidewall Temp	11.6°C (52.9°F)	12.2°C (54.0°F)	12.8°C (55.0°F)	10.8°C (51.4°F)
San Angelo Test Facility Shop Floor Temp	9.6°C (49.3°F)	10.2°C (50.4°F)	10.4°C (50.7°F)	9.8°C (49.6°F)

After the cool down period of a minimum of one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? (X)YES ( )NO (fail)

TELLTALE EXTINGUISHMENT:
RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After illumination verification: Re-adjusted Inflation Pressure:	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.1 kPa (30.5 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ( )YES (X)NO

TPMS Performance Test Results (PASS/FAIL) **PASS**
Left front tire was deflated at UVW + VCW.

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: December 17, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 17 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO E – Left Rear, Right Front Tire Deflation at UVW + VCW

TEST DATE: December 17, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Note: See Data Sheet 3 (Sheet 13 of 22) for Test Weight.

TIRE INFLATION PRESSURES AND TIRE/SURFACE TEMPERATURES BEFORE CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After loading vehicle to UVW + VCW, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 15.9°C (60.6°F) Vehicle cool down period: 62 minutes				
Inflation Pressure	210.1 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.0 kPa (30.5 psi)
Tire Sidewall Temp	13.8°C (56.8°F)	14.8°C (58.6°F)	15.6°C (60.1°F)	13.8°C (56.8°F)
San Angelo Test Facility Shop Floor Temp	11.0°C (51.8°F)	11.4°C (52.5°F)	11.8°C (53.2°F)	10.8°C (51.4°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	19:36:22 UTC	End:	20:01:19 UTC
Trip Odometer Reading:	Start:	294.0 km (182.7 mi)	End:	326.2 km (202.7 mi)
Ambient Temperature:	Start:	15.9°C (60.6°F)	End:	16.6°C (61.9°F)
Roadway Temperature:	Start:	18.8°C (65.8°F)	End:	19.8°C (67.6°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 67

10:10 minutes (stopwatch time) 15.9 km (9.9 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 67

10:28 minutes (stopwatch time) 16.3 km (10.1 mi) distance

Max speed: 97.4 km/h (60.5 mph)

Total Driving Time: 20:39 minutes (VBox time)

DATA SHEET 3 (Sheet 18 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO E – Left Rear, Right Front Tire Deflation at UVW + VCW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Immediately, after vehicle is stopped, engine off: Inflation Pressure	227.9 kPa (33.1 psi)	230.3 kPa (33.4 psi)	231.1 kPa (33.5 psi)	229.2 kPa (33.2 psi)
Tire Sidewall Temp	28.0°C (82.4°F)	26.0°C (78.8°F)	27.2°C (81.0°F)	28.6°C (83.5°F)
San Angelo Test Facility Shop Floor Temp	10.8°C (51.4°F)	11.6°C (52.9°F)	11.6°C (52.9°F)	11.6°C (52.9°F)

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURE(S) OF DEFLATED TIRE(S):

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Indicate Location of Tire(s) Deflated: ( )LF (X)LR ( )RR (X)RF Inflation Pressure		150.5 kPa (21.8 psi)		150.5 kPa (21.8 psi)

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop

0.0 seconds after lamp check (stopwatch time – non-cumulative)

Driving was not required.

TELLTALE ILLUMINATES WITHIN 20 MINUTES: (X)YES ( )NO (fail)

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

DATA SHEET 3 (Sheet 19 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO E – Left Rear, Right Front Tire Deflation at UVW + VCW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After vehicle cool down period: Ambient Temperature: 19.1°C (66.4°F) Vehicle cool down period: 60 minutes				
Inflation Pressure	216.5 kPa (31.4 psi)	143.1 kPa (20.8 psi)	218.0 kPa (31.6 psi)	143.9 kPa (20.9 psi)
Tire Sidewall Temp	18.2°C (64.8°F)	20.2°C (68.4°F)	19.6°C (67.3°F)	18.2°C (64.8°F)
San Angelo Test Facility Shop Floor Temp	12.8°C (55.0°F)	14.2°C (57.6°F)	12.8°C (55.0°F)	11.8°C (53.2°F)

After the cool down period of a minimum of one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? (X)YES ( )NO (fail)

TELLTALE EXTINGUISHMENT:
RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After illumination verification: Re-adjusted Inflation Pressure:	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ( )YES (X)NO

TPMS Performance Test Results (PASS/FAIL) **PASS**
Right front and left rear tires were deflated at UVW + VCW.

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: December 17, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 20 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO F – Left Front, Left Rear, Right Rear, and Right Front Tire Deflation at UVW +VCW

TEST DATE: December 18, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Note: See Data Sheet 3 (Sheet 13 of 22) for Test Weight.

TIRE INFLATION PRESSURES AND TIRE/SURFACE TEMPERATURES BEFORE CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After loading vehicle to UVW + VCW, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 13.5°C (56.3°F) Vehicle cool down period: overnight				
Inflation Pressure	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.0 kPa (30.5 psi)	210.0 kPa (30.5 psi)
Tire Sidewall Temp	13.2°C (55.8°F)	13.2°C (55.8°F)	13.2°C (55.8°F)	13.2°C (55.8°F)
San Angelo Test Facility Shop Floor Temp	12.6°C (54.7°F)	13.0°C (55.4°F)	13.2°C (55.8°F)	12.8°C (55.0°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	15:22:41 UTC	End:	15:47:12 UTC
Trip Odometer Reading:	Start:	327.7 km (203.6 mi)	End:	359.8 km (223.6 mi)
Ambient Temperature:	Start:	13.5°C (56.3°F)	End:	14.3°C (57.7°F)
Roadway Temperature:	Start:	13.7°C (56.7°F)	End:	15.4°C (59.7°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 68

10:10 minutes (stopwatch time) 15.9 km (9.9 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 68

10:25 minutes (stopwatch time) 16.3 km (10.1 mi) distance

Max speed: 98.2 km/h (61.0 mph)

Total Driving Time: 20:36 minutes (VBox time)

DATA SHEET 3 (Sheet 21 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO F – Left Front, Left Rear, Right Rear, and Right Front Tire Deflation at UVW +VCW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Immediately, after vehicle is stopped, engine off: Inflation Pressure	228.6 kPa (33.2 psi)	228.1 kPa (33.1 psi)	229.0 kPa (33.2 psi)	229.1 kPa (33.2 psi)
Tire Sidewall Temp	24.8°C (76.6°F)	23.8°C (74.8°F)	23.8°C (74.8°F)	26.8°C (80.2°F)
San Angelo Test Facility Shop Floor Temp	12.8°C (55.0°F)	13.4°C (56.1°F)	13.6°C (56.5°F)	13.2°C (55.8°F)

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURE(S) OF DEFLATED TIRE(S):

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Indicate Location of Tire(s) Deflated: (X)LF (X)LR (X)RR (X)RF Inflation Pressure	150.5 kPa (22.9 psi)	150.5 kPa (22.9 psi)	150.5 kPa (22.9 psi)	150.5 kPa (22.9 psi)

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop

0.0 seconds after lamp check (stopwatch time – non-cumulative)

Driving was not required.

TELLTALE ILLUMINATES WITHIN 20 MINUTES: (X)YES ( )NO (fail)

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? (X)YES ( )NO (fail)

DATA SHEET 3 (Sheet 22 of 22)
TPMS OPERATIONAL PERFORMANCE

SCENARIO F – Left Front, Left Rear, Right Rear, and Right Front Tire Deflation at UVW +VCW

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After vehicle cool down period: Ambient Temperature: 17.7°C (63.9°F) Vehicle cool down period: 74 minutes				
Inflation Pressure	145.3 kPa (21.1 psi)	144.6 kPa (21.0 psi)	144.2 kPa (20.9 psi)	145.9 kPa (21.2 psi)
Tire Sidewall Temp	17.6°C (63.7°F)	17.4°C (63.3°F)	17.2°C (63.0°F)	17.4°C (63.3°F)
San Angelo Test Facility Shop Floor Temp	14.2°C (57.6°F)	14.6°C (58.3°F)	14.6°C (58.3°F)	13.6°C (56.5°F)

After the cool down period of a minimum of one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? (X)YES ( )NO (fail)

TELLTALE EXTINGUISHMENT:
RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After illumination verification: Re-adjusted Inflation Pressure:	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)	210.1 kPa (30.5 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ( )YES (X)NO

TPMS Performance Test Results (PASS/FAIL) **PASS**
Left front, left rear, right rear, and right front tires were deflated at UVW +VCW.

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: December 18, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 4 (Sheet 1 of 4)
Scenario G – Malfunction Detection Test at LLVW

TEST DATE: December 12, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Time:	Start:	15:24:23 UTC	End:	15:46:10 UTC
Odometer Reading:	Start:	209.9 km (130.4 mi)	End:	239.0 km (148.5 mi)
Ambient Temperature:	Start:	4.0°C (39.2°F)	End:	8.9°C (48.0°F)
Roadway Temperature:	Start:	5.4°C (41.7°F)	End:	11.8°C (53.2°F)
Fuel Level:	Start:	Full		

Note: See Data Sheet 3 (Sheet 2 of 22) for Test Weight.

TPMS TYPE: (X) Direct ( ) Indirect ( ) Other Describe: _____

TPMS MALFUNCTION TELLTALE:
( ) Dedicated stand-alone (X) Combination low tire pressure warning/malfunction telltale

METHOD OF MALFUNCTION SIMULATION:

Describe method of malfunction simulation: Spare tire without TPMS sensor was applied to right front at LLVW.

MALFUNCTION TELLTALE ILLUMINATION
(after ignition locking system is activated to "On" ("Run") position):

Combination Malfunction Telltale

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: see chart , page 69

29.1 km (18.1 mi) distance

Max speed: 107.0 km/h (66.5 mph)
Total Driving Time: 16:52 minutes (VBox time)

COMBINATION MALFUNCTION TELLTALE ILLUMINATES (FLASHING AND ILLUMINATION SEQUENCE) WITHIN 20 MINUTES:
(X)YES ( )NO

DATA SHEET 4 (Sheet 2 of 4)
Scenario G – Malfunction Detection Test at LLVW

After 5 minutes with the ignition locking system in the "Off" or "Lock" position, does the combination low tire pressure/malfunction telltale flash for a period of at least 60 seconds but no longer than 90 seconds, and then remain illuminated when the ignition locking system is activated to the "On" or "Run" position? (X)YES ( )NO (fail)

Time it takes before telltale starts flashing	5.2	seconds
Time telltale remains flashing	70	seconds
Time telltale remains illuminated (Verified for a minimum of 60 seconds)	60+	seconds

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale's illumination sequence repeat when the ignition locking system is activated and the engine running? (X)YES ( )NO (fail)

Extinguishment Phase:

Restore the TPMS to normal operation. Is it necessary to drive the vehicle to extinguish the telltale? ( )YES (X)NO

COMBINATION MALFUNCTION TELLTALE EXTINGUISHED:
(X)YES ( )NO (FAIL)

TPMS MALFUNCTION PERFORMANCE TEST RESULTS (PASS/FAIL) **PASS**
Spare without TPMS sensor was applied to right front at LLVW.

REMARKS: The 5.2 seconds before telltale starts flashing is the lamp check time.

RECORDED BY: Jack R. Stewart DATE: December 12, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 4 (Sheet 3 of 4)
Scenario H – Malfunction Detection Test

TEST DATE: January 27, 2009 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C90100

Time:	Start:	14:30:00 UTC	End:	14:47:00 UTC
Odometer Reading:	Start:	369.0 km (229.3 mi)	End:	369.0 km (229.3 mi)
Ambient Temperature:	Start:	12.8°C (55.0°F)	End:	12.8°C (55.0°F)
Roadway Temperature:	Start:	13.0°C (55.4°F)	End:	13.0°C (55.4°F)
Fuel Level:	Start:	Full		

TPMS TYPE: (X) Direct ( ) Indirect ( ) Other Describe: _____

TPMS MALFUNCTION TELLTALE:
( ) Dedicated stand-alone (X) Combination low tire pressure warning/malfunction telltale

METHOD OF MALFUNCTION SIMULATION:

Describe method of malfunction simulation: Omron TPMS receiver was disconnected.

MALFUNCTION TELLTALE ILLUMINATION
(after ignition locking system is activated to "On" ("Run") position):

Combination Malfunction Telltale

Illumination upon start-up - driving was not required.

COMBINATION MALFUNCTION TELLTALE ILLUMINATES (FLASHING AND ILLUMINATION SEQUENCE) WITHIN 20 MINUTES:
(X)YES ( )NO

DATA SHEET 4 (Sheet 4 of 4)
Scenario H – Malfunction Detection Test

After 5 minutes with the ignition locking system in the "Off" or "Lock" position, does the combination low tire pressure/malfunction telltale flash for a period of at least 60 seconds but no longer than 90 seconds, and then remain illuminated when the ignition locking system is activated to the "On" or "Run" position? (X)YES ( )NO (fail)

Time it takes before telltale starts flashing	5.0	seconds
Time telltale remains flashing	65	seconds
Time telltale remains illuminated (Verified for a minimum of 60 seconds)	60+	seconds

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale's illumination sequence repeat when the ignition locking system is activated and the engine running? (X)YES ( )NO (fail)

Extinguishment Phase:

Restore the TPMS to normal operation. Is it necessary to drive the vehicle to extinguish the telltale? ( )YES (X)NO

COMBINATION MALFUNCTION TELLTALE EXTINGUISHED:
(X)YES ( )NO (FAIL)

TPMS MALFUNCTION PERFORMANCE TEST RESULTS (PASS/FAIL) **PASS**
Omron TPMS receiver was disconnected.

REMARKS: The 5.0 seconds before telltale starts flashing is the lamp check time.

RECORDED BY: Jack R. Stewart DATE: January 27, 2009

APPROVED BY: Kenneth H. Yates

DATA SHEET 5 (Sheet 1 of 3)
TPMS WRITTEN INSTRUCTIONS

TEST
DATE: December 10, 2008 LAB: San Angelo Test Facility VEHICLE NHTSA NO: C90100

The following statement, in the English language, is provided verbatim in the Owner's Manual. (X)YES ( )NO

"Each tire, including the spare (if provided), should be checked monthly when cold and inflated to the inflation pressure recommended by the vehicle manufacturer on the vehicle placard or tire inflation pressure label. (If your vehicle has tires of a different size than the size indicated on the vehicle placard or tire inflation pressure label, you should determine the proper tire inflation pressure for those tires.)

As an added safety feature, your vehicle has been equipped with a tire pressure monitoring system (TPMS) that illuminates a low tire pressure telltale when one or more of your tires is significantly under-inflated. Accordingly, when the low tire pressure telltale illuminates, you should stop and check your tires as soon as possible, and inflate them to the proper pressure. Driving on a significantly under-inflated tire causes the tire to overheat and can lead to tire failure. Under-inflation also reduces fuel efficiency and tire tread life, and may affect the vehicle's handling and stopping ability.

Please note that the TPMS is not a substitute for proper tire maintenance, and it is the driver's responsibility to maintain correct tire pressure, even if under-inflation has not reached the level to trigger illumination of the TPMS low tire pressure telltale."

DATA SHEET 5 (Sheet 2 of 3)
TPMS WRITTEN INSTRUCTIONS

As specified, the following sections, in the English language, are required verbatim in paragraph form in the Owner's Manual:

The following statement is required for all vehicles certified to the standard starting on September 1, 2007 and for vehicles voluntarily equipped with a compliant TPMS MIL before that time.

"Your vehicle has also been equipped with a TPMS malfunction indicator to indicate when the system is not operating properly."

The above statement in the English language is provided verbatim in owner's manual:
(X)YES ( )NO

For vehicles with a dedicated MIL telltale, add the following statement:

"The TPMS malfunction indicator is provided by a separate telltale, which displays the symbol "TPMS" when illuminated."

The above statement in the English language is provided verbatim in owner's manual:
( )YES ( )NO (X)N/A

For vehicles with a combined low tire pressure/MIL telltale, add the following statement:

"The TPMS malfunction indicator is combined with the low tire pressure telltale. When the system detects a malfunction, the telltale will flash for approximately one minute and then remain continuously illuminated. This sequence will continue upon subsequent vehicle start-ups as long as the malfunction exists."

The above statement in the English language is provided verbatim in owner's manual:
(X)YES ( )NO ( )N/A

The following statement is required for all vehicles certified to the standard starting on September 1, 2007 and for vehicles voluntarily equipped with a compliant TPMS MIL before that time.

"When the malfunction indicator is illuminated, the system may not be able to detect or signal low tire pressure as intended. TPMS malfunctions may occur for a variety of reasons, including the installation of replacement or alternate tires or wheels on the vehicle that prevent the TPMS from functioning properly. Always check the TPMS malfunction telltale after replacing one or more tires or wheels on your vehicle to ensure that the replacement or alternate tires and wheels allow the TPMS to continue to function properly."

The above statement in the English language is provided verbatim in owner's manual:
(X)YES ( )NO

DATA INDICATES COMPLIANCE: PASS/FAIL PASS/FAIL: **PASS**

DATA SHEET 5 (Sheet 3 of 3)
TPMS WRITTEN INSTRUCTIONS

Does the Owner's Manual provide an image of the Low Tire Pressure Warning Telltale symbol (and an image of the TPMS Malfunction Telltale warning ("TPMS"), if a dedicated telltale is utilized for this function)? (X)YES ( )NO

Does the Owner's Manual include the following (allowable) information?

- [x] Significance of the low tire pressure warning telltale illuminating
- [x] A description of corrective action to be undertaken
- [x] Whether the tire pressure monitoring system functions with the vehicle's spare tire (if provided)
- [x] How to use a reset button, if one is provided
- [ ] The time for the TPMS telltale(s) to extinguish once the low tire pressure condition or the malfunction is corrected

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: December 10, 2008

APPROVED BY: Kenneth H. Yates

SECTION 4

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

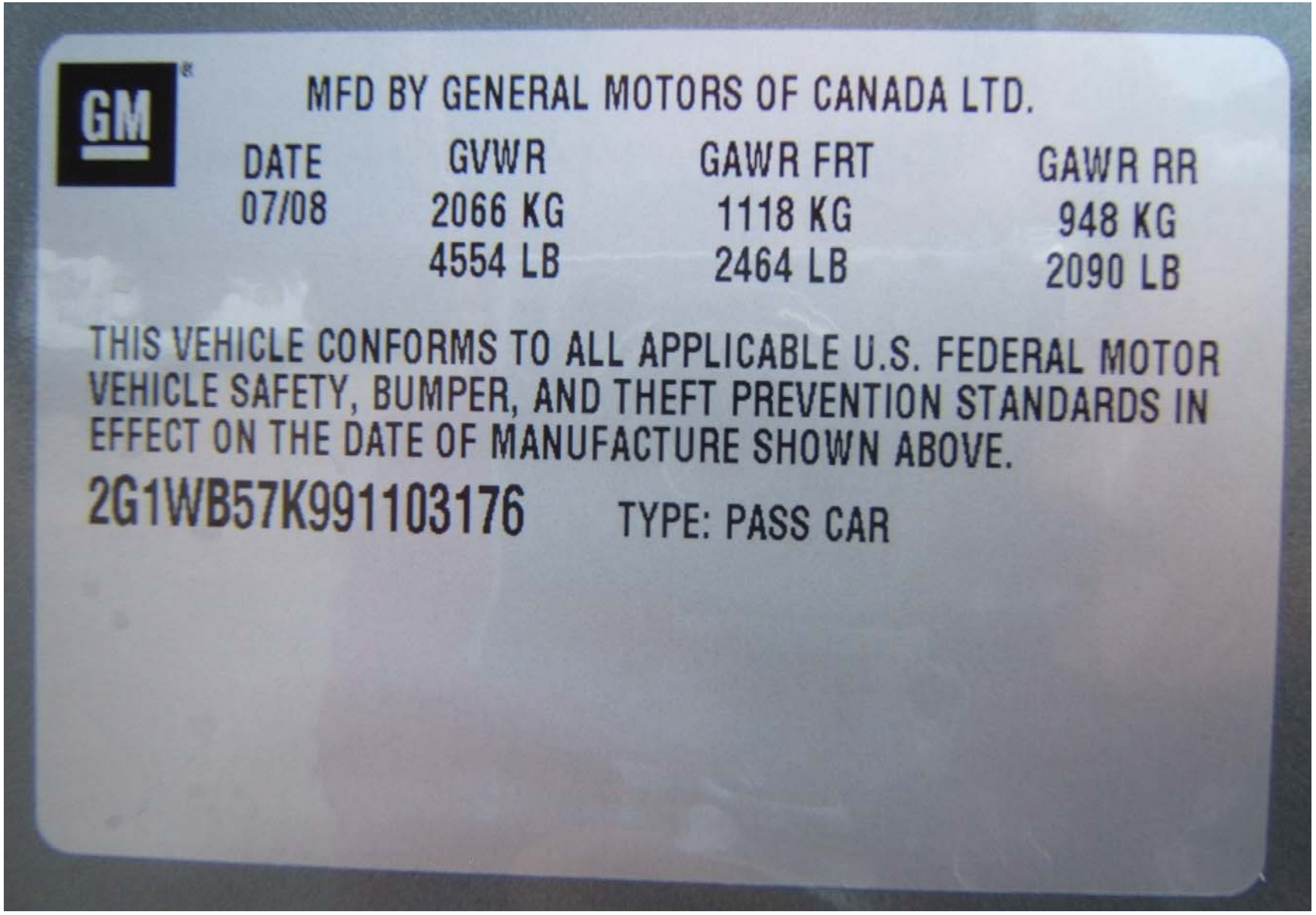
EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO	CAL. DATE	NEXT CAL. DATE
STOPWATCH	WESTCLOX QUARTZ STOPWATCH	NONE	N/A	N/A
VBOX RECORDING DEVICE	RACELOGIC VBOX III	SERIAL # 030209	3/20/2008	3/20/2009
AMBIENT TEMPERATURE GAUGE	FLUKE 50D K/J THERMOMETER	SERIAL # 80840101	3/10/2008	3/10/2009
LASER TEMPERATURE GAUGE (TIRES AND GROUND)	RAYTEK MINITEMP MT6 INFRARED THERMOMETER	SERIAL # MAGR000042598	4/11/2008	4/11/2009
AIR PRESSURE GAUGE	ASHCROFT GENERAL PURPOSE DIGITAL GAUGE	MODEL # D1005PS 02L 100 PSI SERIAL # 20017398-01	11/20/2008	11/20/2009
FLOOR SCALES (VEHICLE)	INTERCOMP SW DELUXE SCALES	PART # 100156 SERIAL # 27032382	8/5/2008	8/5/2009
PLATFORM SCALE (BALLAST)	HOWE RICHARDSON	MODEL # 6401 SERIAL # 0181-5509-26	8/5/2008	8/5/2009

SECTION 5

PHOTOGRAPHS

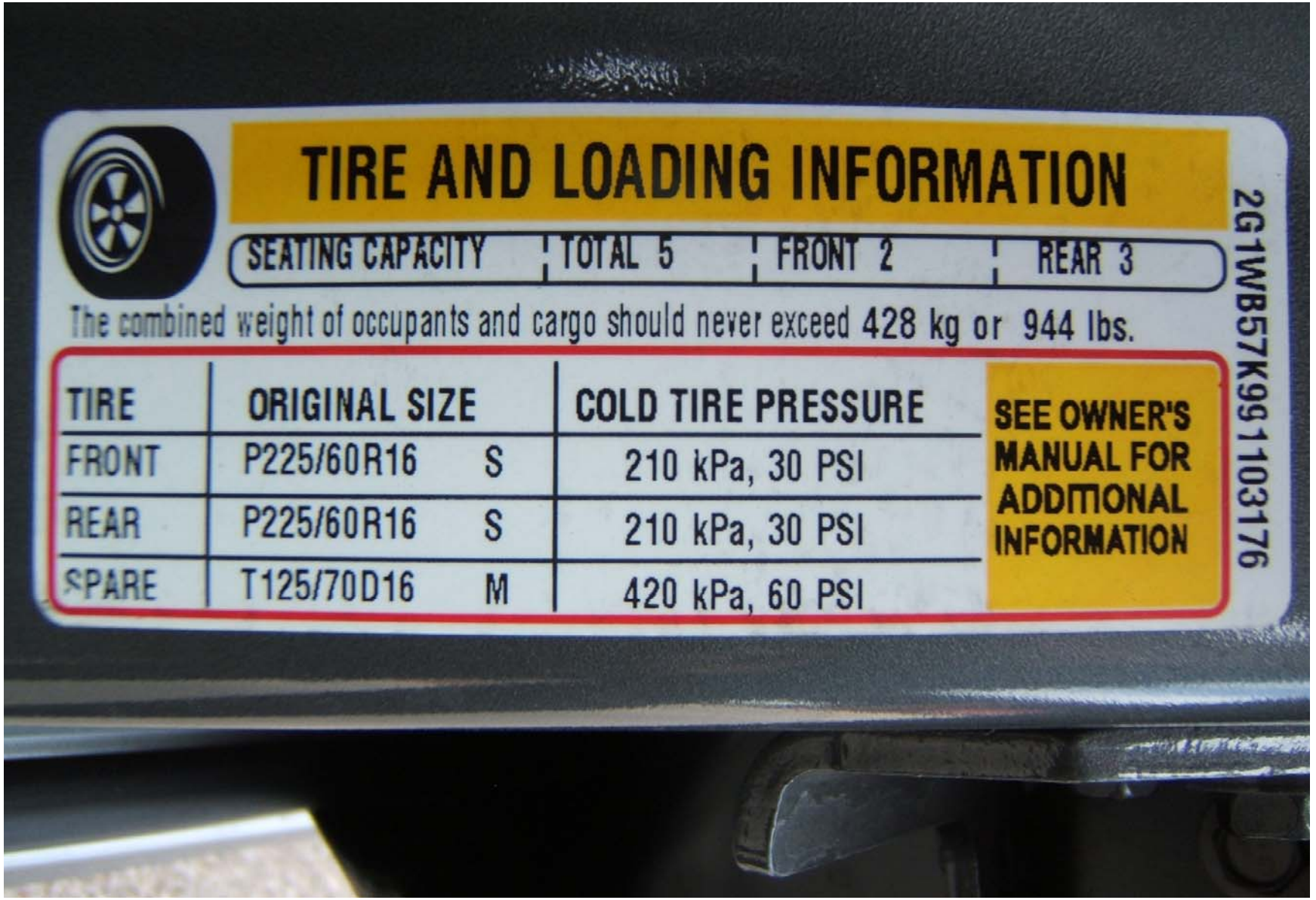
2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO.138

FIGURE 5.1
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE



2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO.138

FIGURE 5.2
VEHICLE CERTIFICATION LABEL



2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.3
VEHICLE PLACARD

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.4
TIRE SHOWING BRAND

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NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.5
TIRE SHOWING MODEL

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NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.6
TIRE SHOWING SIZE AND LOAD INDEX / SPEED RATING

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.7
TIRE SHOWING DOT SERIAL NUMBER

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NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.8
TIRE SHOWING MAX LOAD RATING

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FMVSS NO. 138

FIGURE 5.9
TIRE SHOWING MAX COLD INFLATION PRESSURE

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NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.10
TIRE SHOWING SIDEWALL / TREAD CONSTRUCTION

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.11
RIM SHOWING VALVE STEM

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.12
RIM SHOWING TPMS SENSOR

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.13
DISPLAY SHOWING COMBINATION LOW TIRE PRESSURE / MALFUNCTION TELLTALE AND MESSAGE CENTER LOW TIRE PRESSURE WARNING

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.14
DISPLAY SHOWING LOW TIRE PRESSURE / MALFUNCTION
TELLTALE AND MESSAGE CENTER TPMS MALFUNCTION WARNING

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO 138

FIGURE 5.15
TEST INSTRUMENTATION ON VEHICLE

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.16
VEHICLE REAR SEAT BALLAST
FOR UVW + VCW LOAD

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.17
VEHICLE TRUNK BALLAST FOR UVW + VCW LOAD

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.18
VEHICLE ON WEIGHT SCALES

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NHTSA NO. C90100
FMVSS NO. 138

FIGURE 5.19
SPARE INSTALLED ON RIGHT FRONT
FOR MALFUNCTION DETECTION TEST

2009 CHEVROLET IMPALA
NHTSA NO. C90100
FMVSS NO. 138

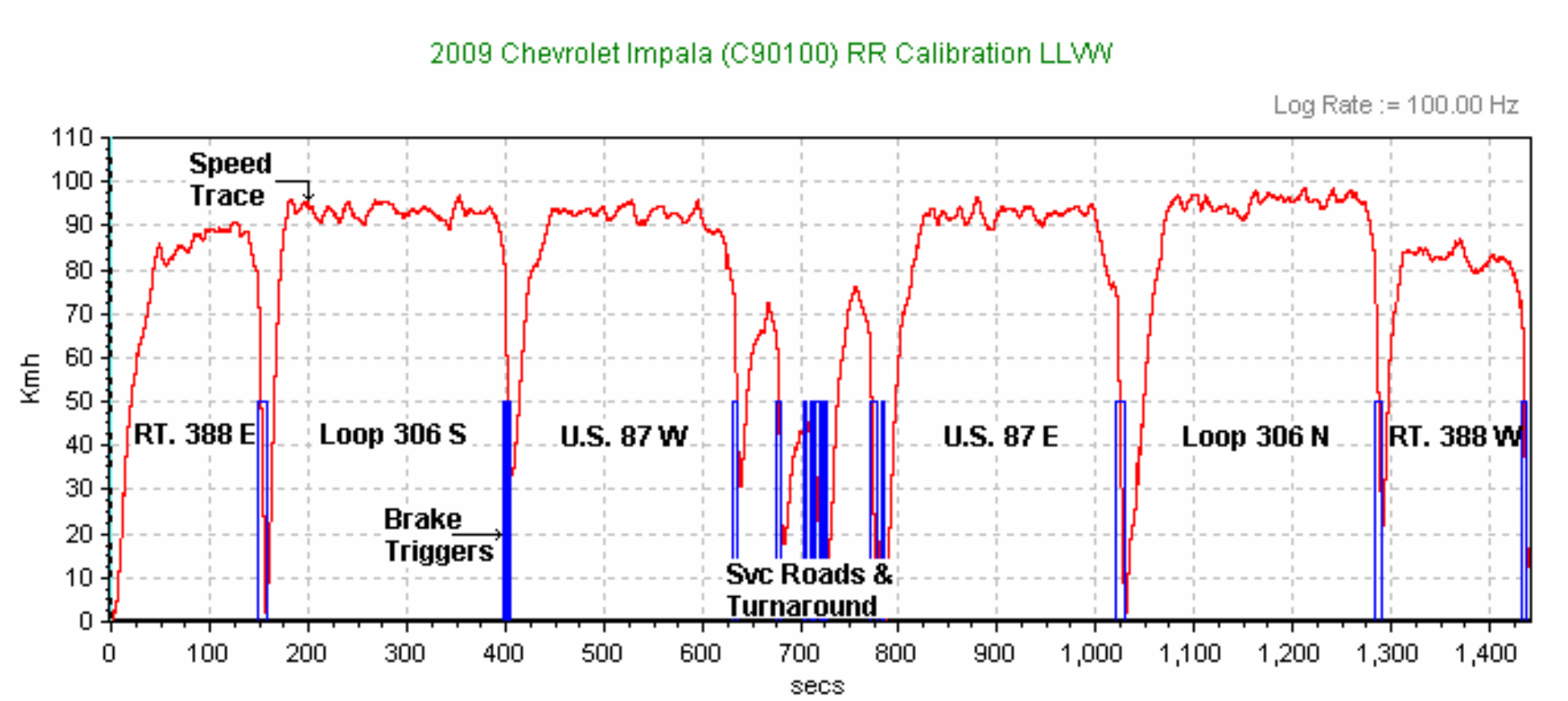
FIGURE 5.20
OMRON TPMS RECEIVER DISCONNECTED
FOR MALFUNCTION DETECTION TEST

SECTION 6

TEST PLOTS

Scenario A:	Right Rear Tire at LLVW
Test Date:	12/10/08
Data File Time:	24:02 minutes
Cumulative Driving Time:	20:39 minutes
Start Point:	GAFB North Gate

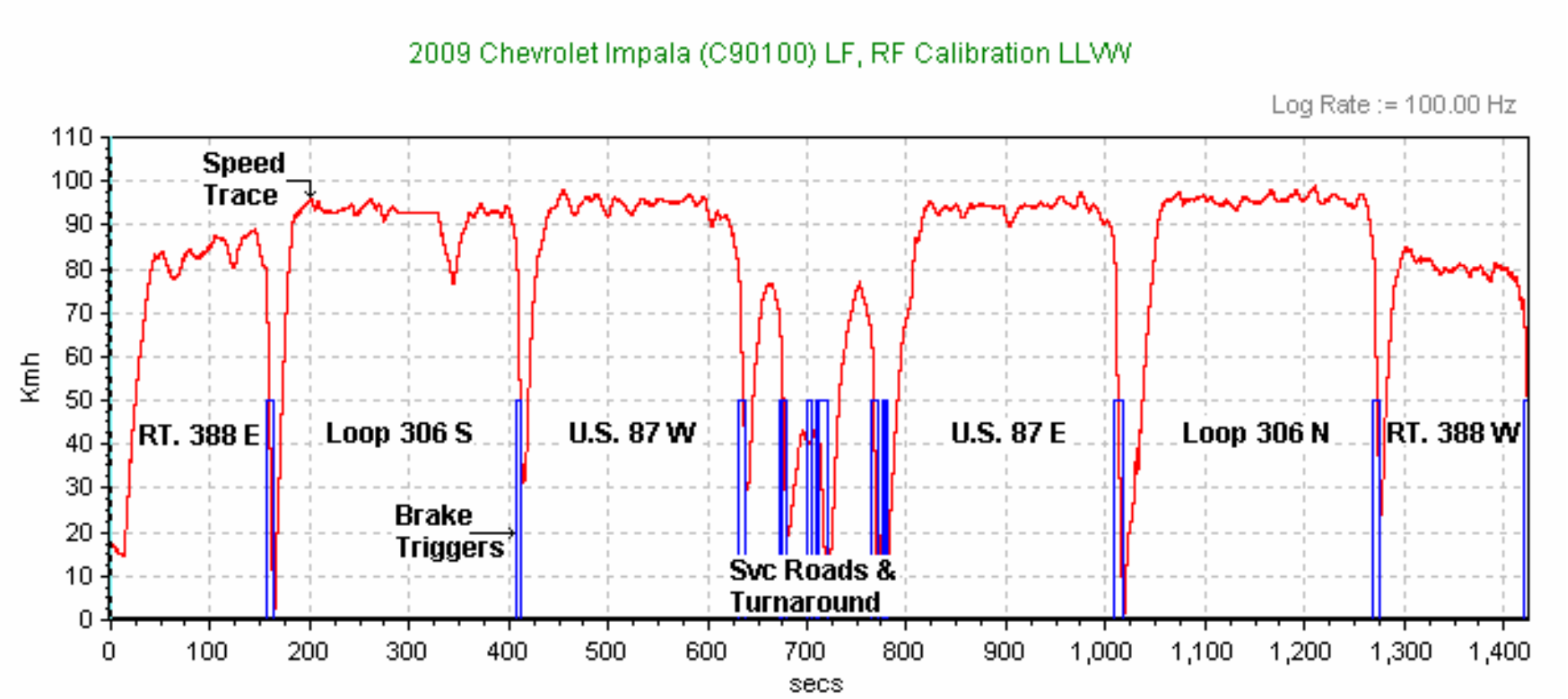
Calibration Phase:



RR Detection Phase: Telltale illumination in 2 seconds. Driving was not required.

Scenario B: Left Front, Right Front Tires at LLVW
Test Date: 12/11/08
Data File Time: 23:45 minutes
Cumulative Driving Time: 20:28 minutes
Start Point: GAFB North Gate

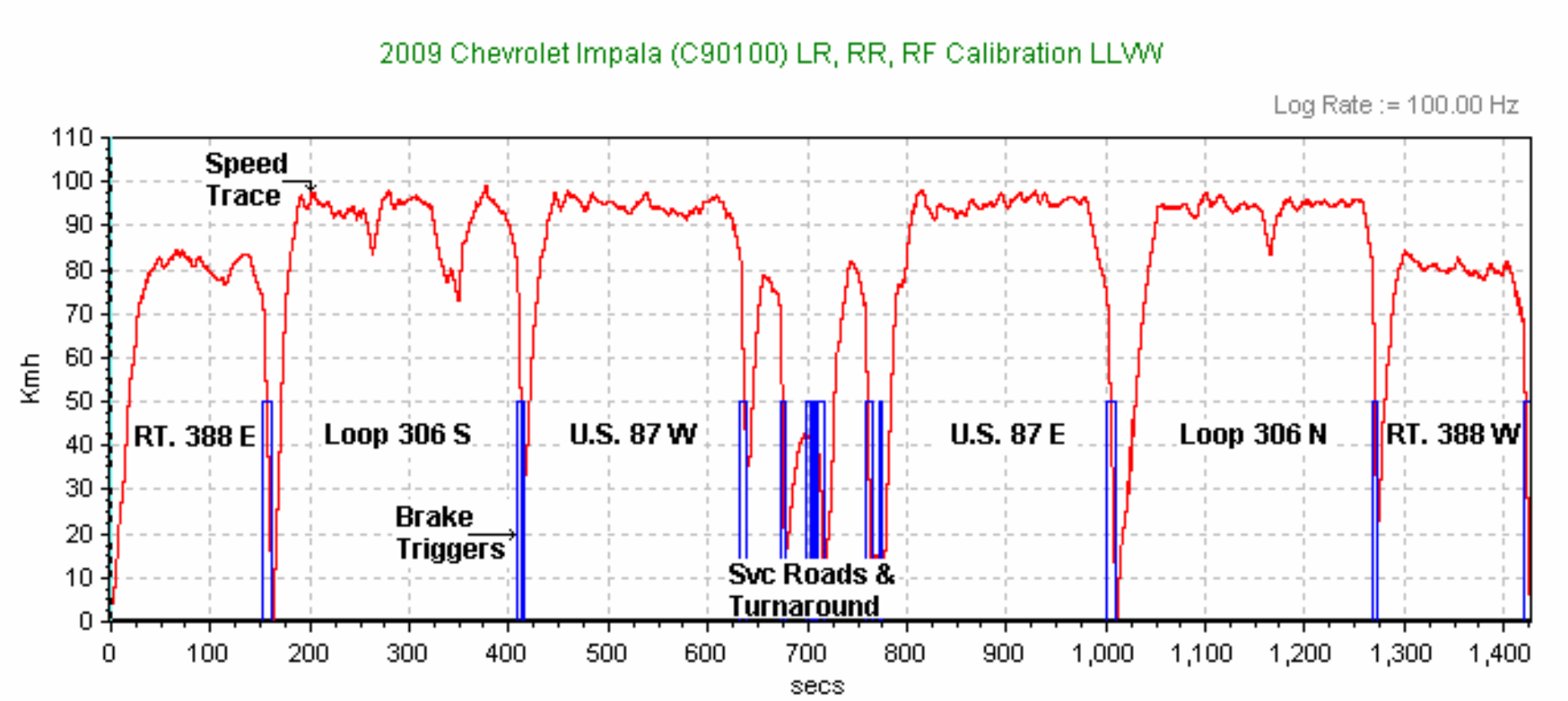
Calibration Phase:



LF, RF Detection Phase: Telltale illumination upon startup. Driving was not required.

Scenario C:	Left Rear, Right Rear, Right Front Tires at LLVW
Test Date:	12/11/08
Data File Time:	23:47 minutes
Cumulative Driving Time:	20:35 minutes
Start Point:	GAFB North Gate

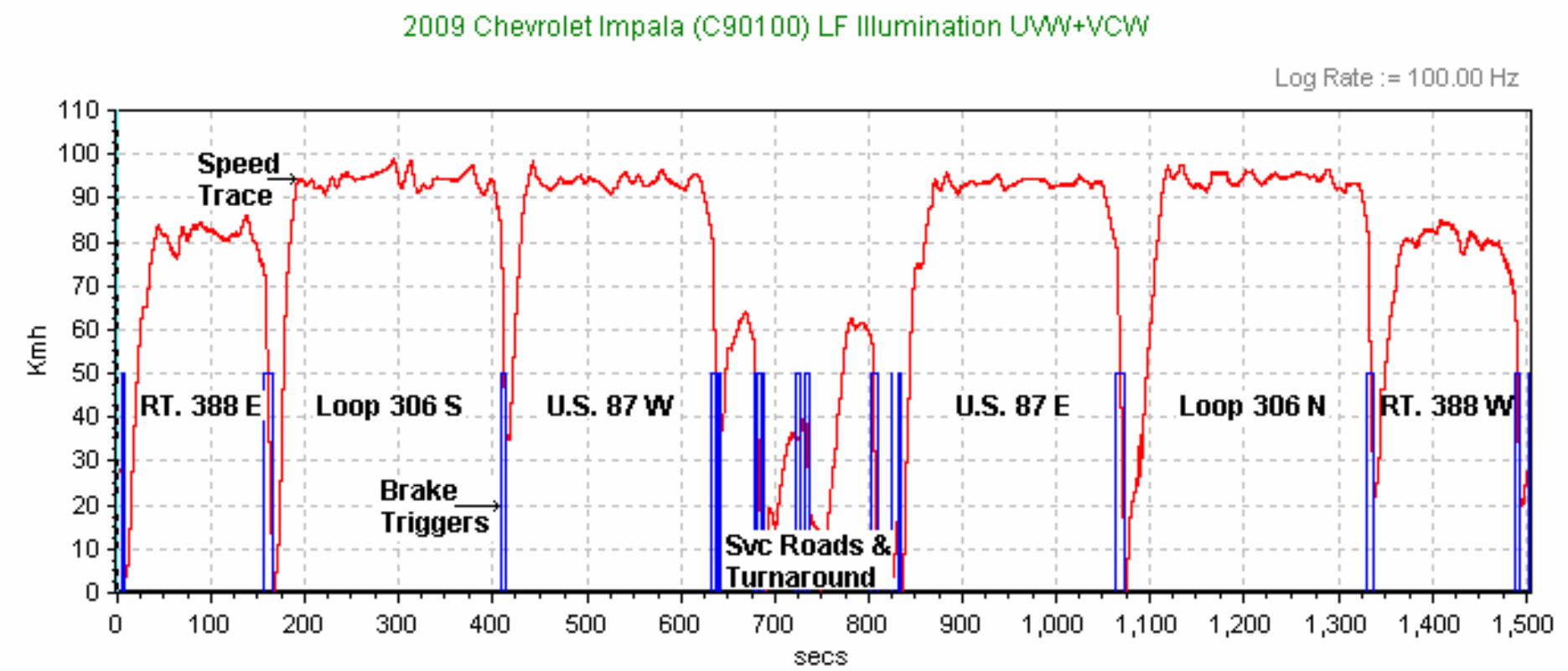
Calibration Phase:



LF, RR, RF Detection Phase: Telltale illumination upon startup. Driving was not required.

Scenario D:	Left Front Tire at UVW + VCW
Test Date:	12/17/08
Data File Time:	25:05 minutes
Cumulative Driving Time:	20:34 minutes
Start Point:	GAFB North Gate

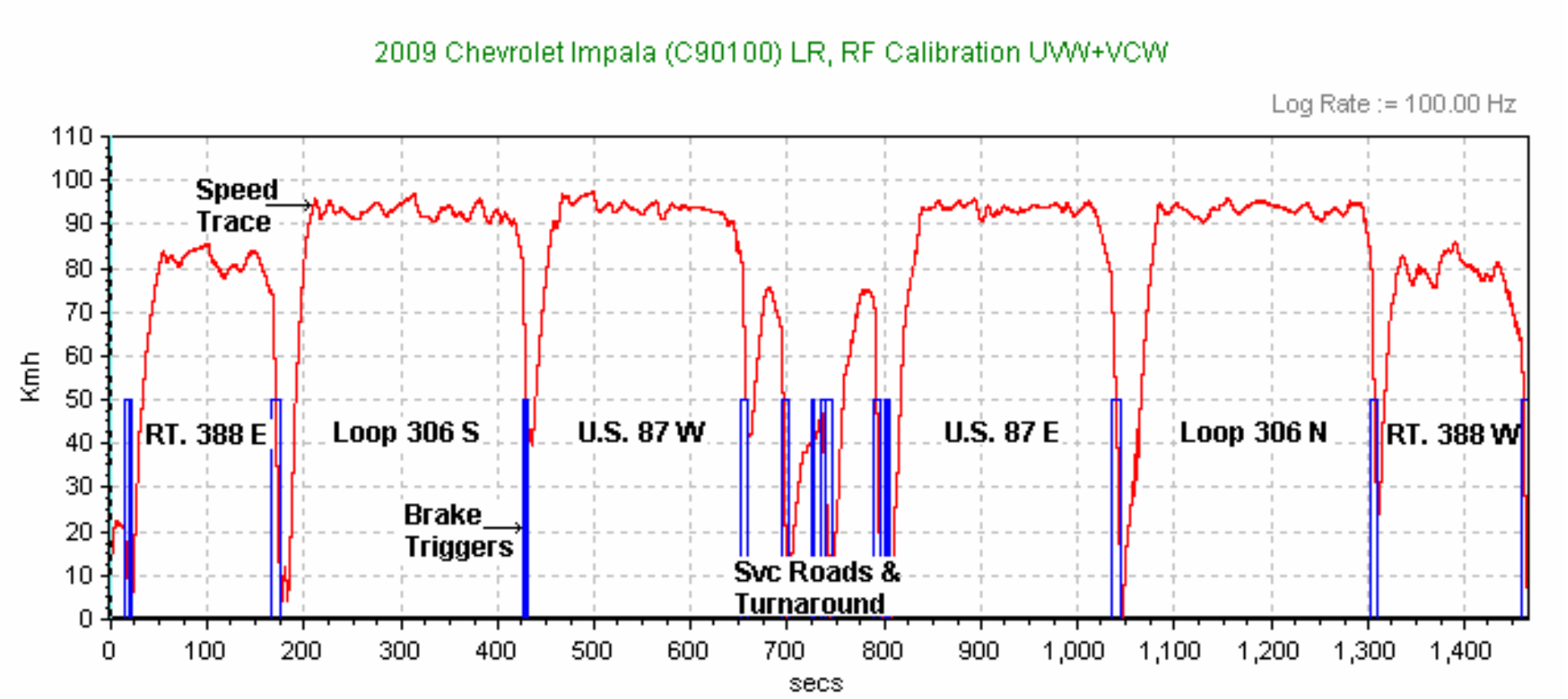
Calibration Phase:



LF Detection Phase: Telltale illumination in 45.5 seconds. Driving above 50 km/h (31 mph) was not required.

Scenario E: Left Rear, Right Front Tire at UVW + VCW
Test Date: 12/17/08
Data File Time: 24:27 minutes
Cumulative Driving Time: 20:39 minutes
Start Point: GAFB North Gate

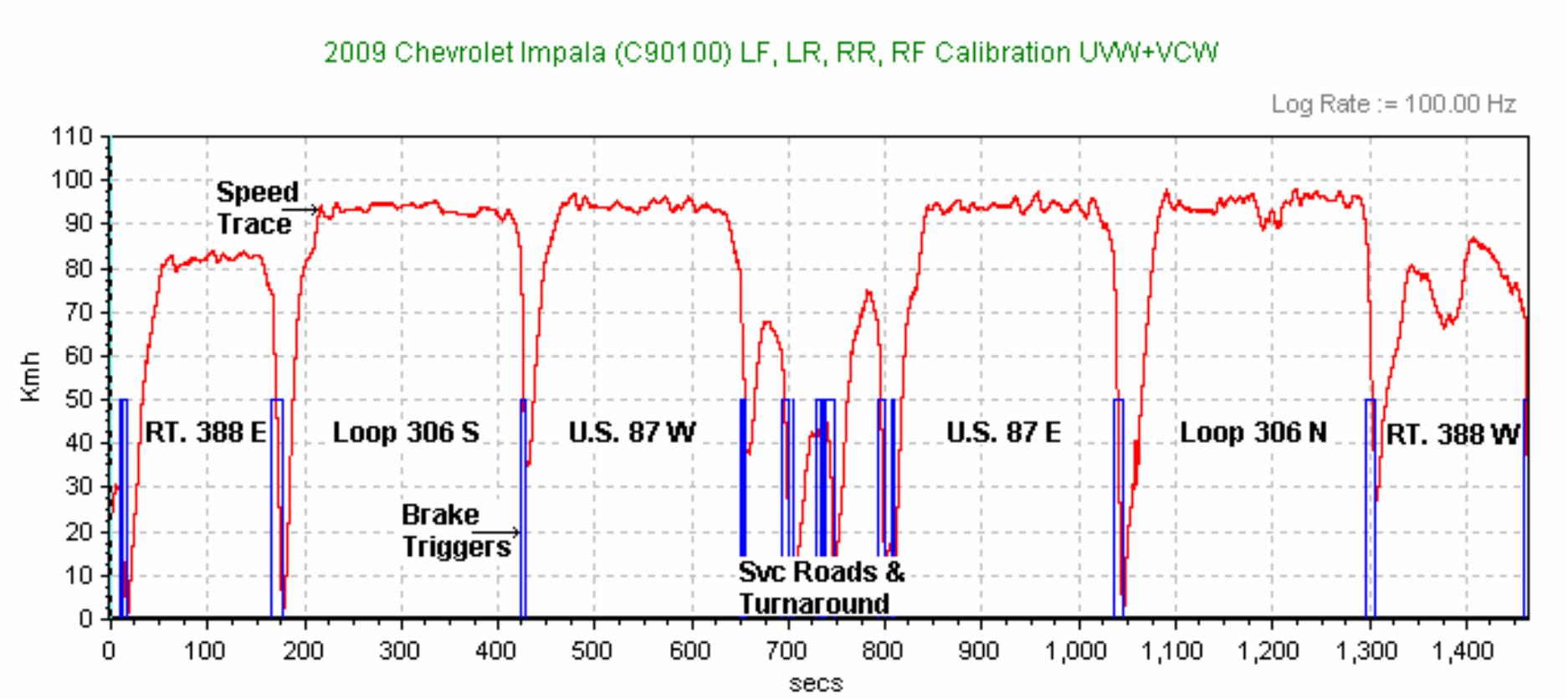
Calibration Phase:



LR, RF Detection Phase: Telltale illumination upon startup. Driving was not required.

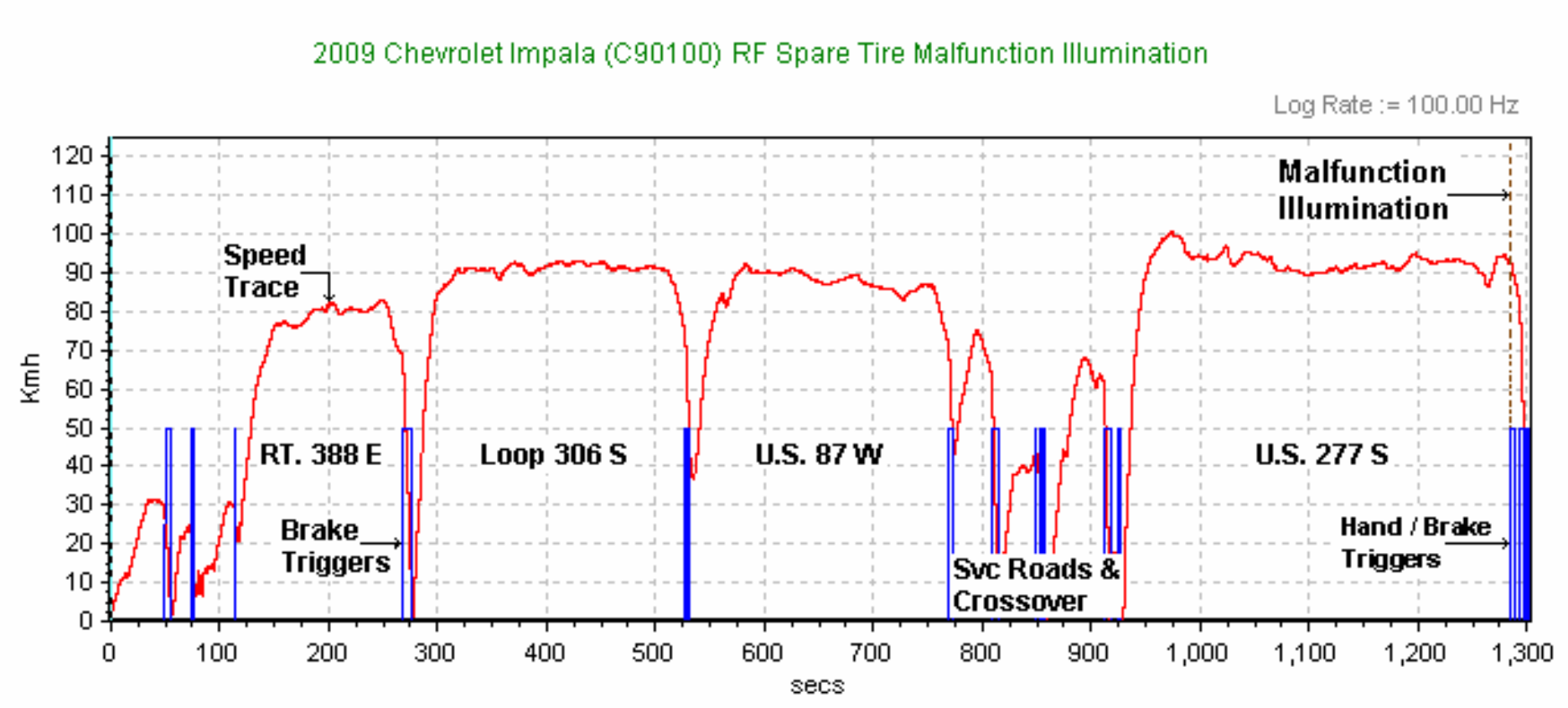
Scenario F:	Left Front, Left Rear, Right Rear, Right Front Tires at UVW + VCW
Test Date:	12/18/08
Data File Time:	24:24minutes
Cumulative Driving Time:	20:36 minutes
Start Point:	GAFB North Gate

Calibration Phase:



LF, LR, RR, RF Detection Phase: Telltale illumination upon startup. Driving was not required.

Scenario G Malfunction Illumination:	Spare Tire without TPMS sensor was applied to right front at LLVW.
Test Date:	12/12/08
Data File Time:	21:44 minutes
Cumulative Driving Time:	16:52 minutes
Start Point:	GAFB North Gate



SECTION 7

OWNER'S MANUAL PAGES

Tire Pressure Light

For vehicles with a tire pressure light, this light comes on briefly when the engine is started.

It provides information about tire pressures and the Tire Pressure Monitoring System.

When the Light is On Steady

This indicates that one or more of the tires is significantly underinflated.

A tire pressure message in the Driver Information Center (DIC), can accompany the light. See *DIC Warnings and Messages on page 3-47* for more information. Stop and check the tires as soon as it is safe to do so. If a tire is underinflated, inflate to the proper pressure. See *Tires on page 5-53* for more information.

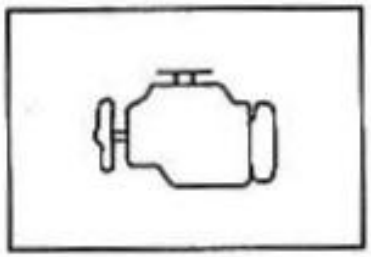
When the Light Flashes First and Then is On Steady

This indicates that there could be a problem with the Tire Pressure Monitor System. The light flashes for about a minute and stays on steady for the remainder of the ignition cycle. This sequence repeats with every ignition cycle. See *Tire Pressure Monitor System on page 5-61* for more information.

Malfunction Indicator Lamp

Check Engine Light

A computer system called OBD II (On-Board Diagnostics-Second Generation) monitors operation of the fuel, ignition, and emission control systems. It ensures that emissions are at acceptable levels for the life of the vehicle, helping to produce a cleaner environment.



This light should come on when the ignition is on, but the engine is not running, as a check to show it is working. If it does not, have the vehicle serviced by your dealer/retailer.

How to Check

Use a good quality pocket-type gage to check tire pressure. You cannot tell if your tires are properly inflated simply by looking at them. Radial tires may look properly inflated even when they are under-inflated. Check the tire's inflation pressure when the tires are cold. Cold means your vehicle has been sitting for at least three hours or driven no more than 1 mile (1.6 km).

Remove the valve cap from the tire valve stem. Press the tire gage firmly onto the valve to get a pressure measurement. If the cold tire inflation pressure matches the recommended pressure on the Tire and Loading Information label, no further adjustment is necessary. If the inflation pressure is low, add air until you reach the recommended amount.

If you overfill the tire, release air by pushing on the metal stem in the center of the tire valve. Re-check the tire pressure with the tire gage.

Be sure to put the valve caps back on the valve stems. They help prevent leaks by keeping out dirt and moisture.

Tire Pressure Monitor System

The Tire Pressure Monitor System (TPMS) uses radio and sensor technology to check tire pressure levels. The TPMS sensors monitor the air pressure in your vehicle's tires and transmit tire pressure readings to a receiver located in the vehicle.

Each tire, including the spare (if provided), should be checked monthly when cold and inflated to the inflation pressure recommended by the vehicle manufacturer on the vehicle placard or tire inflation pressure label. (If your vehicle has tires of a different size than the size indicated on the vehicle placard or tire inflation pressure label, you should determine the proper tire inflation pressure for those tires.)

As an added safety feature, your vehicle has been equipped with a tire pressure monitoring system (TPMS) that illuminates a low tire pressure telltale when one or more of your tires is significantly under-inflated.

Accordingly, when the low tire pressure telltale illuminates, you should stop and check your tires as soon as possible, and inflate them to the proper pressure. Driving on a significantly under-inflated tire causes the tire to overheat and can lead to tire failure. Under-inflation also reduces fuel efficiency and tire tread life, and may affect the vehicle's handling and stopping ability.

Please note that the TPMS is not a substitute for proper tire maintenance, and it is the driver's responsibility to maintain correct tire pressure, even if under-inflation has not reached the level to trigger illumination of the TPMS low tire pressure telltale.

Your vehicle has also been equipped with a TPMS malfunction indicator to indicate when the system is not operating properly. The TPMS malfunction indicator is combined with the low tire pressure telltale. When the system detects a malfunction, the telltale will flash for approximately one minute and then remain continuously illuminated. This sequence will continue upon subsequent vehicle start-ups as long as the malfunction exists.

When the malfunction indicator is illuminated, the system may not be able to detect or signal low tire pressure as intended. TPMS malfunctions may occur for a variety of reasons, including the installation of replacement or alternate tires or wheels on the vehicle that prevent the TPMS from functioning properly. Always check the TPMS malfunction telltale after replacing one or more tires or wheels on your vehicle to ensure that the replacement or alternate tires and wheels allow the TPMS to continue to function properly.

See *Tire Pressure Monitor Operation on page 5-63* for additional information.

Federal Communications Commission (FCC) and Industry and Science Canada

The Tire Pressure Monitor System (TPMS) operates on a radio frequency and complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

The TPMS operates on a radio frequency and complies with RSS-210 of Industry and Science Canada. Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference received, including interference that may cause undesired operation of the device.

Changes or modifications to this system by other than an authorized service facility could void authorization to use this equipment.

Tire Pressure Monitor Operation

This vehicle may have a Tire Pressure Monitor System (TPMS). The TPMS is designed to warn the driver when a low tire pressure condition exists. TPMS sensors are mounted onto each tire and wheel assembly, excluding the spare tire and wheel assembly. The TPMS sensors monitor the air pressure in the vehicle's tires and transmits the tire pressure readings to a receiver located in the vehicle.

When a low tire pressure condition is detected, the TPMS illuminates the low tire pressure warning light located on the instrument panel cluster.

At the same time a message to check the pressure in a specific tire appears on the Driver Information Center (DIC) display. The low tire pressure warning light and the DIC warning message come on at each ignition cycle until the tires are inflated to the correct inflation pressure. Using the DIC, tire pressure levels can be viewed by the driver. For additional information and details about the DIC operation and displays see *DIC Operation and Displays on page 3-40* and *DIC Warnings and Messages on page 3-47*.

The low tire pressure warning light may come on in cool weather when the vehicle is first started, and then turn off as you start to drive. This could be an early indicator that the air pressure in the tire(s) are getting low and need to be inflated to the proper pressure.

A Tire and Loading Information label, attached to your vehicle, shows the size of your vehicle's original equipment tires and the correct inflation pressure for your vehicle's tires when they are cold. See *Loading the Vehicle on page 4-19*, for an example of the Tire and Loading Information label and its location on your vehicle. Also see *Inflation - Tire Pressure on page 5-60*.

Your vehicle's TPMS can warn you about a low tire pressure condition but it does not replace normal tire maintenance. See *Tire Inspection and Rotation on page 5-66* and *Tires on page 5-53*.

Notice: **Liquid tire sealants could damage the Tire Pressure Monitor System (TPMS) sensors. Sensor damage caused by using a tire sealant is not covered by your warranty. Do not use liquid tire sealants.**

TPMS Malfunction Light and Message

The TPMS will not function properly if one or more of the TPMS sensors are missing or inoperable. When the system detects a malfunction, the low tire warning light flashes for about one minute and then stays on for the remainder of the ignition cycle. A DIC warning message is also displayed. The low tire warning light and DIC warning message come on at each ignition cycle until the problem is corrected. Some of the conditions that can cause the malfunction light and DIC message to come on are:

- One of the road tires has been replaced with the spare tire. The spare tire does not have a TPMS sensor. The TPMS malfunction light and DIC message should go off once you re-install the road tire containing the TPMS sensor.
- The TPMS sensor matching process was started but not completed or not completed successfully after rotating the vehicle's tires. The DIC message and TPMS malfunction light should go off once the TPMS sensor matching process is performed successfully. See "TPMS Sensor Matching Process" later in this section.
- One or more TPMS sensors are missing or damaged. The DIC message and the TPMS malfunction light should go off when the TPMS sensors are installed and the sensor matching process is performed successfully. See your dealer/retailer for service.
- Replacement tires or wheels do not match your vehicle's original equipment tires or wheels. Tires and wheels other than those recommended for your vehicle could prevent the TPMS from functioning properly. See *Buying New Tires on page 5-68*.
- Operating electronic devices or being near facilities using radio wave frequencies similar to the TPMS could cause the TPMS sensors to malfunction.

If the TPMS is not functioning it cannot detect or signal a low tire condition. See your dealer/retailer for service if the TPMS malfunction light and DIC message comes on and stays on.

TPMS Sensor Matching Process

Each TPMS sensor has a unique identification code. Any time you rotate your vehicle's tires or replace one or more of the TPMS sensors, the identification codes will need to be matched to the new tire/wheel position. The sensors are matched to the tire/wheel positions in the following order: driver side front tire, passenger side front tire, passenger side rear tire, and driver side rear tire using a TPMS diagnostic tool. See your dealer/retailer for service.

The TPMS sensors can also be matched to each tire/wheel position by increasing or decreasing the tire's air pressure. If increasing the tire's air pressure, do not exceed the maximum inflation pressure indicated on the tire's sidewall.

To decrease air-pressure out of a tire you can use the pointed end of the valve cap, a pencil-style air pressure gage, or a key.

You have two minutes to match the first tire/wheel position, and five minutes overall to match all four tire/wheel positions. If it takes longer than two minutes, to match the first tire and wheel, or more than five minutes to match all four tire and wheel positions the matching process stops and you need to start over.

The TPMS sensor matching process is outlined below:

1. Set the parking brake.
2. Turn the ignition switch to ON/RUN with the engine off.
3. Press the Remote Keyless Entry (RKE) transmitter's lock and unlock buttons at the same time for approximately five seconds. The horn sounds twice to signal the receiver is in relearn mode and TIRE LEARNING ACTIVE message displays on the DIC screen.
4. Start with the driver side front tire.
5. Remove the valve cap from the valve cap stem. Activate the TPMS sensor by increasing or decreasing the tire's air pressure for five seconds, or until a horn chirp sounds. The horn chirp, which may take up to 30 seconds to sound, confirms that the sensor identification code has been matched to this tire and wheel position.
6. Proceed to the passenger side front tire, and repeat the procedure in Step 5.
7. Proceed to the passenger side rear tire, and repeat the procedure in Step 5.

8. Proceed to the driver side rear tire, and repeat the procedure in Step 5. The horn sounds two times to indicate the sensor identification code has been matched to the driver side rear tire, and the TPMS sensor matching process is no longer active. The TIRE LEARNING ACTIVE message on the DIC display screen goes off.
9. Turn the ignition switch to LOCK/OFF.
10. Set all four tires to the recommended air pressure level as indicated on the Tire and Loading Information label.
11. Put the valve caps back on the valve stems.

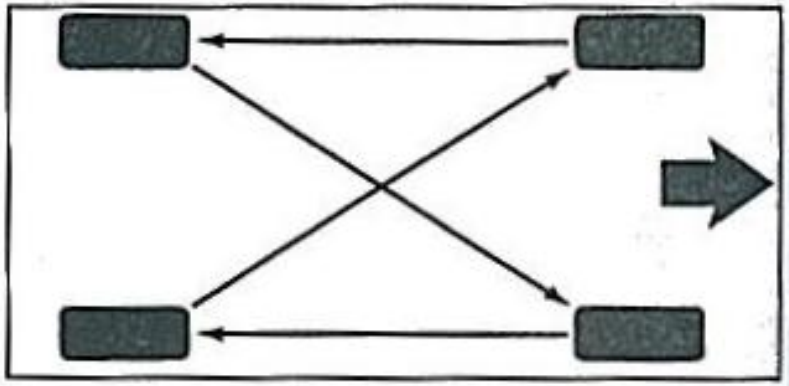
Tire Inspection and Rotation

We recommend that you regularly inspect your vehicle's tires, including the spare tire, for signs of wear or damage. See *When It Is Time for New Tires on page 5-67* for more information.

Tires should be rotated every 5,000 to 8,000 miles (8 000 to 13 000 km). See *Scheduled Maintenance on page 6-4*.

The purpose of a regular tire rotation is to achieve a uniform wear for all tires on the vehicle. This will ensure that your vehicle continues to perform most like it did when the tires were new.

Any time you notice unusual wear, rotate the tires as soon as possible and check wheel alignment. Also check for damaged tires or wheels. See *When It Is Time for New Tires on page 5-67* and *Wheel Replacement on page 5-72*.



When rotating the vehicle's tires, always use the correct rotation pattern shown here.

Do not include the compact spare tire in the tire rotation.

After the tires have been rotated, adjust the front and rear inflation pressures as shown on the Tire and Loading Information label. See *Inflation - Tire Pressure on page 5-60* and *Loading the Vehicle on page 4-19*.