REPORT NUMBER 138-STF-08-006

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

FUJI HEAVY INDUSTRIES
2008 SUBARU IMPREZA
FOUR-DOOR PASSENGER CAR
NHTSA NO. C85502

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

August 26, 2008

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
NVS-220
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVENUE, SE
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INTRODUCTION

1.1 PURPOSE OF COMPLIANCE TEST

A 2008 Subaru Impreza 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 2008 Subaru Impreza four-door passenger car. Nomenclatures applicable to the test vehicle are:

A. Vehicle Identification Number: JF1GH61608H813547

B. NHTSA Number: C85502

C Manufacturer: Fuji Heavy Industries, Inc.

D. Manufacture Date: 10/2007

1.3 TEST DATE

The test vehicle was tested during the time period August 8 through August 14, 2008.

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.

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 two 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 internal cargo area. 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 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, but in all scenarios illumination occurred before a speed of 50 km/h was reached.

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, or until all tires excluding deflated tire(s) were within seven kPa (one psi) of vehicle placard cold inflation pressure. 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 Impreza telltale extinguished before 50 km/h was reached.

A malfunction detection scenario was performed with the vehicle loaded to its LLVW. A malfunction was simulated by placing the compact spare tire (with no TPMS sensor) on the right front wheel position. The vehicle was started and driven until telltale illumination.

2.2 SUMMARY OF RESULTS

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

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

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

C. Left front
D. Right front and left rear
E. Left front, left rear, right rear, and right front

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

One malfunction detection scenario was performed on the test vehicle at LLVW. The vehicle's combination malfunction telltale properly indicated a malfunction per the standard's requirements.

SECTION 3

TEST DATA

FMVSS No. 138 – TEST DATA SUMMARY

TEST DATES: August 8 - 13, 2008 LAB: U. S. DOT San Angelo Test Facility

VIN: JF1GH61608H813547 VEHICLE NHTSA NUMBER: C85502

CERTIFICATION LABEL BUILD DATE: 10/2007

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: August 8, 2008 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C85502 VIN: JF1GH61608H813547

CERTIFICATION LABEL BUILD DATE: 10/2007 ENGINE: 2.5 liter horizontally-opposed SOHC

MY/MAKE/MODEL/BODY STYLE: 2008 Subaru Impreza four-door passenger car

TIRE CONDITIONING:

(X) Tires used more than 100 km. Actual odometer reading : 698 km (434 mi)

VEHICLE ALIGNMENT AND WHEEL BALANCING:

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

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

TPMS IDENTIFICATION:

TPMS SENSOR MAKE/MODEL: Schrader Electronics & Calsonic Kansei Corporation model / part #28103SA001

Source: Manufacturer provided 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 provided information

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

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	P205/55R16	230 kPa (33 psi)	Vehicle placard
Rear	P205/55R16	220 kPa (32 psi)	Vehicle placard
Spare	T125/70D17	420 kPa (60 psi)	Vehicle placard

INSTALLED TIRE DATA (Use diagrams as reference):

Diagram - Passenger Car Tire Labeling

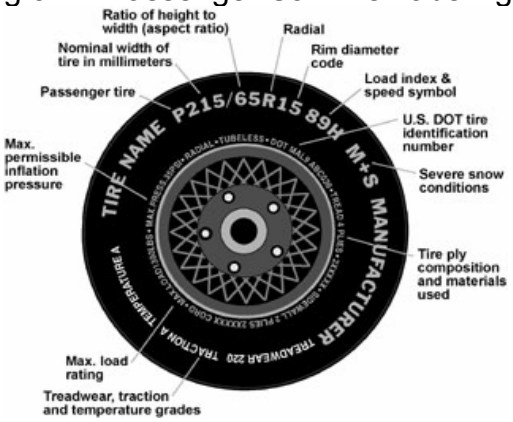
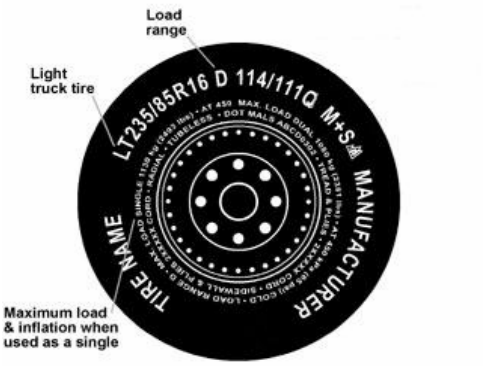


Diagram - Other Markings on Light Trucks



Front and Rear Axles

Tire Size and Load Index / Speed Rating: P205/55R16 89V

Manufacturer/Tire Name: Bridgestone Potenza RE92A

Sidewall Max Load Rating: 580 kg (1,279 lbs)

Max Inflation Pressure: 350 kPa (51 psi)

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

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

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	230 kPa x .75 = 172.5 kPa	220 kPa x .75 = 165.0 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 350 kPa (51 psi) 140 kPa (20 psi)	(X) P-metric-Standard load ( ) P-metric-Extra Load Load Range ( ) C, ( ) D, or ( ) E (X) Maximum or ( ) Rated 350 kPa (51 psi) 140 kPa (20 psi)
(C) Telltale Warning Activation Pressure is the higher of Part (A) or (B)	172.5 kPa (25.0 psi)	165.0 kPa (23.9 psi)
(D) Pressure at which to deflate tire(s) = (C) – 7 kPa	165.5 kPa (24.0 psi)	158.0 kPa (22.9 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: August 8, 2008

APPROVED BY: Kenneth H. Yates

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

TEST DATE: August 8, 2008 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C85502

TPMS Low Tire Pressure Warning Telltale

TPMS Low Tire Pressure Warning Telltale Location: Lower left side of fuel gauge

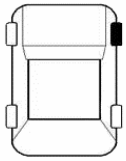
Telltale is mounted inside the occupant compartment in front of and in clear view of the driver?

(X)YES ( )NO (fail)

Identify Telltale Symbol Used (check box above figure).

[X]

[ ]



[ ]

OTHER (fail)
(describe below)

Note any words or additional symbols used.

None

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

TPMS Malfunction Telltale

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

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

(X)YES ( )NO (fail)

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

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 OFF/RUN and START

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

Time telltale remains illuminated 2.15 seconds.

Starter Interlocks:

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

TEST RESULTS

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

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: August 8, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 1 of 19)
TPMS OPERATIONAL PERFORMANCE

TEST DATE: August 8, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C85502

Time:	Start:	10:00 am	End:	10:35 am
Ambient Temperature:	Start:	28.5°C (83.3°F)	End:	29.3°C (84.7°F)
Odometer Reading*:	Start:	698 km (434 mi)		
Fuel Level:	Start:	Full		
Weather Conditions:		Partly cloudy		

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	230.0 kPa (33.4 psi)	220.0 kPa (31.9 psi)	220.0 kPa (31.9 psi)	230.0 kPa (33.4 psi)
Tire Sidewall Temp	29.1°C (84.4°F)	29.0°C (84.2°F)	28.9°C (84.0°F)	29.3°C (84.7°F)

* For test scenarios, the trip odometer with increments in tenths was used.

DATA SHEET 3 (Sheet 2 of 19)
TPMS OPERATIONAL PERFORMANCE

VEHICLE WEIGHT:

Vehicle Ratings from Certification Label:

GVWR: 1,950 kg (4,299 lbs)

GAWR (front): 990 kg (2,183 lbs)

GAWR (rear): 1,000 kg (2,205 lbs)

Vehicle Capacity Weight:

Vehicle Capacity Weight 408 kg (900 lbs)

Measured Unloaded Vehicle Weight:

LF	413 kg (909 lbs)	LR	308 kg (682 lbs)
RF	398 kg (878 lbs)	RR	302 kg (665 lbs)
Front Axle	811 kg (1,787 lbs)	Rear Axle	610 kg (1,347 lbs)

Total Vehicle 1,421 kg (3,134 lbs)

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

LF	461 kg (1,017 lbs)		LR	358 kg (789 lbs)	
RF	450 kg (992 lbs)		RR	355 kg (782 lbs)	
Front Axle	911 kg (2,009 lbs)	(≤ GAWR)	Rear Axle	713 kg (1,571 lbs)	(≤ GAWR)

Total Vehicle 1,624 kg (3,580 lbs) (not greater than GVWR)

Note: For scenarios A, B, and Malfunction, this total vehicle weight measures the vehicle loaded to Lightly Loaded Vehicle Weight (LLVW), 202 kg (446 lbs) of driver, passenger, and test equipment.

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

SCENARIO A – Right Rear Tire Deflation at LLVW

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

VEHICLE NHTSA NUMBER: C85502

Note: See Data Sheet 3 (Sheet 2 of 19) 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: 32.0°C (89.6°F) Vehicle cool down period: 68 minutes				
Inflation Pressure	230.0 kPa (33.4 psi)	220.0 kPa (31.9 psi)	220.0 kPa (31.9 psi)	230.1 kPa (33.4 psi)
Tire Sidewall Temp	35.4°C (95.7°F)	34.6°C (94.3°F)	35.0°C (95.0°F)	35.2°C (95.4°F)
San Angelo Test Facility Shop Floor Temp	32.8°C (91.0°F)	33.2°C (91.8°F)	33.0°C (91.4°F)	32.6°C (90.7°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	18:46:14 UTC	End:	19:10:41 UTC
Odometer Reading:	Start:	36.5 km (22.7 mi)	End:	68.7 km (42.7 mi)
Ambient Temperature:	Start:	32.0°C (89.6°F)	End:	33.0°C (91.4°F)
Roadway Temperature:	Start:	50.0°C (122.0°F)	End:	52.2°C (126.0°F)

Driving in first direction:

Starting point: Goodfellow Air Force Base (GAFB) north gate Direction: see chart, page 54

10:14 minutes (stopwatch time) 15.9 km (9.9 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 54

10:27 minutes (stopwatch time) 16.3 km (10.1 mi) distance

Max speed: 98.2 km/h (61.0 mph)

Total Driving Time: 20:41 minutes (VBox time)

DATA SHEET 3 (Sheet 4 of 19)
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	244.2 kPa (35.4 psi)	236.6 kPa (34.3 psi)	236.0 kPa (34.2 psi)	246.1 kPa (35.7 psi)
Tire Sidewall Temp	47.2°C (117.0°F)	44.4°C (111.9°F)	43.8°C (110.8°F)	46.6°C (115.9°F)
San Angelo Test Facility Shop Floor Temp	33.0°C (91.4°F)	33.6°C (92.5°F)	33.4°C (92.1°F)	33.2°C (91.8°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: ( )LF ( )LR (X)RR ( )RF Inflation Pressure			158.0 kPa (22.9 psi)	

TELLTALE ILLUMINATION:

Driving in first direction:

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

2:55 minutes (stopwatch time – non-cumulative) 0.8 km (0.5 mi) distance

Driving above 50 km/hr was not required.

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

Does the vehicle have a telltale that identifies which tire(s) is (are) under-inflated?
( )YES (X)NO

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)

DATA SHEET 3 (Sheet 5 of 19)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation at LLVW

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)

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: 33.8°C (92.8°F) Vehicle cool down period: 61 minutes				
Inflation Pressure	231.9 kPa (33.6 psi)	223.5 kPa (32.4 psi)	149.6 kPa (21.7 psi)	233.2 kPa (33.8 psi)
Tire Sidewall Temp	36.4°C (97.5°F)	37.4°C (99.3°F)	37.2°C (99.0°F)	34.8°C (94.6°F)
San Angelo Test Facility Shop Floor Temp	33.8°C (92.8°F)	34.4°C (93.9°F)	34.2°C (93.6°F)	33.6°C (92.5°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 cool down period: Re-adjusted Inflation Pressure:	230.0 kPa (33.4 psi)	220.1 kPa (31.9 psi)	220.1 kPa (31.9 psi)	230.0 kPa (33.4 psi)

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

Starting point: San Angelo Test Facility shop Direction: west

2:43 minutes (stopwatch time – non-cumulative) 0.2 km (0.1 mi) distance

TEST RESULTS

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

REMARKS: None

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

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 6 of 19)
TPMS OPERATIONAL PERFORMANCE

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

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

VEHICLE NHTSA NUMBER: C85502

Note: See Data Sheet 3 (Sheet 2 of 19) 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: 30.1°C (86.2°F) Vehicle cool down period: 68 minutes				
Inflation Pressure	230.0 kPa (33.4 psi)	220.0 kPa (31.9 psi)	220.0 kPa (31.9 psi)	230.0 kPa (33.4 psi)
Tire Sidewall Temp	31.8°C (89.2°F)	31.6°C (88.9°F)	31.6°C (88.9°F)	31.2°C (88.2°F)
San Angelo Test Facility Shop Floor Temp	31.4°C (88.5°F)	31.0°C (87.8°F)	31.0°C (87.8°F)	31.0°C (87.8°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	15:34:29 UTC	End:	15:59:05 UTC
Odometer Reading:	Start:	100.4 km (62.4 mi)	End:	132.3 km (82.2 mi)
Ambient Temperature:	Start:	30.6°C (87.1°F)	End:	31.2°C (88.2°F)
Roadway Temperature:	Start:	40.8°C (105.4°F)	End:	45.0°C (113.0°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 55

10:09 minutes (stopwatch time) 15.8 km (9.8 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 55

10:30 minutes (stopwatch time) 16.1 km (10.0 mi) distance

Max speed: 97.9 km/h (60.8 mph)

Total Driving Time: 20:40 minutes (VBox time)

DATA SHEET 3 (Sheet 7 of 19)
TPMS OPERATIONAL PERFORMANCE

SCENARIO B – Left Front, Left 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	249.5 kPa (36.2 psi)	240.3 kPa (34.9 psi)	240.4 kPa (34.9 psi)	250.2 kPa (36.3 psi)
Tire Sidewall Temp	47.0°C (116.6°F)	41.0°C (105.8°F)	43.4°C (110.1°F)	44.4°C (111.9°F)
San Angelo Test Facility Shop Floor Temp	32.0°C (89.6°F)	32.4°C (90.3°F)	32.2°C (90.0°F)	32.2°C (90.0°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 ( )RR (X)RF Inflation Pressure	165.5 kPa (24.0 psi)	158.0 kPa (22.9 psi)		165.5 kPa (24.0 psi)

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: west

1:46 minutes (stopwatch time – non-cumulative) 0.2 km (0.1 mi) distance

Driving above 50 km/hr was not required.

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

Does the vehicle have a telltale that identifies which tire(s) is (are) under-inflated?
( )YES (X)NO

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)

DATA SHEET 3 (Sheet 8 of 19)
TPMS OPERATIONAL PERFORMANCE

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

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)

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: 33.4°C (92.1°F) Vehicle cool down period: 61 minutes				
Inflation Pressure	158.0 kPa (22.9 psi)	150.1 kPa (21.8 psi)	226.7 kPa (32.9 psi)	158.1 kPa (22.9 psi)
Tire Sidewall Temp	35.2°C (95.4°F)	36.6°C (97.9°F)	36.2°C (97.2°F)	35.8°C (96.4°F)
San Angelo Test Facility Shop Floor Temp	33.4°C (92.1°F)	33.4°C (92.1°F)	33.4°C (92.1°F)	33.2°C (91.8°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 cool down period: Re-adjusted Inflation Pressure:	230.1 kPa (33.4 psi)	220.0 kPa (31.9 psi)	220.0 kPa (31.9 psi)	230.1 kPa (33.4 psi)

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

Starting point: San Angelo Test Facility shop Direction: west

2:35 minutes (stopwatch time – non-cumulative) 0.6 km (0.4 mi) distance

TEST RESULTS

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

REMARKS: None

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

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 9 of 19)
TPMS OPERATIONAL PERFORMANCE

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

VEHICLE NHTSA NUMBER: C85502

Time:	Start:	1:34 pm	End:	2:14 pm
Ambient Temperature:	Start:	35.7°C (96.3°F)	End:	37.2°C (99.0°F)
Odometer Reading:	Start:	134.9 km (83.8 mi)		
Fuel Level:	Start:	Full		
Weather Conditions:		Partly cloudy		

Time vehicle remained with engine off and tires shielded from direct sunlight:
(1 hour minimum): 75 minutes

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	230.0 kPa (33.4 psi)	220.0 kPa (31.9 psi)	220.0 kPa (31.9 psi)	230.1 kPa (33.4 psi)
Tire Sidewall Temp	38.6°C (101.5°F)	39.4°C (102.9°F)	39.8°C (103.6°F)	38.2°C (100.8°F)

DATA SHEET 3 (Sheet 10 of 19)
TPMS OPERATIONAL PERFORMANCE

VEHICLE WEIGHT:

Vehicle Ratings from Certification Label:

GVWR: 1,950 kg (4,299 lbs)

GAWR (front): 990 kg (2,183 lbs)

GAWR (rear): 1,000 kg (2,205 lbs)

Vehicle Capacity Weight:

Vehicle Capacity Weight 408 kg (900 lbs)

Measured Unloaded Vehicle Weight:

LF	413 kg (911 lbs)	LR	308 kg (679 lbs)
RF	398 kg (877 lbs)	RR	302 kg (666 lbs)
Front Axle	811 kg (1,788 lbs)	Rear Axle	610 kg (1,345 lbs)

Total Vehicle 1,421 kg (3,133 lbs)

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

LF	473 kg (1,042 lbs)		LR	450 kg (992 lbs)	
RF	461 kg (1,017 lbs)		RR	445 kg (982 lbs)	
Front Axle	934 kg (2,059 lbs)	(≤ GAWR)	Rear Axle	895 kg (1,974 lbs)	(≤ GAWR)

Total Vehicle 1,829 kg (4,033 lbs) (not greater than GVWR)

Note: For scenarios C, D, and E, this Total Vehicle Weight measures the vehicle loaded to Unloaded Vehicle Weight (UVW) and Vehicle Capacity Weight (VCW), 408 kg (900 lbs) of driver, passenger, test equipment, and ballast.

DATA SHEET 3 (Sheet 11 of 19)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – Left Front Tire Deflation at UVW + VCW

TEST DATE: August 13, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C85502

Note: See Data Sheet 3 (Sheet 10 of 19) 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: 23.2°C (73.8°F) Vehicle cool down period: overnight				
Inflation Pressure	230.1 kPa (33.4 psi)	220.1 kPa (31.9 psi)	220.1 kPa (31.9 psi)	230.1 kPa (33.4 psi)
Tire Sidewall Temp	26.6°C (79.9°F)	27.2°C (81.0°F)	26.2°C (79.2°F)	27.2°C (81.0°F)
San Angelo Test Facility Shop Floor Temp	28.4°C (83.1°F)	28.4°C (83.1°F)	28.4°C (83.1°F)	28.4°C (83.1°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	13:12:54 UTC	End:	13:37:53 UTC
Odometer Reading:	Start:	136.2 km (84.6 mi)	End:	168.2 km (104.5 mi)
Ambient Temperature:	Start:	23.8°C (74.8°F)	End:	24.5°C (76.1°F)
Roadway Temperature:	Start:	27.6°C (81.7°F)	End:	29.4°C (84.9°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 56

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 56

10:26 minutes (stopwatch time) 16.1 km (10.0 mi) distance

Max speed: 98.9 km/h (61.5 mph)

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

DATA SHEET 3 (Sheet 12 of 19)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – 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	249.3 kPa (36.2 psi)	242.2 kPa (35.1 psi)	242.1 kPa (35.1 psi)	249.5 kPa (36.2 psi)
Tire Sidewall Temp	38.8°C (101.8°F)	36.8°C (98.2°F)	36.8°C (98.2°F)	37.4°C (99.3°F)
San Angelo Test Facility Shop Floor Temp	28.6°C (83.5°F)	29.2°C (84.6°F)	29.0°C (84.2°F)	29.2°C (84.6°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	165.5 kPa (24.0 psi)			

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: west

2:11 minutes (stopwatch time – non-cumulative) 0.5 km (0.3 mi) distance

Driving above 50 km/hr was not required.

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

Does the vehicle have a telltale that identifies which tire(s) is (are) under-inflated?
( )YES (X)NO

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)

DATA SHEET 3 (Sheet 13 of 19)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – Left Front Tire Deflation at UVW + VCW

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)

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: 26.9°C (80.4°F) Vehicle cool down period: 62 minutes				
Inflation Pressure	160.2 kPa (23.2 psi)	228.7 kPa (33.2 psi)	228.1 kPa (33.1 psi)	239.1 kPa (34.7 psi)
Tire Sidewall Temp	30.6°C (87.1°F)	30.6°C (87.1°F)	30.8°C (87.4°F)	31.2°C (88.2°F)
San Angelo Test Facility Shop Floor Temp	29.8°C (85.6°F)	30.0°C (86.0°F)	30.2°C (86.4°F)	30.0°C (86.0°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 cool down period: Re-adjusted Inflation Pressure:	230.0 kPa (33.4 psi)	220.0 kPa (31.9 psi)	220.1 kPa (31.9 psi)	230.0 kPa (33.4 psi)

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

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

3.33 minutes (stopwatch time – non-cumulative) 0.8 km (0.5 mi) distance

TEST RESULTS

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

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: August 13, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 14 of 19)
TPMS OPERATIONAL PERFORMANCE

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

TEST DATE: August 3, 2008 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C85502

Note: See Data Sheet 3 (Sheet 10 of 19) 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: 30.4°C (86.7°F) Vehicle cool down period: 80 minutes				
Inflation Pressure	230.1 kPa (33.4 psi)	220.1 kPa (31.9 psi)	220.1 kPa (31.9 psi)	230.1 kPa (33.4 psi)
Tire Sidewall Temp	32.4°C (90.3°F)	32.2°C (90.0°F)	32.2°C (90.0°F)	32.4°C (90.3°F)
San Angelo Test Facility Shop Floor Temp	31.2°C (88.2°F)	31.2°C (88.2°F)	31.4°C (88.5°F)	31.6°C (88.9°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	16:43:34 UTC	End:	17:08:07 UTC
Odometer Reading:	Start:	172.2 km (107.0 mi)	End:	204.2 km (126.9 mi)
Ambient Temperature:	Start:	30.8°C (87.4°F)	End:	31.9°C (89.4°F)
Roadway Temperature:	Start:	46.8°C (116.2°F)	End:	48.8°C (119.8°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 57

10:08 minutes (stopwatch time) 15.8 km (9.8 mi) distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 57

10:34 minutes (stopwatch time) 16.3 km (10.1 mi) distance

Max speed: 99.0 km/h (61.5 mph)

Total Driving Time: 20:42 minutes (VBox time)

DATA SHEET 3 (Sheet 15 of 19)
TPMS OPERATIONAL PERFORMANCE

SCENARIO D – 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	250.6 kPa (36.3 psi)	244.3 kPa (35.4 psi)	244.6 kPa (35.5 psi)	251.7 kPa (36.5 psi)
Tire Sidewall Temp	47.6°C (117.7°F)	46.4°C (115.5°F)	45.8°C (114.4°F)	47.0°C (116.6°F)
San Angelo Test Facility Shop Floor Temp	32.2°C (90.0°F)	32.2°C (90.0°F)	32.4°C (90.3°F)	32.2°C (90.0°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		158.0 kPa (22.9 psi)		165.5 kPa (24.0 psi)

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: west

1.38 minutes (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)

Does the vehicle have a telltale that identifies which tire(s) is (are) under-inflated?
( )YES (X)NO

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)

DATA SHEET 3 (Sheet 16 of 19)
TPMS OPERATIONAL PERFORMANCE

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

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)

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: 33.9°C (93.0°F) Vehicle cool down period: 62 minutes				
Inflation Pressure	237.2 kPa (34.4 psi)	147.4 kPa (21.4 psi)	228.0 kPa (33.1 psi)	157.3 kPa (22.8 psi)
Tire Sidewall Temp	36.8°C (98.2°F)	36.6°C (97.9°F)	36.6°C (97.9°F)	36.4°C (97.5°F)
San Angelo Test Facility Shop Floor Temp	33.6°C (92.5°F)	33.8°C (92.8°F)	33.6°C (92.5°F)	33.4°C (92.1°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 cool down period: Re-adjusted Inflation Pressure:	230.0 kPa (33.4 psi)	220.0 kPa (31.9 psi)	220.1 kPa (31.9 psi)	230.1 kPa (33.4 psi)

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

Starting point: San Angelo Test Facility shop Direction: west

2:02 minutes (stopwatch time – non-cumulative) 0.5 km (0.3 mi) distance

TEST RESULTS

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

REMARKS: None

RECORDED BY: Jack R. Stewart DATE: August 13, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 17 of 19)
TPMS OPERATIONAL PERFORMANCE

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

TEST DATE: August 14, 2008 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C85502

Note: See Data Sheet 3 (Sheet 10 of 19) 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: 27.5°C (81.5°F) Vehicle cool down period: overnight				
Inflation Pressure	230.1 kPa (33.4 psi)	220.1 kPa (31.9 psi)	220.1 kPa (31.9 psi)	230.0 kPa (33.4 psi)
Tire Sidewall Temp	28.6°C (83.5°F)	28.8°C (83.8°F)	28.8°C (83.8°F)	28.8°C (83.8°F)
San Angelo Test Facility Shop Floor Temp	29.6°C (85.3°F)	29.6°C (85.3°F)	29.6°C (85.3°F)	29.8°C (85.6°F)

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	14:47:09 UTC	End:	15:11:26 UTC
Odometer Reading:	Start:	207.8 km (129.1 mi)	End:	239.8 km (149.0 mi)
Ambient Temperature:	Start:	27.8°C (82.0°F)	End:	28.3°C (82.9°F)
Roadway Temperature:	Start:	33.6°C (92.5°F)	End:	40.4°C (104.7°F)

Driving in first direction:

Starting point: GAFB north gate Direction: see chart, page 58

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 58

10:30 minutes (stopwatch time) 16.1 km (10.0 mi) distance

Max speed: 98.3 km/h (61.1 mph)

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

DATA SHEET 3 (Sheet 18 of 19)
TPMS OPERATIONAL PERFORMANCE

SCENARIO E – 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	253.4 kPa (36.8 psi)	245.9 kPa (35.7 psi)	245.8 kPa (35.7 psi)	253.0 kPa (36.7 psi)
Tire Sidewall Temp	44.8°C (112.6°F)	45.2°C (113.4°F)	43.2°C (109.8°F)	42.8°C (109.0°F)
San Angelo Test Facility Shop Floor Temp	31.2°C (88.2°F)	31.2°C (88.2°F)	31.0°C (87.8°F)	31.2°C (88.2°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	165.5 kPa (24.0 psi)	158.0 kPa (22.9 psi)	158.0 kPa (22.9 psi)	165.5 kPa (24.0 psi)

TELLTALE ILLUMINATION:

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: west

1:34 minutes (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)

Does the vehicle have a telltale that identifies which tire(s) is (are) under-inflated?
( )YES (X)NO

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)

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

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

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)

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: 30.8°C (87.4°F) Vehicle cool down period: 62				
Inflation Pressure	158.1 kPa (22.9 psi)	150.0 kPa (21.8 psi)	150.0 kPa (21.8 psi)	159.5 kPa (23.1 psi)
Tire Sidewall Temp	34.2°C (93.6°F)	33.2°C (91.8°F)	33.8°C (92.8°F)	34.0°C (93.2°F)
San Angelo Test Facility Shop Floor Temp	31.4°C (88.5°F)	31.6°C (88.9°F)	31.6°C (88.9°F)	31.6°C (88.9°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 cool down period: Re-adjusted Inflation Pressure:	230.0 kPa (33.4 psi)	220.1 kPa (31.9 psi)	220.0 kPa (31.9 psi)	230.1 kPa (33.4 psi)

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

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

2:33 minutes (stopwatch time – non-cumulative) 0.5 km (0.3 mi) distance

TEST RESULTS

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: August 14, 2008

APPROVED BY: Kenneth H. Yates

DATA SHEET 4 (Sheet 1 of 2)
SCENARIO F – Malfunction Detection Test at LLVW

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

VEHICLE NHTSA NUMBER: C85502

Time:	Start:	13:03:53 UTC	End:	13:14:41 UTC
Odometer Reading:	Start:	72.4 km (45.0 mi)	End:	99.0 km (61.5 mi)
Ambient Temperature:	Start:	29.2°C (84.6°F)	End:	28.0°C (82.4°F)
Fuel Level:	Start:	Full		

Note: See Data Sheet 3 (Sheet 2 of 19) 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 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: GAFB north gate Direction: see chart, page 59

8:07 minutes (stopwatch time) 12.6 km (7.8 mi) distance

Max speed: 93.9 km/h (58.3 mph)
Total Driving Time: 07:49 minutes (VBox time)

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

DATA SHEET 4 (Sheet 2 of 2)
SCENARIO F – 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 3 seconds

Time telltale remains flashing 76 seconds

Time telltale remains illuminated 60+ seconds
(Verified for a minimum of 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? (X)YES ( )NO

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

2:45 minutes (stopwatch time – non-cumulative) 0.5 km (0.3 mi) distance

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: None

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

APPROVED BY: Kenneth H. Yates

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

TEST DATE: August 13, 2008 LAB: San Angelo Test Facility VEHICLE NHTSA NO: C85502

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?

- ☑ Significance of the low tire pressure warning telltale illuminating
- ☑ A description of corrective action to be undertaken
- ☑ Whether the tire pressure monitoring system functions with the vehicle's spare tire (if provided)
- ☐ 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: August 13, 2008

APPROVED BY: Kenneth H. Yates

SECTION 4

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TABLE 1 - INSTRUMENTATION AND EQUIPMENT INFORMATION LIST

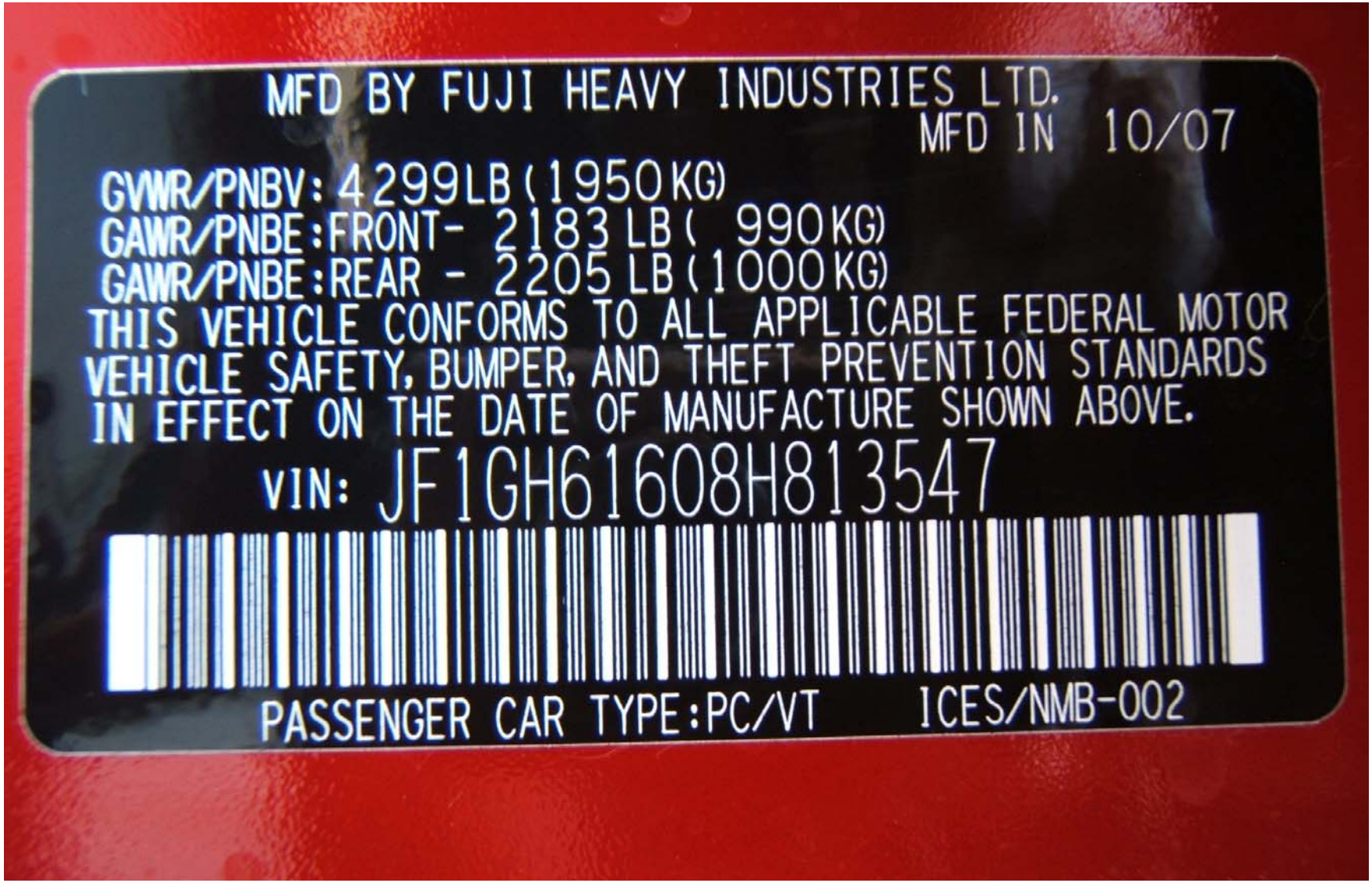
EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO	CAL. DATE	NEXT CAL. DATE
STOPWATCH	WESTCLOX QUARTZ STOPWATCH	NONE	N/A	N/A
VBOX RECORDING DEVICE	RACELOGIC VBOX III	SERIAL #030209	3/20/2008	3/20/2009
AMBIENT TEMPERATURE GAUGE	FLUKE 50D K/J THERMOMETER	SERIAL #80840101	3/10/2008	3/10/2009
LASER TEMPERATURE GAUGE (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	12/11/2007	12/11/2008
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

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO.138

FIGURE 5.1
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE



2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO.138

FIGURE 5.2
VEHICLE CERTIFICATION LABEL

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FMVSS NO. 138

FIGURE 5.3
VEHICLE PLACARD

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.4
TIRE SHOWING BRAND

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.5
TIRE SHOWING MODEL

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.6
TIRE SHOWING SIZE AND LOAD INDEX / SPEED RATING

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FIGURE 5.7
TIRE SHOWING DOT SERIAL NUMBER

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NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.8
TIRE SHOWING MAX LOAD RATING
AND MAX COLD INFLATION PRESSURE

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.9
TIRE SHOWING SIDEWALL / TREAD CONSTRUCTION

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.10
RIM SHOWING VALVE STEM

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.11
DISPLAY SHOWING LOW TIRE
PRESSURE / MALFUNCTION TELLTALE

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO 138

FIGURE 5.12
TEST INSTRUMENTATION ON VEHICLE

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.13
VEHICLE REAR SEAT BALLAST
FOR UVW + VCW LOAD

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.14
REAR OF VEHICLE BALLAST FOR UVW + VCW

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

FIGURE 5.15
VEHICLE ON WEIGHT SCALES

2008 SUBARU IMPREZA
NHTSA NO. C85502
FMVSS NO. 138

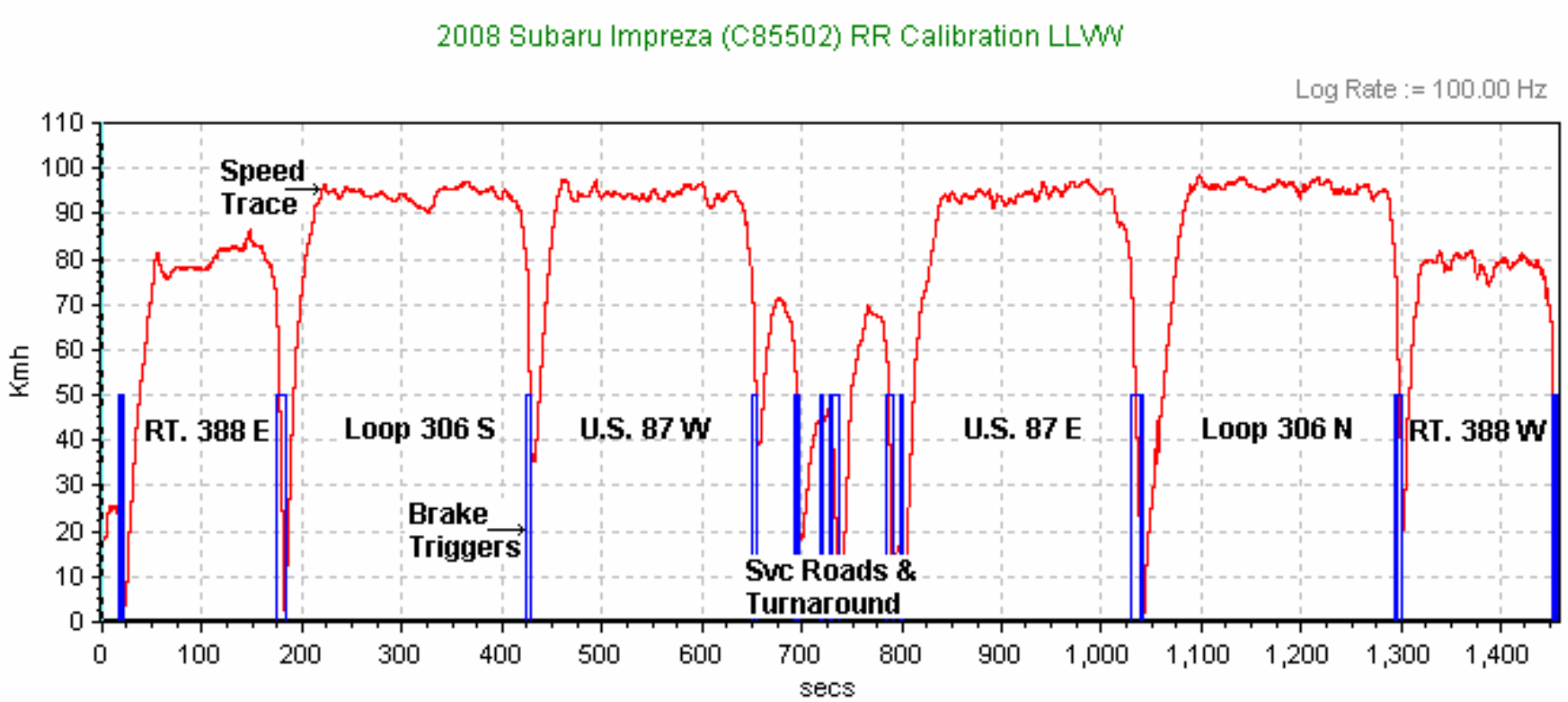
FIGURE 5.16
SPARE INSTALLED ON RIGHT FRONT
FOR MALFUNCTION DETECTION TEST

SECTION 6

TEST PLOTS

Scenario A:	Right Rear Tire at LLVW
Test Date:	8/11/08
Data File Time:	24:18 minutes
Cumulative Driving Time:	20:41 minutes
Start Point:	GAFB North Gate

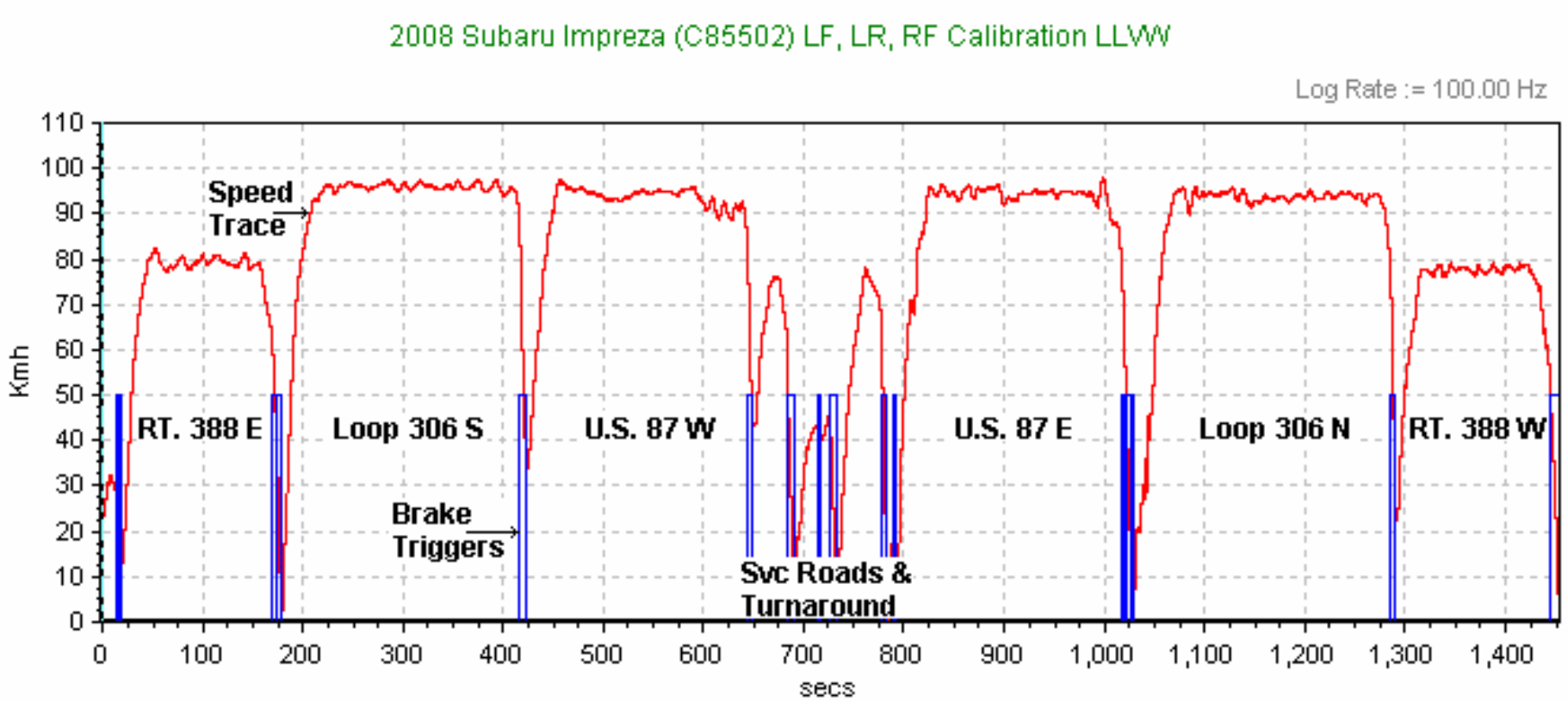
Calibration Phase:



RR Detection Phase: Telltale illumination in 2:55 minutes. Driving above 50 km/h (31 mph) was not required.

Scenario B:	Left Front, Left Rear, Right Front Tires at LLVW
Test Date:	8/12/08
Data File Time:	24:14 minutes
Cumulative Driving Time:	20:40 minutes
Start Point:	GAFB North Gate

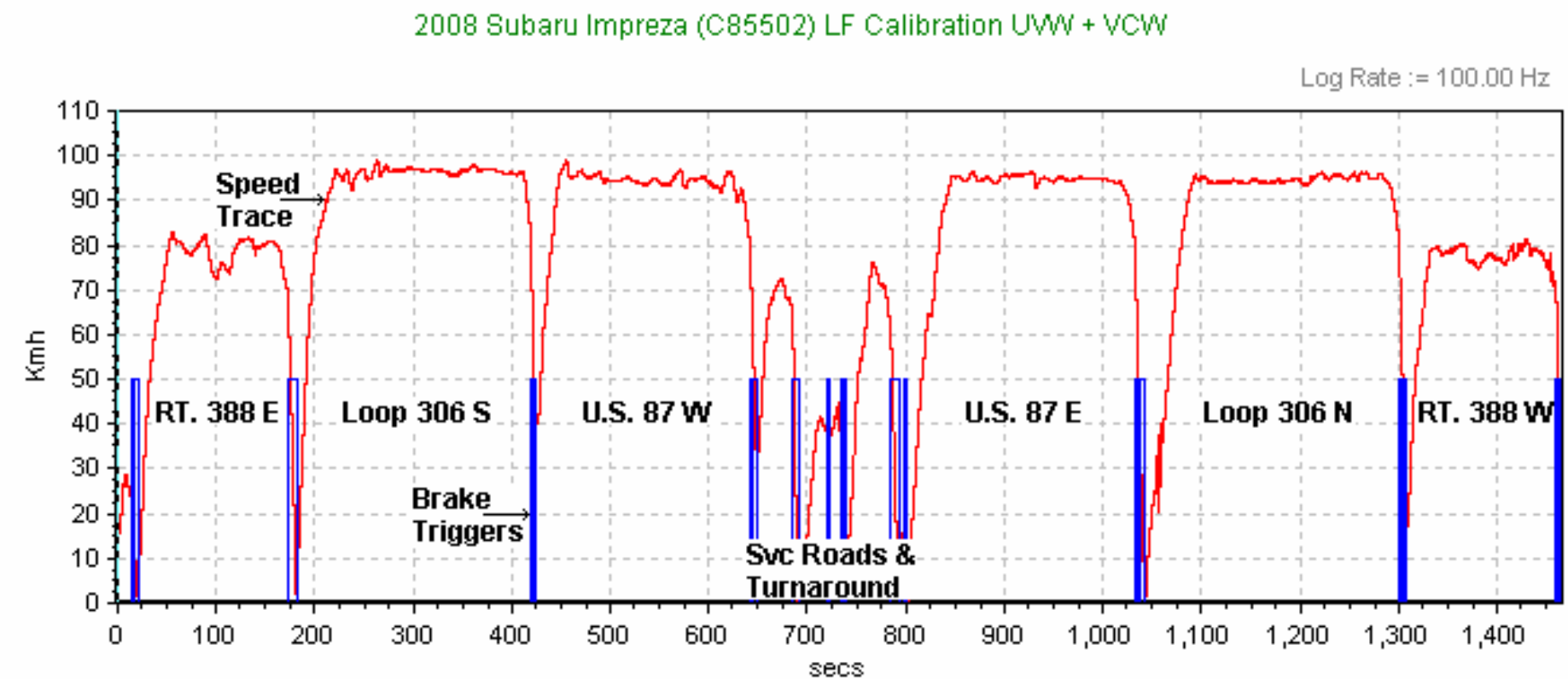
Calibration Phase:



LF, LR, RF Detection Phase: Telltale illumination in 1:46 minutes. Driving above 50 km/h (31 mph) was not required.

Scenario C:	Left Front Tire at UVW + VCW
Test Date:	8/13/08
Data File Time:	24:26 minutes
Cumulative Driving Time:	20:36 minutes
Start Point:	GAFB North Gate

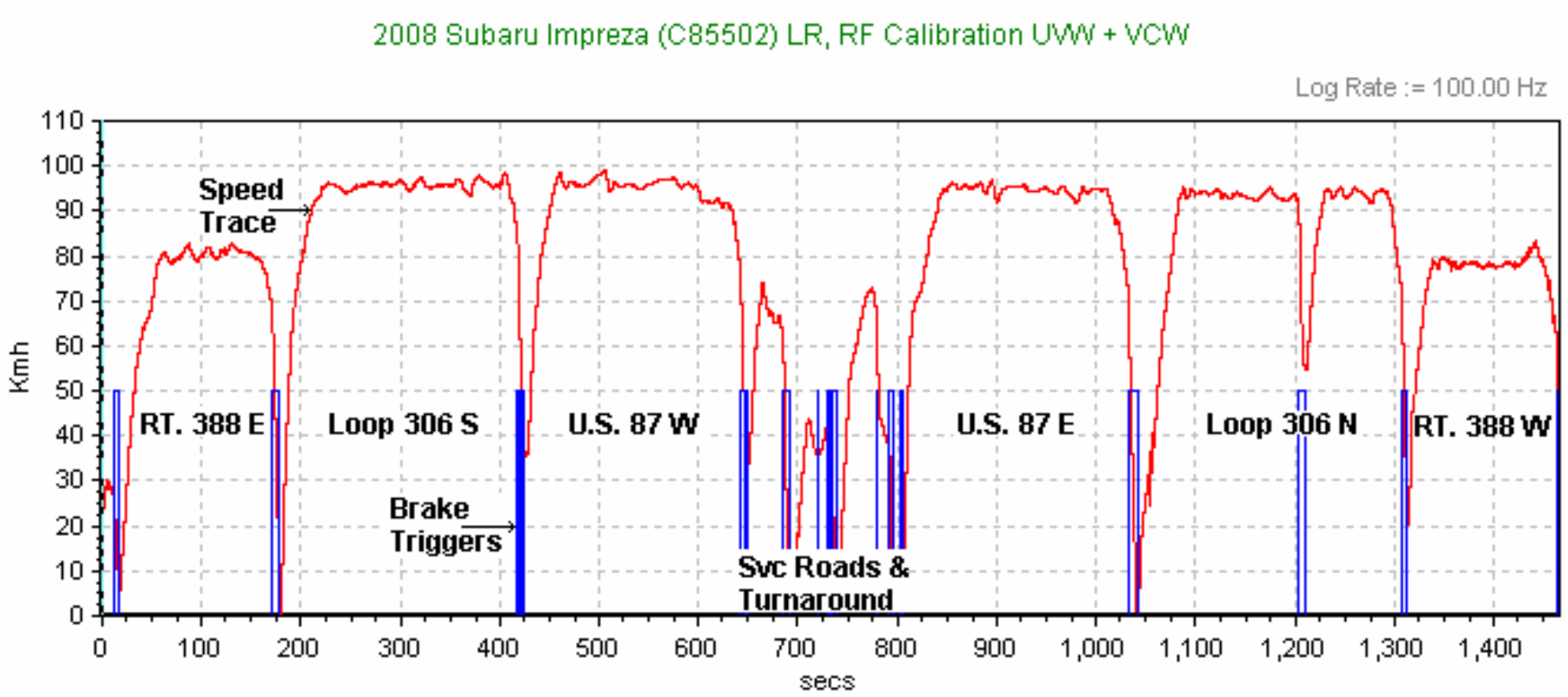
Calibration Phase:



LF Detection Phase: Telltale illumination in 2:11 minutes. Driving above 50 km/h (31 mph) was not required.

Scenario D:	Left Rear, Right Front Tires at UVW + VCW
Test Date:	8/13/08
Data File Time:	24:26 minutes
Cumulative Driving Time:	20:42 minutes
Start Point:	GAFB North Gate

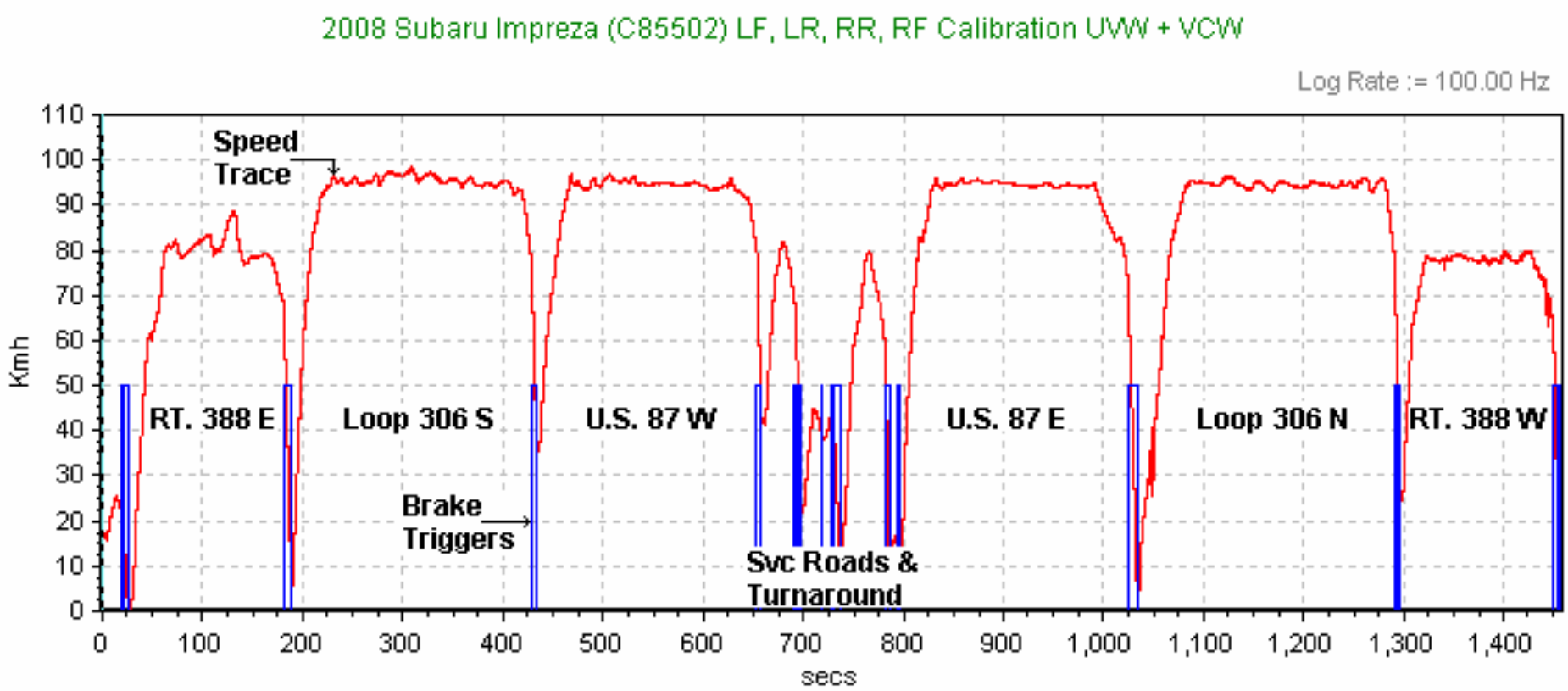
Calibration Phase:



LR, RF Detection Phase: Telltale illumination in 1:38 minutes. Driving above 50 km/h (31 mph) was not required.

Scenario E:	Left Front, Left Rear, Right Rear, Right Front Tires at UVW + VCW
Test Date:	8/14/08
Data File Time:	24:18 minutes
Cumulative Driving Time:	20:39 minutes
Start Point:	GAFB North Gate

Calibration Phase:



LF, LR, RR, RF Detection Phase: Telltale illumination in 1:34 minutes. Driving above 50 km/h (31 mph) was not required.

Malfunction Illumination:	Spare without TPMS sensor was applied to right front at LLVW.
Test Date:	8/12/08
Data File Time:	11:34 minutes
Cumulative Driving Time:	07:49 minutes
Start Point:	GAFB North Gate