REPORT NUMBER 138-STF-19-003

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

GENERAL MOTORS OF CANADA COMPANY
2019 CHEVROLET EQUINOX
MPV
NHTSA NO. C20190100

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

FEBRUARY 11, 2019

PREPARED FOR

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
NEF-200
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVENUE, SE
WASHINGTON, D.C. 20590

This publication is distributed by the U. S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: Doris Beebe

Approved By: [signature]

Accepted By: H. Kerrin Bessant

Acceptance Date: 2/11/19

Technical Report Documentation Page

1. Report No. 138-STF-19-003	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Final Report of FMVSS No. 138 Compliance Testing of 2019 Chevrolet Equinox MPV, NHTSA No.C20190100		5. Report Date February 11, 2019 6. Performing Organization Code STF
7. Author(s) Anthony Walden, Test Technician II Tommy Oliver, Program Analyst I Kenneth Yates, Safety Compliance Engineer		8. Performing Organization Report Number STF-DOT-19-138-003
9. Performing Organization Name and Address U.S. DOT San Angelo Test Facility 131 Comanche Trail, Building 3527 Goodfellow AFB, Texas 76908		10. Work Unit No. (TRAIS) 11. Contract or Grant No.
12. Sponsoring Agency Name and Address United States Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance, NEF-200 1200 New Jersey Avenue, SE Washington, DC 20590		13. Type of Report and Period Covered Final Test Report November 13, 2018, through February 6, 2019 14. Sponsoring Agency Code NEF-200
15. Supplementary Notes		
16. Abstract Compliance tests were conducted on the subject 2019 Chevrolet Equinox in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure Number TP-138-04 for the determination of FMVSS 138 compliance. Test failure identified was as follows: None		
17. Key Words Compliance Testing Safety Engineering FMVSS 138	18. Distribution Statement National Highway Traffic Safety Administration Technical Information Services Division NPO-411, Room E12-100 1200 New Jersey Avenue, S.E. Washington, DC 20590 Email: tis@dot.gov FAX: 202-493-2833	
19. Security Classification (of this report) UNCLASSIFIED	21. No. of Pages 86	22. Price
20. Security Classification (of this page) UNCLASSIFIED		

Form DOT F 1700.7 (8-72)

TABLE OF CONTENTS

SECTION PAGE

1 Introduction 1
2 Test Procedure and Summary of Results 2
3 Test Data 5
Test Data Summary 6
Vehicle Weigh-in for LLVW 13
Normal Deflation Test, Scenario A – Left Rear Tire Deflation at LLVW 14
Normal Deflation Test, Scenario B – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW 17
Malfunction Detection Test 1 – Left Front TPMS Sensor Removed at LLVW 20
Gradual Deflation Test 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW 22
Vehicle Weigh-in for UVW+VCW 30
Normal Deflation Test, Scenario C – Right Front Tire Deflation at UVW+VCW 32
Normal Deflation Test, Scenario D – Right Rear, Right Front Tire Deflation at UVW+VCW 35
Malfunction Detection Test 2 –TPMS RF Module Disconnection at UVW+VCW 38
Gradual Deflation Test 2 - Left Rear Tire Deflation at UVW+VCW 40
TPMS Written Instructions 47
4 Test Equipment List and Calibration Information 50
5 Photographs 51

Figure

5.1 ¾ Front View from Left Side of Vehicle
5.2 Vehicle Certification Label
5.3 Vehicle Placard
5.4 Tire Showing Brand
5.5 Tire Showing Model
5.6 Tire Showing Size and Load Index / Speed Rating
5.7 Tire Showing DOT Number
5.8 Tire Showing Max Load Rating and Max Cold Inflation Pressure
5.9 Tire Showing Sidewall / Tread Construction
5.10 Test Instrumentation Installed in Vehicle
5.11 Rear Seat Ballast for UVW+VCW GAWR Load
5.12 Cargo Area Ballast for UVW+VCW GAWR Load
5.13 Vehicle on Weight Scales
5.14 Malfunction Detection Test 1: Left Front TPMS Sensor Replaced at LLVW
5.15 Malfunction Detection Test 2: TPMS RF Module Disconnected at UVW+VCW
5.16 TPMS Low Tire Pressure Telltale and Display Showing Low Tire Location
5.17 TPMS System Malfunction Telltale and Warning
5.18 TPMS Low Tire Pressure Telltale and Display Showing Gradual Deflation Test Low Tire Locations

6 Test Plots 70
7 Owner's Manual Page 81

SECTION 1

INTRODUCTION

1.1 PURPOSE OF COMPLIANCE TEST

This testing was conducted as part of the Department of Transportation, National Highway Traffic Safety Administration's Federal Motor Vehicle Safety Standard (FMVSS) No. 138, "Tire Pressure Monitoring Systems" Compliance Program. The purpose of the test was to determine if the 2019 Chevrolet Equinox supplied by the Office of Vehicle Safety Compliance satisfies the requirements of TP-138-04 dated August 28, 2017.

1.2 TEST VEHICLE

The test vehicle was a 2019 Chevrolet Equinox MPV. Nomenclatures applicable to the test vehicle are:

A. Vehicle Identification Number: 2GNAXHEV6K6106330

B. NHTSA Number: C20190100

C. Manufacturer: General Motors of Canada Company

D. Manufacture Date: 06/2018

1.3 TEST DATE

The test vehicle was tested November 13, 2018, through February 6, 2019.

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 and vehicle labeling information were 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 UVW and the weights of the driver, one passenger, and test equipment. The vehicle was loaded to its UVW plus Vehicle Capacity Weight (VCW) for two additional tire deflation scenarios. The VCW included the weights of the driver, one passenger, test equipment, ballast in the rear seat, and ballast in the rear 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 3iSL 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 and low inflation pressure detection phase (as appropriate). The cumulative driving time was calculated by post-processing the VBOX graph data, and is reported in Section 3 (Test Data) as 'Total Cumulative Driving Time'.

The low tire pressure test scenarios consisted of five phases, in accordance with FMVSS 138, Test Procedures, Section S6:

1. Lamp Check Phase, S6(a) through (c): With the vehicle stationary and the ignition locking system in the "Lock" or "Off" position, the tires were set at the vehicle's placard cold inflation pressure and the ignition locking system was activated to the "On" ("Run") position. The ignition locking system can also be initially positioned as designated by the manufacturer as a check position. If applicable, the set/reset button was used to reset the TPMS system in accordance with the instructions in the vehicle owner's manual.
2. Calibration Phase, S6(d): The vehicle was driven for at least twenty minutes of cumulative driving time between 50 and 100 km/h. Immediately after, 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.

3. Detection Phase, S6(f): The vehicle was started and driven (if necessary) to ensure that the low inflation pressure telltale illuminated. The test is discontinued if no illumination occurs.
4. Re-illumination Phase, S6(g) through (h): Vehicle was parked in the San Angelo Test Facility (SATF) open bay shielded from direct sunlight and the ignition locking system deactivated to the "Off" or "Lock" position. 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.
5. Extinguishment Phase, S6(i): Tires were adjusted to vehicle placard cold inflation pressure. If the vehicle has a manual reset, the set/reset button was used to reset the TPMS system illumination. The system was reset as required by the owner's manual instructions or manufacturer's supplied information. If necessary, the vehicle was driven to ensure that the TPMS telltale is extinguished.

The two LLVW gradual deflation test scenarios, Section 13.4 of Test Procedures of FMVSS 138, followed the steps for the low tire pressure test above except that:

Calibration Phase: The vehicle was driven for 20 to 22 minutes of cumulative driving time between 50 and 100 km/h. Immediately after, the selected tire(s) were deflated to fourteen kPa (two psi) below the Recommended Cold Inflation Pressure(s). After one minute, the inflation pressure(s) of only deflated tire(s) were rechecked and adjusted if necessary.

Detection Phase: The vehicle was started and driven for 20 to 22 minutes at speeds between 50 and 100 km/h to determine if the low inflation pressure telltale illuminated. If no illumination occurred, the selected tire(s) were deflated an additional fourteen kPa (two psi) and after one minute, the pressure(s) were rechecked and adjusted if necessary. The cycle of fourteen kPa deflation was repeated until illumination occurred. Testing would have stopped if illumination had not occurred before deflation pressures reached more than 33% below the manufacturer's recommended cold inflation pressure threshold.

The two malfunction scenarios performed were: the left front TPMS sensor removal at LLVW, and the TPMS RF module disconnection at UVW+VCW.

2.2 SUMMARY OF RESULTS

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

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

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

C. Right front
D. Right rear, right front

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

One gradual deflation scenario was performed on the test vehicle at LLVW:

Gradual Deflation 1: Left front, left rear, right rear, right front

One gradual deflation scenario was performed on the test vehicle at UVW+VCW

Gradual Deflation 2: Left rear

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

One malfunction detection scenario was performed on the test vehicle at LLVW:

Malfunction 1: Left front TPMS sensor was removed.

One malfunction detection scenario was performed on the test vehicle at UVW+VCW:

Malfunction 2: The TPMS RF module was disconnected.

The data indicates that the vehicle's TPMS meets the malfunction requirements.

SECTION 3

TEST DATA

FMVSS No. 138 – TEST DATA SUMMARY

TEST DATES: November 13, 2018, through February 6, 2019

LAB: U.S. DOT San Angelo Test Facility VEHICLE NHTSA NUMBER: C20190100

VIN: 2GNAXHEV6K6106330 CERTIFICATION LABEL BUILD DATE: 06/2018

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: November 13, 2018 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100 VIN: 2GNAXHEV6K6106330

CERTIFICATION LABEL BUILD DATE: 06/2018 ENGINE: 1.5L, 4-cylinder

MY/MAKE/MODEL/BODY STYLE: 2019 Chevrolet Equinox MPV

TIRE CONDITIONING:

(X) Tires used more than 100 km. Actual odometer reading: 63 mi (101 km)

VEHICLE ALIGNMENT AND WHEEL BALANCING:

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

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

TPMS IDENTIFICATION:

TPMS MAKE/MODEL: Sensors: Sensata Technologies (Schrader), model #13516164

ECU: Bosch Corporation, model #13524922

Source: Manufacturer supplied information

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

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

TPMS MALFUNCTION INDICATOR TYPE:

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

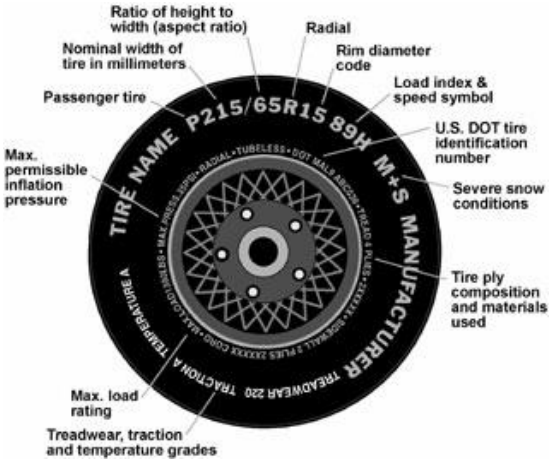
DATA SHEET 1 (Sheet 2 of 3)
TEST PREPARATION INFORMATION

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

Axle	Tire Size	Recommended Cold Inflation Pressure	Source
Front	225/65R17	240 kPa, 35 psi	Vehicle placard
Rear	225/65R17	240 kPa, 35 psi	Vehicle placard
Spare	T135/70R16	420 kPa 60 psi	Vehicle placard

INSTALLED TIRE DATA

Diagram – Passenger Car Tire Labeling



Front and Rear Axles

Tire Size and Load Index / Speed Rating: 225/65R17 102H

Manufacturer/Tire Name: Michelin Premier LTX

Sidewall Max Load Rating: 850 kg, 1,874 lbs.

Max Inflation Pressure: 300 kPa, 44 psi

Sidewall Construction (number of plies and ply material): 2 polyester

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

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	240 kPa x .75 = 180.0 kPa	240 kPa x .75 = 180.0 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 300 kPa 140 kPa	(X) P-metric-Standard load ( ) P-metric-Extra Load Load Range ( ) C, ( ) D, or ( ) E (X) Maximum or ( ) Rated 300 kPa 140 kPa
(C) Telltale Warning Activation Pressure is the higher of Part (A) or (B)	180.0 kPa	180.0 kPa
(D) Pressure at which to deflate tire(s) = (C) – 7 kPa	173.0 kPa	173.0 kPa

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: Tommy Oliver DATE: November 13, 2018

APPROVED BY: Kenneth Yates

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

TEST DATE: November 13, 2018 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

TPMS Low Tire Pressure Warning Telltale

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

(X)YES ( )NO (fail)

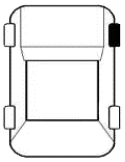
TPMS Low Tire Pressure Warning Telltale Location: Inside speedometer, on the right side

Identify Telltale Symbol Used (check box above figure).

[X]



[ ]



[ ]

OTHER (fail)
(describe below)

Note any words or additional symbols used: Plan view with all tire positions is also used during a telltale illumination. It is part of a reconfigurable display located between the tachometer and the speedometer.

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

TPMS Malfunction Telltale

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

Note any words or additional symbols used: None

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

Check Telltale Lamp Functions:

LOW TIRE PRESSURE WARNING AND MALFUNCTION TELLTALE

Ignition locking system position when telltale illuminates:

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

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

Time telltale remains illuminated 5 seconds.

Starter Interlocks:

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

Describe the interlock features: Brake pedal must be depressed when pushing the Ignition button to start the vehicle. The telltale lamp check only illuminates once the vehicle is started.

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

REMARKS: None

RECORDED BY: Tommy Oliver DATE: November 13, 2018

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 1 of 42)
TPMS OPERATIONAL PERFORMANCE

TEST DATE: December 11, 2018 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

Time: Start: 1:26 pm End: 1:47 pm

Ambient Temperature: Start: 15.6°C End: 16.0°C

Trip Odometer Reading: Start: 63 mi

Fuel Level: Start: Full

Weather Conditions: Indoors

Time vehicle remained with engine off and tires shielded from direct sunlight (1 hour minimum): 2 hours

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	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa
Tire Sidewall Temp	16.2°C	16.1°C	16.1°C	16.3°C

VEHICLE WEIGHT:

Vehicle Ratings from Certification Label:

GVWR: 2,025 kg, 4,464 lbs.

GAWR (front): 1,175 kg, 2,590 lbs.

GAWR (rear): 1,200 kg, 2,645 lbs.

Vehicle Capacity Weight from Vehicle Placard:

Vehicle Capacity Weight 500 kg, 1,102 lbs.

Measured Unloaded Vehicle Weight:

LF	440.5 kg	LR	330.5 kg
RF	435.5 kg	RR	293.5 kg
Front Axle	876.0 kg	Rear Axle	624.0 kg

Total Vehicle 1,500.0 kg

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

LF	496.0 kg	LR	380.5 kg
RF	486.5 kg	RR	340.0 kg
Front Axle	982.5 kg (≤ GAWR)	Rear Axle	720.5 kg (≤ GAWR)

Total Vehicle 1,703.0 kg (not greater than GVWR)

Note: For scenarios A and B, Malfunction 1, and Gradual Deflation 1, this Total Vehicle Weight measures the vehicle loaded to Lightly Loaded Vehicle Weight (LLVW). This consisted of the Unloaded Vehicle Weight (UVW) and 203.0 kg of driver, passenger, and test equipment.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: December 11, 2018

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 3 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO A – Left Rear Tire Deflation at LLVW

TEST DATE: December 18, 2018 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

Note: See Data Sheet 3 (Sheet 2 of 42) 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 LLVW, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 14.1°C Vehicle cool down period: overnight				
Inflation Pressure	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa
Tire Sidewall Temp	12.0°C	12.0°C	12.4°C	12.0°C
San Angelo Test Facility Shop Floor Temp	12.6°C	12.0°C	13.0°C	13.2°C

SYSTEM CALIBRATION/LEARNING PHASE:

Time:	Start:	16:44:10 UTC	End:	17:09:41 UTC
Trip Odometer Reading:	Start:	64.6 mi	End:	84.7 mi
Ambient Temperature:	Start:	14.1°C	End:	15.2°C
Roadway Temperature:	Start:	15.2°C	End:	18.2°C
Weather Conditions:		Clear and cool		

Driving in first direction:

Starting point: GAFB North Gate Direction: see chart, page 71

10:11 minutes (cumulative stopwatch time) 10.0 mi distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 71

10:25 minutes (cumulative stopwatch time) 10.1 mi distance

Max speed: 97.89 km/h

Total Cumulative Driving Time: 20:36 minutes (VBOX processed data)

DATA SHEET 3 (Sheet 4 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO A – Left 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	262.0 kPa	256.2 kPa	256.7 kPa	262.3 kPa
Tire Sidewall Temp	26.8°C	22.8°C	23.2°C	26.6°C
San Angelo Test Facility Shop Floor Temp	14.2°C	13.8°C	14.0°C	14.4°C

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 ( )RF Inflation Pressure		173.0 kPa		

TELLTALE ILLUMINATION:

Starting point: San Angelo Test Facility shop

Telltale illuminated at lamp check. Driving the vehicle was not necessary.

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

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? ( )YES (X)NO (see Remarks)

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)

*The vehicle has a plan view that shows which tires are under-inflated.

DATA SHEET 3 (Sheet 5 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO A – Left 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: 17.3°C Vehicle cool down period: 72 minutes				
Inflation Pressure	251.0 kPa	169.3 kPa	249.2 kPa	251.6 kPa
Tire Sidewall Temp	20.4°C	17.6°C	18.6°C	20.6°C
San Angelo Test Facility Shop Floor Temp	15.4°C	15.2°C	15.4°C	15.6°C

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

TELLTALE EXTINGUISHMENT:

RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After illumination verification: Re-adjusted Inflation Pressure:	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa

Is it necessary to use a set/reset button to extinguish the low tire pressure telltale?
( )YES ( )NO (X)N/A

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 tire was deflated at LLVW.

REMARKS: Brake pedal must be depressed when pushing the Ignition button to start the vehicle. The telltale only illuminates once the vehicle is started.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: December 18, 2018

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 6 of 42)
TPMS OPERATIONAL PERFORMANCE

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

TEST DATE: December 20, 2018 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

Note: See Data Sheet 3 (Sheet 2 of 42) 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 LLVW, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 15.8°C Vehicle cool down period: overnight				
Inflation Pressure	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa
Tire Sidewall Temp	14.8°C	14.6°C	15.4°C	15.8°C
San Angelo Test Facility Shop Floor Temp	14.8°C	14.8°C	15.2°C	15.2°C

SYSTEM CALIBRATION/LEARNING PHASE:

Time: Start: 18:36:35 UTC End: 19:01:59 UTC

Trip Odometer Reading: Start: 85.8 mi End: 105.9 mi

Ambient Temperature: Start: 15.6°C End: 16.7°C

Roadway Temperature: Start: 24.8°C End: 24.6°C

Weather Conditions: Clear, cloudy, and windy

Driving in first direction:

Starting point: GAFB North Gate Direction: see chart, page 72

10:11 minutes (cumulative stopwatch time) 10.0 mi distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 72

10:25 minutes (cumulative stopwatch time) 10.1 mi distance

Max speed: 99.23 km/h

Total Cumulative Driving Time: 20:34 minutes (VBOX processed data)

DATA SHEET 3 (Sheet 7 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO B – Left Front, 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	257.5 kPa	252.6 kPa	252.2 kPa	256.7 kPa
Tire Sidewall Temp	27.0°C	22.4°C	23.0°C	27.0°C
San Angelo Test Facility Shop Floor Temp	15.8°C	15.4°C	15.6°C	15.8°C

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	173.0 kPa	173.0 kPa	173.0 kPa	173.0 kPa

TELLTALE ILLUMINATION:

Starting point: San Angelo Test Facility shop

Telltale illuminated at lamp check. Driving the vehicle was not necessary.

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

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? ( )YES (X)NO (see Remarks)

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)

*The vehicle has a plan view that shows which tires are under-inflated.

DATA SHEET 3 (Sheet 8 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO B – Left Front, 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: 18.0°C Vehicle cool down period: 68 minutes				
Inflation Pressure	167.8 kPa	169.5 kPa	170.0 kPa	168.3 kPa
Tire Sidewall Temp	21.6°C	18.8°C	19.6°C	21.8°C
San Angelo Test Facility Shop Floor Temp	16.4°C	16.2°C	16.4°C	16.8°C

After the cool down period of a minimum of one hour, 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:	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa

Is it necessary to use the set/reset button to extinguish the low tire pressure telltale?
( )YES ( )NO (X)N/A

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

TEST RESULTS

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

REMARKS: Brake pedal must be depressed when pushing the Ignition button to start the vehicle. The telltale only illuminates once the vehicle is started.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: December 20, 2018

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 9 of 42)
TPMS OPERATIONAL PERFORMANCE

MALFUNCTION DETECTION TEST 1 –
Left Front TPMS Sensor Removed at LLVW

TEST DATE: December 21, 2018 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

Time:	Start:	11:00 am	End:	12:23 pm
Trip Odometer Reading:	Start:	106.5 mi	End:	134.4 mi
Ambient Temperature:	Start:	14.6°C	End:	23.8°C

Note: See Data Sheet 3 (Sheet 2 of 42) 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: The left front tire TPMS sensor was disconnected (see Figure 5.14).

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

Combination Malfunction Telltale

Driving in first direction:

TELLTALE ILLUMINATION:

Starting point: San Angelo Test Facility shop

Total distance to illumination: 16.2 mi

Time to illumination: 16:04 minutes total cumulative driving time

Max speed: 96.50 km/h

Total Cumulative Driving Time: 16:06 minutes (VBOX processed data)

TEST RESULTS

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

DATA SHEET 3 (Sheet 10 of 42)
TPMS OPERATIONAL PERFORMANCE

MALFUNCTION DETECTION TEST 1 –
Left Front TPMS Sensor Removed 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? ( )YES (X)NO (See Remarks)

Time it takes before telltale starts flashing	6	seconds
Time telltale remains flashing	64	seconds (See Remarks)
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:

Starting point: San Angelo Test Facility shop

Total distance to extinguishment: 0.1 mi

Time to extinguishment: 1:30 total driving time (non-cumulative stopwatch time)

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

TPMS MALFUNCTION PERFORMANCE TEST RESULTS (PASS/FAIL) **PASS**
The left front tire TPMS sensor was removed.

REMARKS: Ignition button and brake must be depressed when pushing the ignition button to start the vehicle. The telltale only illuminates once the vehicle is started.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: December 21, 2018

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 11 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TEST DATE: January 31, 2019 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190300

Time:	Start: 9:02 am	End: 12:05 pm
Ambient Temperature:	Start: 11.7°C	End: 15.8°C
Odometer Reading (mi):	Start: 135.0	End: 237.0
Fuel Level:	Start: Full	End: 3.0 gallons used

Note: See Data Sheet 3 (Sheet 2 of 34) for Test Weight.

TIRE INFLATION PRESSURES

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Pre-test cold measurements after ambient soak	236.8 kPa	237.7 kPa	237.3 kPa	238.1 kPa

DATA SHEET 3 (Sheet 12 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW

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

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After loading vehicle to LLVW, positioning vehicle at selected test start point, and vehicle cool down period: Vehicle cool down period: overnight				
Re-adjusted Inflation Pressure	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa
Tire Sidewall Temp	10.4°C	9.8°C	9.4°C	9.8°C
San Angelo Test Facility Shop Floor Temp	11.8°C	11.2°C	10.8°C	11.4°C

SYSTEM CALIBRATION/LEARNING PHASE

Driving in first direction:

Starting point: GAFB North Gate Direction: see chart, page 75
Cumulative vehicle driving time (10 – 15 minutes) at a vehicle speed of 75+ 25 km/h excluding time periods when brake pedal is applied.

10:11 minutes (a) 10.0 distance (mi)

Driving in opposite direction:

Starting point: US Highway 87 crossover overpass Direction: See chart, page 75
Cumulative vehicle driving time (5 - 12 minutes) at a vehicle speed of 75+ 25 km/h excluding time periods when brake pedal is applied.

10:31 minutes (b) 10.0 distance (mi)

Total stopwatch cumulative driving time (20 - 22 minutes) 20:42 minutes (a + b)

Max speed 96.26 km/h

Total Cumulative Driving Time
VBOX Processed Data (a) + (b) 20:48 minutes
(20 - 22 minutes)

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	254.1 kPa	249.2 kPa	249.6 kPa	254.1 kPa
Tire Sidewall Temp	19.2°C	14.2°C	12.6°C	18.2°C
Roadway Temp	10.4°C	9.8°C	8.4°C	8.8°C

DATA SHEET 3 (Sheet 13 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TIRE PRESSURE & TEMPERATURE DURING LOW INFLATION PRESSURE TEST

Location of Deflated Tire(s)	**(X) LF**	**(X) LR**	**(X) RR**	**(X) RF**
Original Tire Pressures (kPa)	**240.0 kPa**	**240.0 kPa**	**240.0 kPa**	**240.0 kPa**

Execution Procedure and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
First 14-kPa Deflation Increment	226.0 kPa	226.0 kPa	226.0 kPa	226.0 kPa
Driving in first direction:				
Cumulative driving time (10 - 15 minutes) 10:11 minutes (a)				
Did low inflation pressure telltale illuminate? Yes ____ No X				
Driving in opposite direction:				
Cumulative driving time (5 - 12 minutes) 10:25 minutes (b)				
Did low inflation pressure telltale illuminate? Yes ____ No X				
Total cumulative driving time (20 - 22 minutes) 20:36 minutes (a + b)				
Tire Pressures and Temperatures	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Inflation Pressure	230.6 kPa	229.6 kPa	229.5 kPa	232.2 kPa
Temperature	21.6°C	15.8°C	15.4°C	20.6°C

DATA SHEET 3 (Sheet 14 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TIRE PRESSURE & TEMPERATURE DURING LOW INFLATION PRESSURE TEST

Execution Procedure and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Second 14-kPa Deflation Increment	212.0 kPa	212.0 kPa	212.0 kPa	212.0 kPa

Driving in first direction:

Cumulative driving time (10 - 15 minutes) 10:11 minutes (a)

Did low inflation pressure telltale illuminate? Yes ____ No X

Driving in opposite direction:

Cumulative driving time (5 - 12 minutes) 10:25 minutes (b)

Did low inflation pressure telltale illuminate? Yes ____ No X

Total cumulative driving time (20 - 22 minutes) 20:36 minutes (a + b)

Tire Pressures and Temperatures	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Inflation Pressure	215.7 kPa	215.6 kPa	215.5 kPa	216.5 kPa
Temperature	23.8°C	19.6°C	21.4°C	28.0°C

DATA SHEET 3 (Sheet 15 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TIRE PRESSURE & TEMPERATURE DURING LOW INFLATION PRESSURE TEST

Execution Procedure and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Third 14-kPa Deflation Increment	198.0 kPa	198.0 kPa	198.0 kPa	198.0 kPa
Driving in first direction:				
Cumulative driving time (10 - 15 minutes)	10:11 minutes (a)			
Did low inflation pressure telltale illuminate?	Yes ____	No X		
Driving in opposite direction - see chart, page 94:				
Cumulative driving time (5 - 12 minutes)	10:23 minutes (b)			
Did low inflation pressure telltale illuminate?	Yes ____	No X		
Total cumulative driving time (20 - 22 minutes)	20:34 minutes (a + b)			
Tire Pressures and Temperatures	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Inflation Pressure	202.5 kPa	202.8 kPa	202.8 kPa	203.9 kPa
Temperature	26.4°C	22.0°C	24.8°C	29.4°C

DATA SHEET 3 (Sheet 16 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TIRE PRESSURE & TEMPERATURE DURING LOW INFLATION PRESSURE TEST

Execution Procedure and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Fourth 14-kPa Deflation Increment	184.0 kPa	184.0 kPa	184.0 kPa	184.0 kPa
Driving in first direction (see chart page 76):				
Cumulative driving time (10 - 15 minutes) 10:11 minutes (a)				
Did low inflation pressure telltale illuminate? Yes ____ No X				
Driving in opposite direction:				
Cumulative driving time (5 - 12 minutes) 3:30 minutes (b)				
Did low inflation pressure telltale illuminate? Yes X No ____				
Total cumulative driving time (20 - 22 minutes) 13:41 minutes (a + b)				
Tire Pressures and Temperatures	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Inflation Pressure	187.6 kPa	187.0 kPa	185.0 kPa	184.6 kPa
Temperature	24.6°C	20.0°C	24.4°C	26.8°C

Max speed 97.64 km/h

Total Cumulative Driving Time VBOX Processed Data (a) + (b) 13:42 minutes

DATA SHEET 3 (Sheet 17 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW

TELLTALE ILLUMINATION:

Execution Procedure Paragraph and Item
Did the low inflation pressure warning telltale illuminate before the inflation pressures in the deflated tire(s) reached the low inflation pressure(s) threshold calculated? **__X__ YES (pass) _____ NO**

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

Tire Locations Verified: (X)LF (X)LR (X)RR (X)RF

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? ( )YES (X)NO (see Remarks)

After ignition locking system deactivation the and vehicle engine re-start, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position (i.e. Key-on-Engine-on)?
(X)YES ( )NO (fail)

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure Paragraph and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
After vehicle cool down period. Vehicle cool down period: 64 minutes				
Inflation Pressure	178.6 kPa	180.1 kPa	179.3 kPa	177.6 kPa
Tire Sidewall Temp	21.0°C	17.8°C	18.0°C	21.6°C
Roadway Temp	15.2°C	14.8°C	14.8°C	15.4°C

*The vehicle has a plan view that shows which tires are under-inflated.

DATA SHEET 3 (Sheet 18 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 1 – Left Front, Left Rear, Right Rear, Right Front Tire Deflation at LLVW

After the cool down period of approximately one hour, and vehicle engine restart, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position?

(X)YES ( )NO (see Remarks)

TELLTALE EXTINGUISHMENT:

RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure Paragraph and Item	LF Tire	LR Tire	RR Tire	RF Tire
After cool down period; Re-adjusted Inflation Pressure kPa	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa

If vehicle is equipped with a manual reset control, does activation of this control extinguish the telltale?

( )YES ( )NO (X)N/A

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

Starting point: San Angelo Test Facility shop

Total distance to extinguishment: 0.1 mi

Time to extinguishment: 0:52 minutes (non-cumulative stopwatch time)

TPMS PERFORMANCE TEST RESULTS (PASS/FAIL) **PASS**

REMARKS: Brake pedal must be depressed when pushing the Ignition button to start the vehicle. The telltale only illuminates once the vehicle is started.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: January 31, 2019

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 19 of 42)
TPMS OPERATIONAL PERFORMANCE

TEST DATE: February 1, 2019 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

Time: Start: 9:01 am End: 9:30 am

Ambient Temperature: Start: 18.4°C End: 20.2°C

Trip Odometer Reading: Start: 237.0 mi

Fuel Level: Start: Full

Weather Conditions: Indoors

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	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa
Tire Sidewall Temp	15.8°C	15.0°C	15.4°C	15.6°C

DATA SHEET 3 (Sheet 20 of 42)
TPMS OPERATIONAL PERFORMANCE

VEHICLE WEIGHT:

Vehicle Ratings from Certification Label:

GVWR: 2,025 kg, 4,464 lbs.

GAWR (front): 1,175 kg, 2,590 lbs.

GAWR (rear): 1,200 kg, 2,645 lbs.

Vehicle Capacity Weight from Vehicle Placard:

Vehicle Capacity Weight 500 kg, 1,102 lbs.

Measured Unloaded Vehicle Weight:

LF	442.5 kg	LR	330.5 kg
RF	433.5 kg	RR	296.0 kg
Front Axle	876.0 kg	Rear Axle	626.5 kg

Total Vehicle 1,502.5 kg

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

LF	502.0 kg	LR	526.0 kg
RF	487.0 kg	RR	487.5 kg
Front Axle	989.0 kg (≤ GAWR)	Rear Axle	1,013.5 kg (≤ GAWR)

Total Vehicle 2,002.5 kg (not greater than GVWR)

Note: For scenarios C and D, Malfunction 2 and Gradual Deflation 2, this Total Vehicle Weight measures the vehicle loaded to Unloaded Vehicle Weight (UVW) and Vehicle Capacity Weight (VCW). This consisted of the UVW and 500.0 kg of driver, passenger, test equipment, and ballast.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: February 1, 2019

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 21 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO C – Right Front Tire Deflation at UVW+VCW

TEST DATE: February 4, 2019 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

Note: See Data Sheet 3 (Sheet 20 of 42) 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 LLVW, positioning vehicle at selected test start point, and vehicle cool down period: Ambient Temperature: 17.4°C Vehicle cool down period: overnight				
Inflation Pressure	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa
Tire Sidewall Temp	16.4°C	16.0°C	16.2°C	16.2°C
San Angelo Test Facility Shop Floor Temp	15.6°C	15.6°C	15.8°C	15.8°C

SYSTEM CALIBRATION/LEARNING PHASE:

Time: Start: 15:24:22 UTC End: 15:49:17 UTC

Trip Odometer Reading: Start: 237.8 mi End: 257.9 mi

Ambient Temperature: Start: 17.2°C End: 18.2°C

Roadway Temperature: Start: 18.6°C End: 20.6°C

Weather Conditions: Clear & warm

Driving in first direction:

Starting point: GAFB North Gate Direction: see chart, page 73

10:11 minutes (cumulative stopwatch time) 9.9 mi distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 73

10:25 minutes (cumulative stopwatch time) 10.2 mi distance

Max speed: 101.20 km/h

Total Cumulative Driving Time: 20:21 minutes (VBOX processed data)

DATA SHEET 3 (Sheet 22 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO C – 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	261.1 kPa	260.0 kPa	260.3 kPa	262.7 kPa
Tire Sidewall Temp	30.4°C	28.2°C	27.2°C	29.6°C
San Angelo Test Facility Shop Floor Temp	17.2°C	16.0°C	16.6°C	17.2°C

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 ( )RR (X)RF				
Inflation Pressure				173.0 kPa

TELLTALE ILLUMINATION:

Starting point: San Angelo Test Facility shop

Telltale illuminated at lamp check. Driving the vehicle was not necessary.

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

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? ( )YES (X)NO (see Remarks)

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)

*The vehicle has a plan view that shows which tires are under-inflated.

DATA SHEET 3 (Sheet 23 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO C – 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: 20.2°C Vehicle cool down period: 63 minutes				
Inflation Pressure	250.5 kPa	247.8 kPa	248.9 kPa	167.0 kPa
Tire Sidewall Temp	25.0°C	21.6°C	22.2°C	24.8°C
San Angelo Test Facility Shop Floor Temp	17.6°C	17.4°C	17.6°C	17.8°C

After the cool down period of a minimum of one hour, 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:	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa

Is it necessary to use the set/reset button to extinguish the low tire pressure telltale?

( )YES ( )NO (X)N/A

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

TEST RESULTS

TPMS Performance Test Results (PASS/FAIL) **PASS**

Right front tire was deflated at LLVW.

REMARKS: Brake pedal must be depressed when pushing the Ignition button to start the vehicle. The telltale only illuminates once the vehicle is started.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: February 4, 2019

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 24 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO D – Right Rear, Right Front Tire Deflation at UVW+VCW

TEST DATE: February 5, 2019 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

Note: See Data Sheet 3 (Sheet 20 of 42) 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: 16.2°C Vehicle cool down period: overnight				
Inflation Pressure	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa
Tire Sidewall Temp	16.2°C	16.0°C	15.8°C	16.2°C
San Angelo Test Facility Shop Floor Temp	16.4°C	16.4°C	16.4°C	16.6°C

SYSTEM CALIBRATION/LEARNING PHASE:

Time: Start: 14:39:39 UTC End: 15:04:41 UTC

Trip Odometer Reading: Start: 258.9 mi End: 279.0 mi

Ambient Temperature: Start: 15.6°C End: 16.2°C

Roadway Temperature: Start: 13.8°C End: 15.0°C

Weather Conditions: Partly cloudy and cool

Driving in first direction:

Starting point: GAFB North Gate Direction: see chart, page 74

10:11 minutes (cumulative stopwatch time) 10.0 mi distance

Driving in opposite direction:

Starting point: US 87 crossover overpass Direction: see chart, page 74

10:25 minutes (cumulative stopwatch time) 10.1 mi distance

Max speed: 98.27 km/h

Total Cumulative Driving Time: 20:36 minutes (VBOX processed data)

DATA SHEET 3 (Sheet 25 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO D – Right 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	257.4 kPa	254.7 kPa	255.7 kPa	257.5 kPa
Tire Sidewall Temp	27.2°C	23.6°C	24.0°C	27.0°C
San Angelo Test Facility Shop Floor Temp	16.8°C	16.6°C	16.8°C	17.4°C

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 (X)RF Inflation Pressure			173.0 kPa	173.0 kPa

TELLTALE ILLUMINATION:

Starting point: San Angelo Test Facility shop

Telltale illuminated at lamp check. Driving the vehicle was not necessary.

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

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? ( )YES (X)NO (see Remarks)

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)

*The vehicle has a plan view that shows which tires are under-inflated.

DATA SHEET 3 (Sheet 26 of 42)
TPMS OPERATIONAL PERFORMANCE

NORMAL DEFLATION TEST, SCENARIO D – Right 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: 20.0°C Vehicle cool down period: 64 minutes				
Inflation Pressure	248.5 kPa	245.5 kPa	168.1 kPa	168.4 kPa
Tire Sidewall Temp	23.6°C	20.6°C	21.0°C	23.6°C
San Angelo Test Facility Shop Floor Temp	18.0°C	17.8°C	17.8°C	18.2°C

After the cool down period of a minimum of one hour, 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:	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa

Is it necessary to use the set/reset button to extinguish the low tire pressure telltale?
( )YES ( )NO (X)N/A

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

TEST RESULTS

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

REMARKS: Brake pedal must be depressed when pushing the Ignition button to start the vehicle. The telltale only illuminates once the vehicle is started.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: February 5, 2019

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 27 of 42)
TPMS OPERATIONAL PERFORMANCE

MALFUNCTION DETECTION TEST 2 –
TPMS RF Module Disconnection at UVW+VCW

TEST DATE: February 5, 2019 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20190100

Time:	Start:	10:42 am	End:	11:09 am
Trip Odometer Reading:	Start:	279.6 mi	End:	297.0 mi
Ambient Temperature:	Start:	20.1°C	End:	22.1°C

Note: See Data Sheet 3 (Sheet 20 of 42) 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: TPMS RF module was disconnected (see Remarks). See Figure 5.15.

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

Combination Malfunction Telltale

Driving in first direction:

TELLTALE ILLUMINATION:

Starting point: San Angelo Test Facility shop

Total distance to illumination: 16.1 mi

Time to illumination: 16:04 minutes total cumulative driving time

Max speed: 98.96 km/h

Total Cumulative Driving Time: 16:04 minutes (VBOX processed data)

TEST RESULTS

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

DATA SHEET 3 (Sheet 28 of 42)
TPMS OPERATIONAL PERFORMANCE

MALFUNCTION DETECTION TEST 2 –
TPMS RF Module Disconnection at UVW+VCW

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	seconds
Time telltale remains flashing	65	seconds (See Remarks)
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:

Starting point: San Angelo Test Facility shop

Total distance to extinguishment: 0.1 mi

Time to extinguishment: 1:53 total driving time (non-cumulative stopwatch time)

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

TPMS MALFUNCTION PERFORMANCE TEST RESULTS (PASS/FAIL) **PASS**
TPMS RF module was disconnected.

REMARKS: Vehicle had to be running before disconnecting the TPMS RF Module or the vehicle could not be started.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: February 5, 2019

APPROVED BY: Kenneth Yates

DATA SHEET 3 (Sheet 29 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 2 – Left Rear Tire Deflation at UVW+VCW

TEST DATE: February 6, 2019 LAB: U.S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C20195500

Note: See Data Sheet 3 (Sheet 20 of 42) for Test Weight.

Time:	Start: 9:33 am	End: 1:15 pm
Ambient Temperature	Start: 19.3°C	End: 23.2^{0}C
Odometer Reading (mi):	Start: 329.2	End: 411.9
Fuel Level:	Start: Full	End: 3.0 gallons below full

Note: See Data Sheet 3 (Sheet 20 of 34) for Test Weight.

TIRE INFLATION PRESSURES AND TIRE/ROADWAY TEMPERATURES

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
Pre-test cold measurements after ambient soak	241.5 kPa	241.4 kPa	241.7 kPa	241.5 kPa

DATA SHEET 3 (Sheet 30 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 2 – Left Rear Tire Deflation at UVW+VCW

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

Execution Procedure	LF Tire	LR Tire	RR Tire	RF Tire
After loading vehicle to LLVW, positioning vehicle at selected test start point, and vehicle cool down period: Vehicle cool down period: overnight minutes				
Re-adjusted Inflation Pressure	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa
Tire Sidewall Temp	19.0°C	18.8°C	18.8°C	19.2°C
San Angelo Test Facility Shop Floor Temp	18.6°C	18.4°C	18.4°C	18.8°C

SYSTEM CALIBRATION/LEARNING PHASE

Driving in first direction:

Starting point: GAFB North Gate Direction: see chart, page 79
Cumulative vehicle driving time (10 – 15 minutes) at a vehicle speed of 75± 25 km/h excluding time periods when brake pedal is applied.

10:11 minutes (a) 10.0 distance (mi)

Driving in opposite direction:

Starting point: US Highway 87 crossover overpass Direction: see chart, page 79
Cumulative vehicle driving time (5 - 12 minutes) at a vehicle speed of 75± 25 km/h excluding time periods when brake pedal is applied.

10:25 minutes (b) 10.1 distance (mi)

Total stopwatch cumulative driving time (20 - 22 minutes) 20:36 minutes (a + b)

Max speed 97.70 km/h **Total Cumulative Driving Time (VBOX Processed Data) 20:35 minutes**
(20 - 22 minutes)

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	257.0 kPa	255.0 kPa	256.2 kPa	259.0 kPa
Tire Sidewall Temp	31.8°C	26.0°C	26.2°C	29.4°C
Roadway Temp	19.2°C	18.8°C	18.6°C	18.6°C

DATA SHEET 3 (Sheet 31 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 2 – Left Rear Tire Deflation at UVW+VCW

TIRE PRESSURE & TEMPERATURE DURING LOW INFLATION PRESSURE TEST

Location of Deflated Tire(s)	**( ) LF**	**(X) LR**	**( ) RR**	**( ) RF**
Original Tire Pressures (kPa)		**240.0 kPa**		

Execution Procedure and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
First 14-kPa Deflation Increment		226.0 kPa		
Driving in first direction:				
Cumulative driving time (10 - 15 minutes) 10:11 minutes (a)				
Did low inflation pressure telltale illuminate? Yes ____ No X				
Driving in opposite direction:				
Cumulative driving time (5 - 12 minutes) 10:25 minutes (b)				
Did low inflation pressure telltale illuminate? Yes ____ No X				
Total cumulative driving time (20 - 22 minutes) 20:36 minutes (a + b)				
Tire Pressures and Temperatures	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Inflation Pressure	258.5 kPa	230.3 kPa	257.1 kPa	259.9 kPa
Temperature	33.2°C	27.2°C	30.0°C	30.4°C

DATA SHEET 3 (Sheet 32 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 2 – Left Rear Tire Deflation at UVW+VCW

TIRE PRESSURE & TEMPERATURE DURING LOW INFLATION PRESSURE TEST

Execution Procedure and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Second 14-kPa Deflation Increment		212.0kPa		

Driving in first direction:

Cumulative driving time (10 - 15 minutes) 10:11 minutes (a)

Did low inflation pressure telltale illuminate? Yes ____ No X

Driving in opposite direction:

Cumulative driving time (5 - 12 minutes) 10:25 minutes (b)

Did low inflation pressure telltale illuminate? Yes ____ No X

Total cumulative driving time (20 - 22 minutes) 20:36 minutes (a + b)

Tire Pressures and Temperatures	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Inflation Pressure	259.6 kPa	215.9 kPa	258.3 kPa	261.2 kPa
Temperature	30.6°C	28.4°C	27.6°C	30.8°C

DATA SHEET 3 (Sheet 33 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 2 – Left Rear Front Tire Deflation at UVW+VCW

TIRE PRESSURE & TEMPERATURE DURING LOW INFLATION PRESSURE TEST

Execution Procedure and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Third 14-kPa Deflation Increment		198.0 kPa		

Driving in first direction (see chart, page 80):

Cumulative driving time (10 - 15 minutes) 10:11 minutes (a)

Did low inflation pressure telltale illuminate? Yes ____ No X

Driving in opposite direction (see chart, page 96):

Cumulative driving time (5 - 12 minutes) 3:14 minutes (b)

Did low inflation pressure telltale illuminate? Yes X No ____

Total cumulative driving time (20 - 22 minutes) 13:25 minutes (a + b)

Tire Pressures and Temperatures	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
Inflation Pressure	260.8 kPa	199.5 kPa	255.7 kPa	256.0 kPa
Temperature	31.6°C	28.0°C	25.6°C	27.4°C

Max speed 93.50 km/h

Total Cumulative Driving Time (VBOX Processed Data) 13:30 minutes

DATA SHEET 3 (Sheet 34 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 2 – Left Rear Tire Deflation at UVW+VCW

TELLTALE ILLUMINATION:

Execution Procedure Paragraph and Item
Did the low inflation pressure warning telltale illuminate before the inflation pressures in the deflated tire(s) reached the low inflation pressure(s) threshold calculated? **__X__ YES (pass) _____ NO**

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

Tire Locations Verified: ( )LF (X)LR ( )RR ( )RF

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? ( )YES (X)NO (see Remarks)

After ignition locking system deactivation the and vehicle engine re-start, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position (i.e. Key-on-Engine-on)?
(X)YES ( )NO (fail)

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure Paragraph and Item	**LF Tire**	**LR Tire**	**RR Tire**	**RF Tire**
After vehicle cool down period. Vehicle cool down period: 60 minutes				
Inflation Pressure	243.6 kPa	186.6 kPa	240.2 kPa	241.0 kPa
Tire Sidewall Temp	23.4°C	21.6°C	19.6°C	20.8°C
Roadway Temp	19.8°C	19.6°C	19.4°C	19.4°C

.
*The vehicle has a plan view that shows which tires are under-inflated.

DATA SHEET 3 (Sheet 35 of 34)
TPMS OPERATIONAL PERFORMANCE

GRADUAL DEFLATION TEST 2 – Left Rear Tire Deflation at UVW+VCW

After the cool down period of approximately one hour, and vehicle engine restart, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position?

(X)YES ( )NO (see Remarks)

TELLTALE EXTINGUISHMENT:

RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure Paragraph and Item	LF Tire	LR Tire	RR Tire	RF Tire
After cool down period; Re-adjusted Inflation Pressure kPa	240.0 kPa	240.0 kPa	240.0 kPa	240.0 kPa

If vehicle is equipped with a manual reset control, does activation of this control extinguish the telltale?

( )YES ( )NO (X)N/A

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

TPMS PERFORMANCE TEST RESULTS (PASS/FAIL) **PASS**

REMARKS: Brake pedal must be depressed when pushing the Ignition button to start the vehicle. The telltale only illuminates once the vehicle is started.

RECORDED BY: Anthony Walden and Tommy Oliver DATE: February 6, 2019

APPROVED BY: Kenneth Yates

DATA SHEET 4 (Sheet 1 of 3)
TPMS WRITTEN INSTRUCTIONS

TEST DATE: November 13, 2018 LAB: San Angelo Test Facility

VEHICLE NHTSA NO: C20190100

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 4 (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**

REMARKS: _____

DATA SHEET 4 (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: Tommy Oliver DATE: November 13, 2018

APPROVED BY: Kenneth Yates

SECTION 4

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO	CAL. DATE	NEXT CAL. DATE
AIR PRESSURE GAUGE*	ASHCROFT GENERAL PURPOSE DIGITAL GAUGE	MODEL # D1005PS 02L 100 PSI, SERIAL #20017398-01	03/15/2018	03/15/2019
AIR PRESSURE GAUGE*	ASHCROFT GENERAL PURPOSE DIGITAL GAUGE	DG2551L2NAM02L 100# - XCA, #3093017001	12/13/2018	12/13/2019
FLOOR SCALES (VEHICLE & BALLAST)	INTERCOMP SW DELUXE SCALES	SERIAL #27032382-23746	10/25/2018	10/25/2019
DIGITAL THERMOMETER	FLUKE 50D	SERIAL #80840101	06/08/2018	06/08/2019
LASER TEMPERATURE GAUGE (TIRES AND GROUND)	RAYTEK MINITEMP MT6U	SERIAL # 30181378	03/12/2018	03/12/2019
VBOX RECORDING DEVICE	RACELOGIC VBOX 3iSL	SERIAL # 24491	08/03/2018	08/03/2019
STOPWATCH	ROBIC SC-505W STOPWATCH	N/A	N/A	N/A

* #20017398-01 stopped working. #3093017001 was used beginning with Scenario A.

SECTION 5

PHOTOGRAPHS



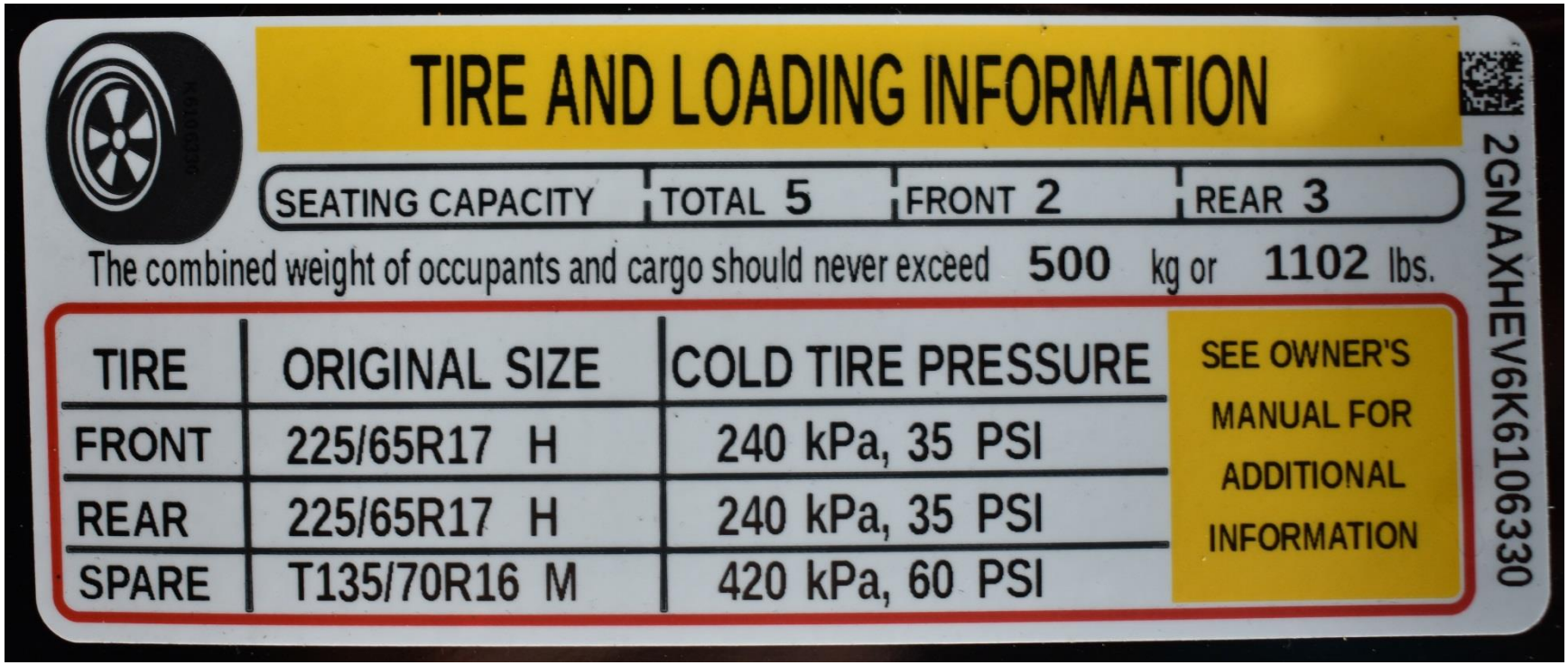
2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.1
¾ FRONT VIEW FROM LEFT SIDE OF VEHICLE



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.2
VEHICLE CERTIFICATION LABEL



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.3
VEHICLE PLACARD



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.4
TIRE SHOWING BRAND



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.5
TIRE SHOWING MODEL



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.6
TIRE SHOWING SIZE AND LOAD INDEX / SPEED RATING



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.7
TIRE SHOWING DOT NUMBER



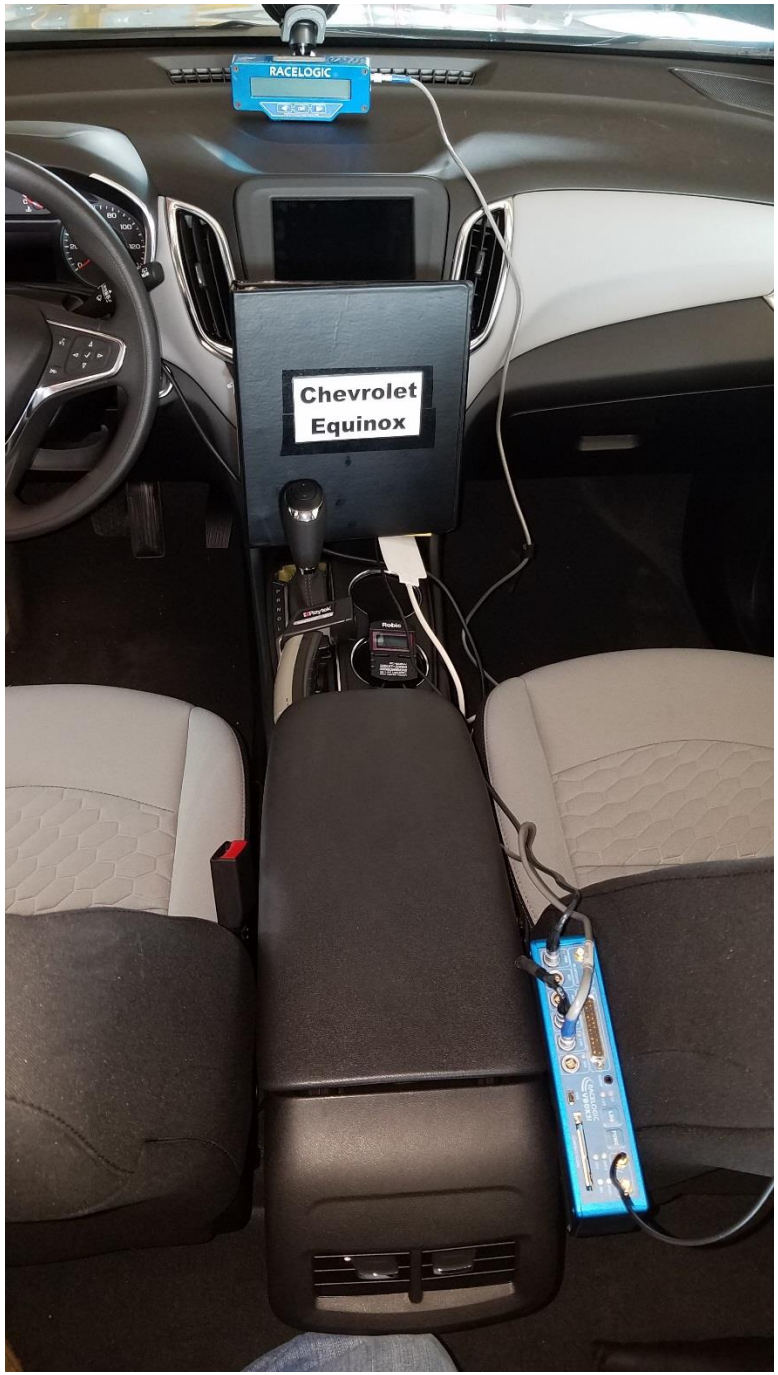
2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

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



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.9
TIRE SHOWING SIDEWALL / TREAD CONSTRUCTION



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.10
TEST INSTRUMENTATION INSTALLED IN VEHICLE



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.11
REAR SEAT BALLAST FOR UVW+VCW
GAWR LOAD



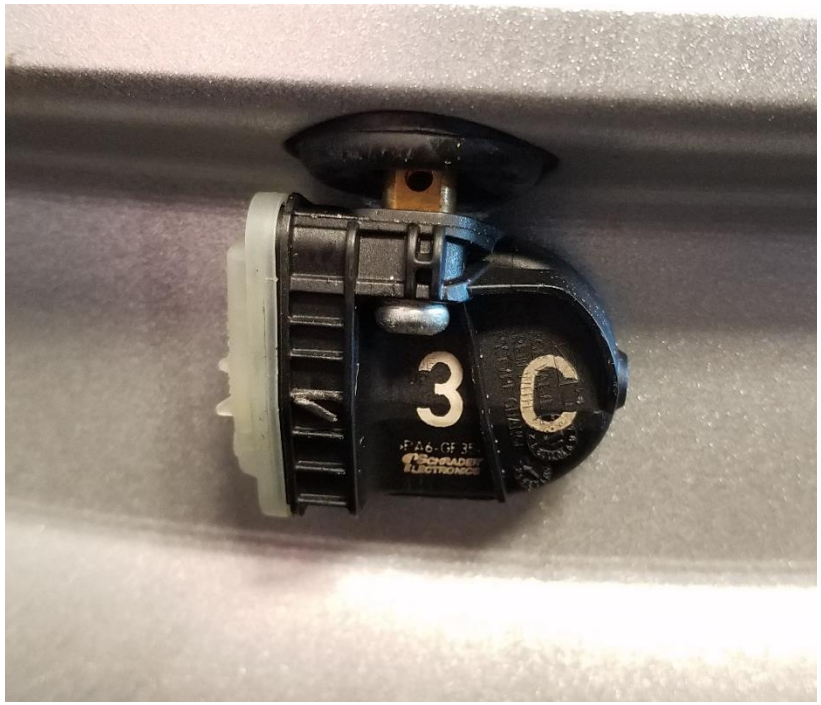
2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.12
VEHICLE CARGO AREA BALLAST FOR UVW+VCW GAWR LOAD



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

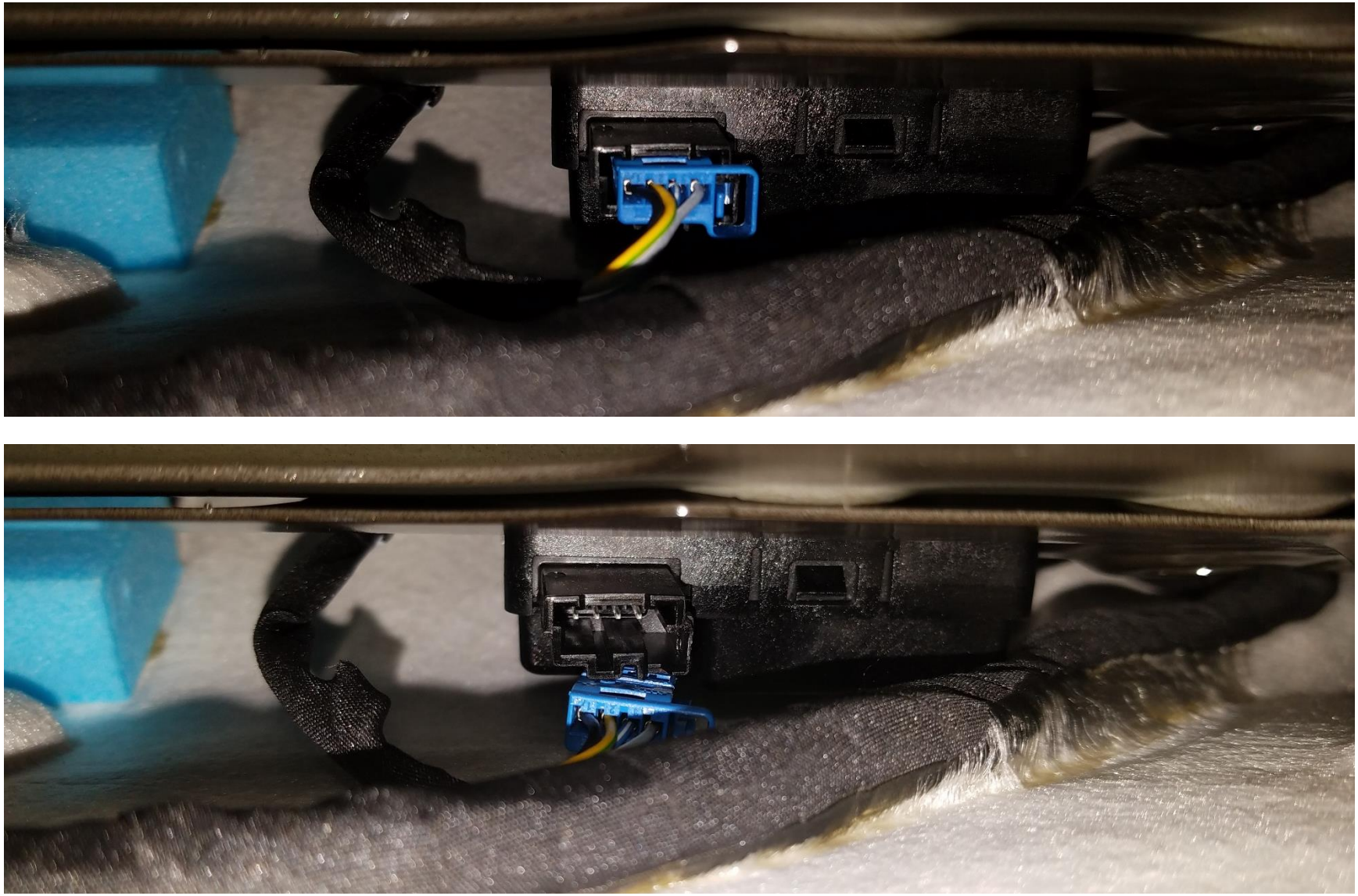
FIGURE 5.13
VEHICLE ON WEIGHT SCALES





2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.14
MALFUNCTION DETECTION TEST 1
LEFT FRONT TPMS SENSOR REMOVED AT LLVW



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.15
MALFUNCTION DETECTION TEST 2:
TPMS RF MODULE DISCONNECTED AT UVW+VCW



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.16
TPMS LOW TIRE PRESSURE TELLTALE
AND DISPLAY SHOWING LOW TIRE LOCATION



2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.17
TPMS SYSTEM MALFUNCTION TELLTALE AND WARNING



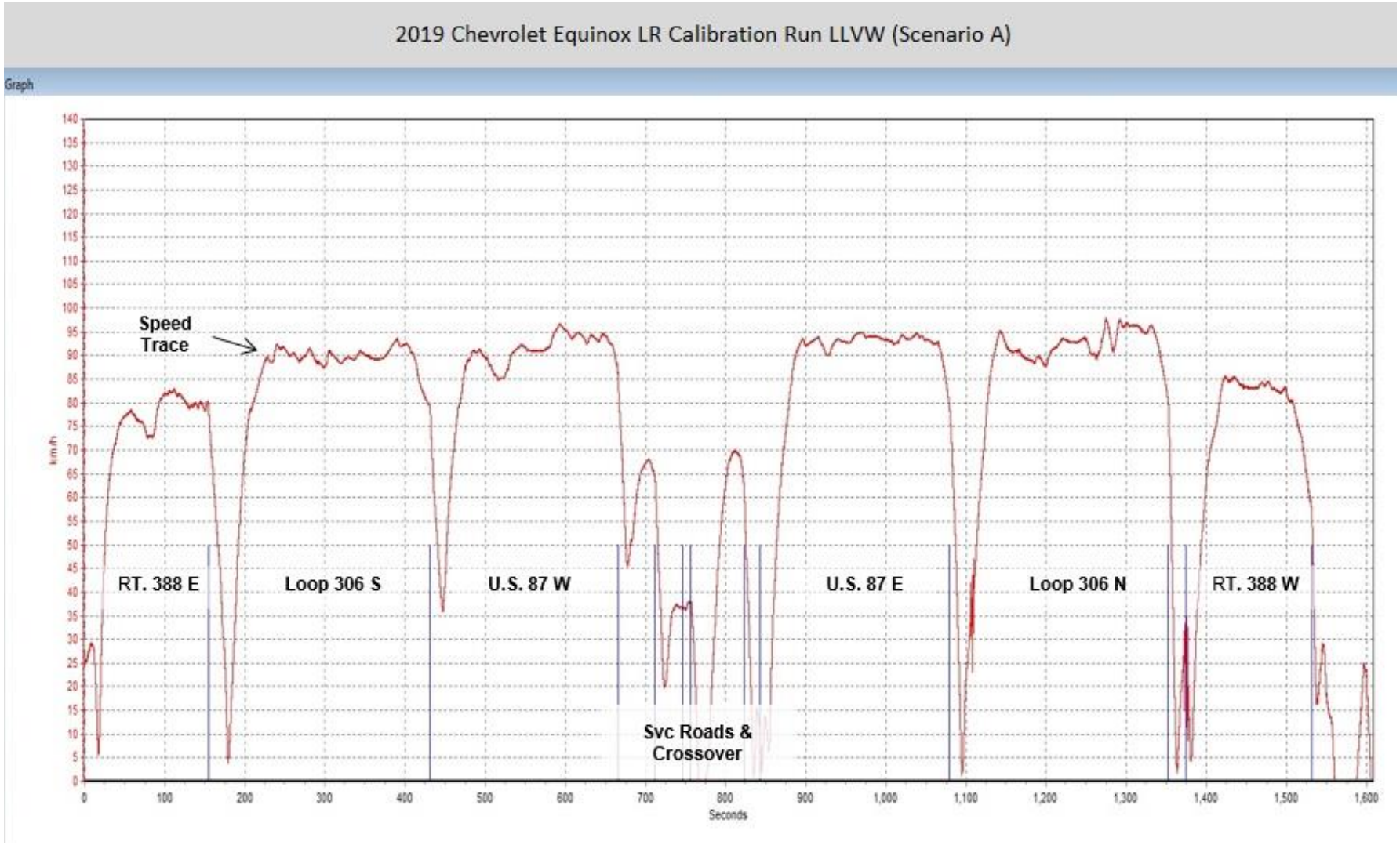
2019 CHEVROLET EQUINOX
NHTSA NO. C20190100
FMVSS NO. 138

FIGURE 5.18
TPMS LOW TIRE PRESSURE TELLTALE AND DISPLAY
SHOWING GRADUAL DEFLATION TEST LOW TIRE LOCATION

SECTION 6
TEST PLOTS

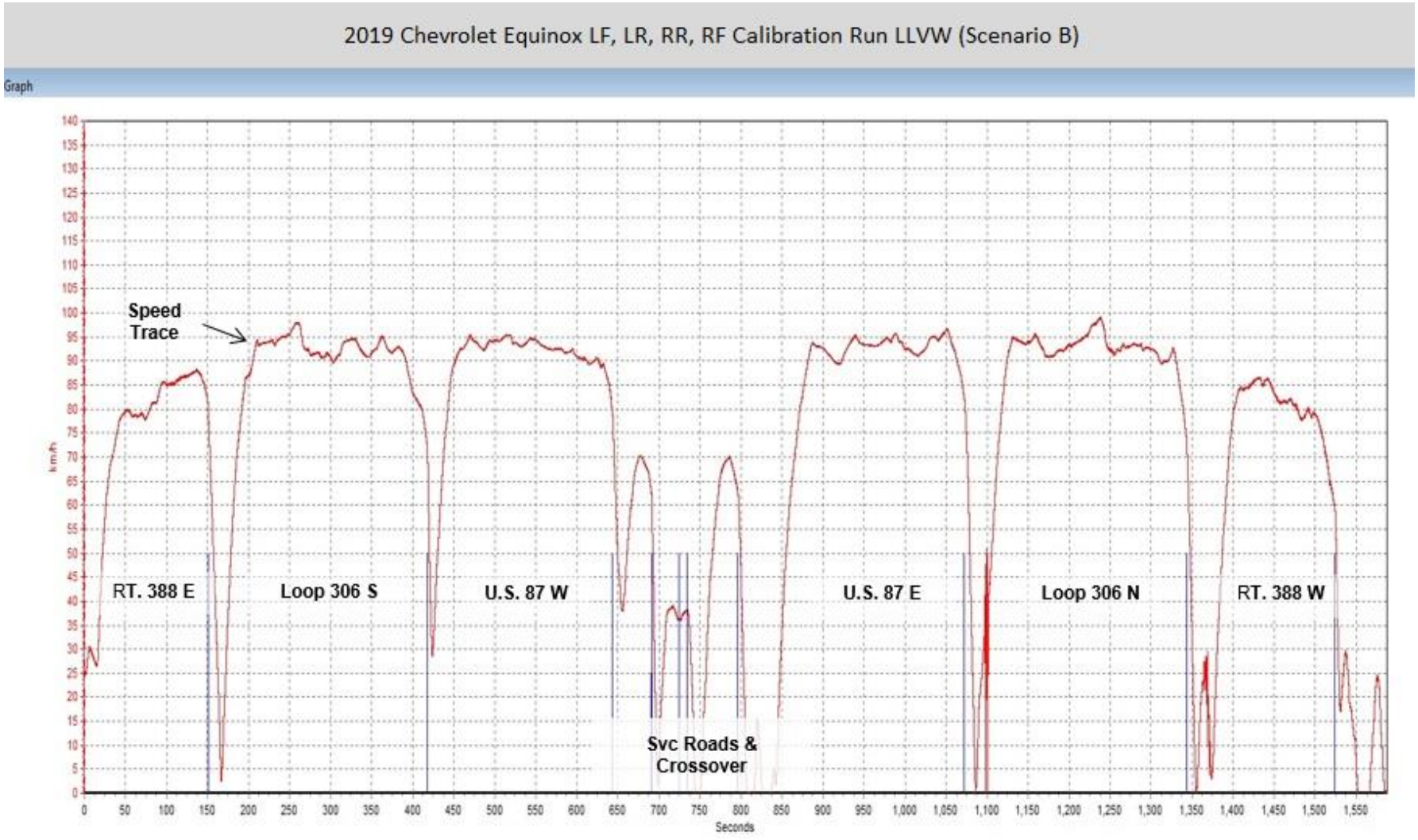
Scenario A: Left Rear Tire at LLVW
Test Date: 12/18/18
Data File Time: 26:48 minutes
Cumulative Driving Time: 20:36 minutes
Start Point: GAFB North Gate

Calibration Phase:



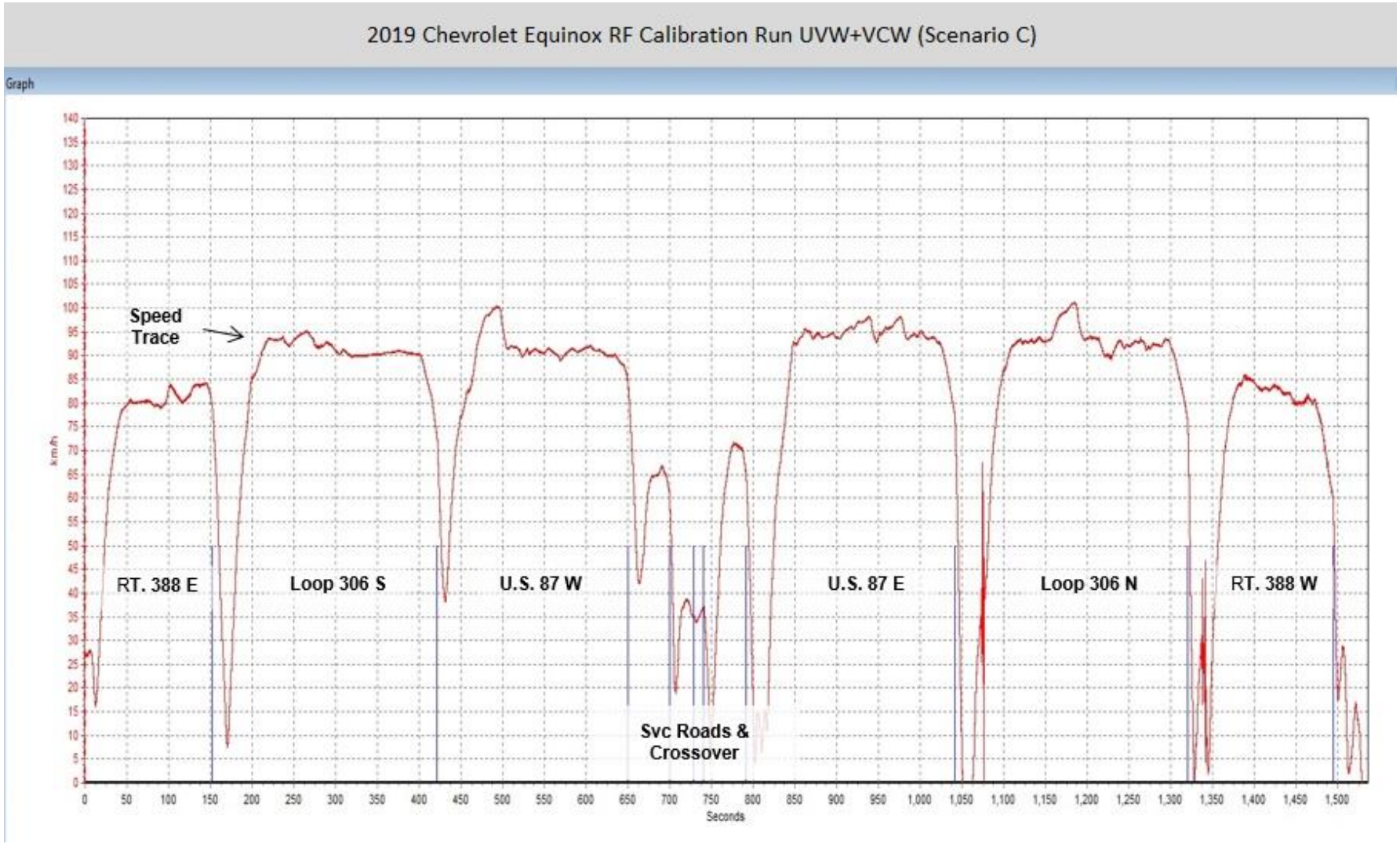
Scenario B: Left Front, Left Rear, Right Rear, Right Front Tires at LLVW
Test Date: 12/20/18
Data File Time: 26:28 minutes
Cumulative Driving Time: 20:34 minutes
Start Point: GAFB North Gate

Calibration Phase:



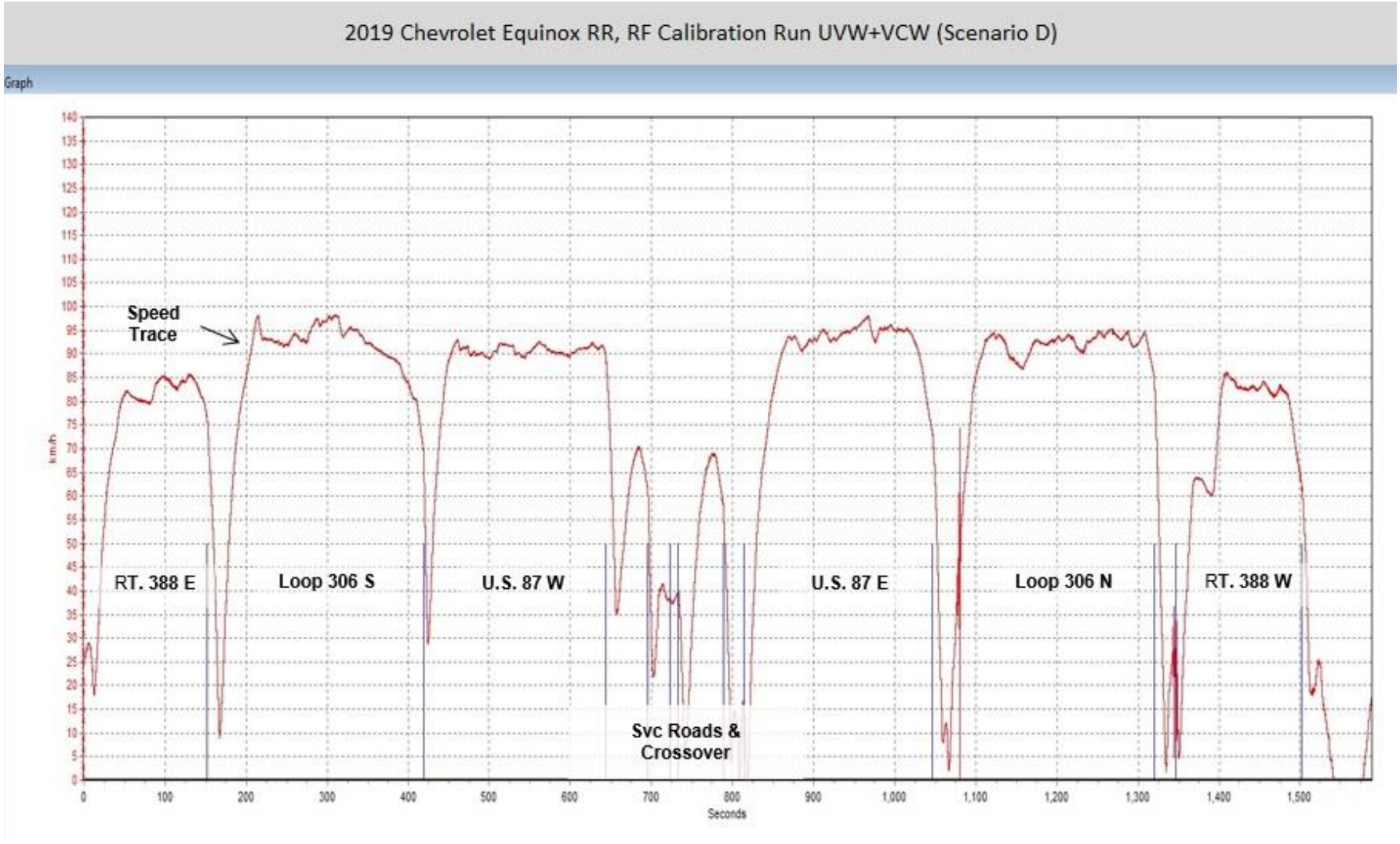
Scenario C: Right Front Tire at UVW+VCW
Test Date: 2/4/19
Data File Time: 25:36 minutes
Cumulative Driving Time: 20:21 minutes
Start Point: GAFB North Gate

Calibration Phase:



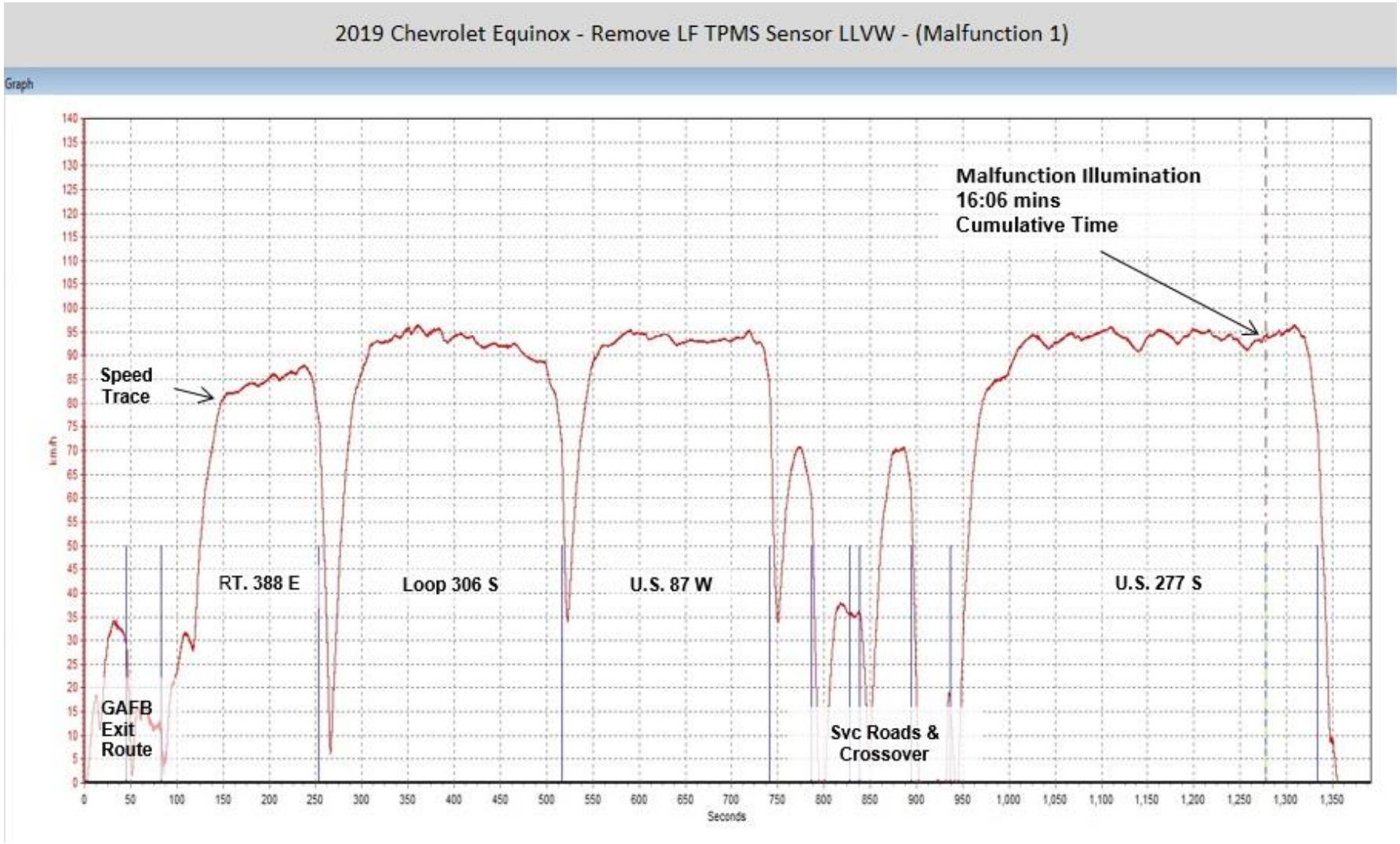
Scenario D:	Right Rear, Right Front Tires at UVW+VCW
Test Date:	2/5/19
Data File Time:	26:29 minutes
Cumulative Driving Time:	20:36 minutes
Start Point:	GAFB North Gate

Calibration Phase:



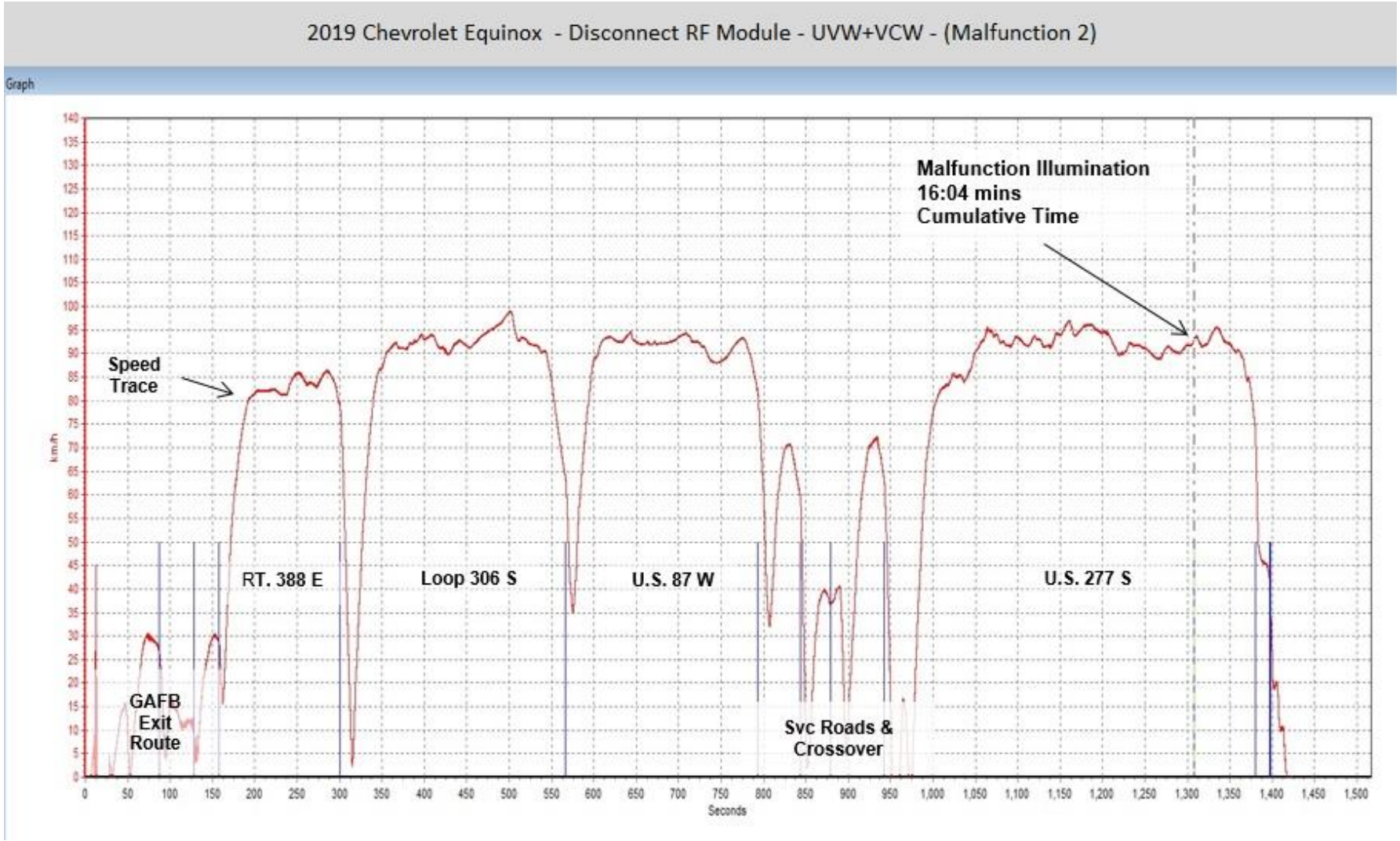
Malfunction 1: Left Front Tire TPMS Sensor Removed at LLVW
Test Date: 12/21/18
Data File Time: 23:11 minutes
Cumulative Driving Time: 16:06 minutes
Start Point: San Angelo Test Facility shop

Detection Phase:



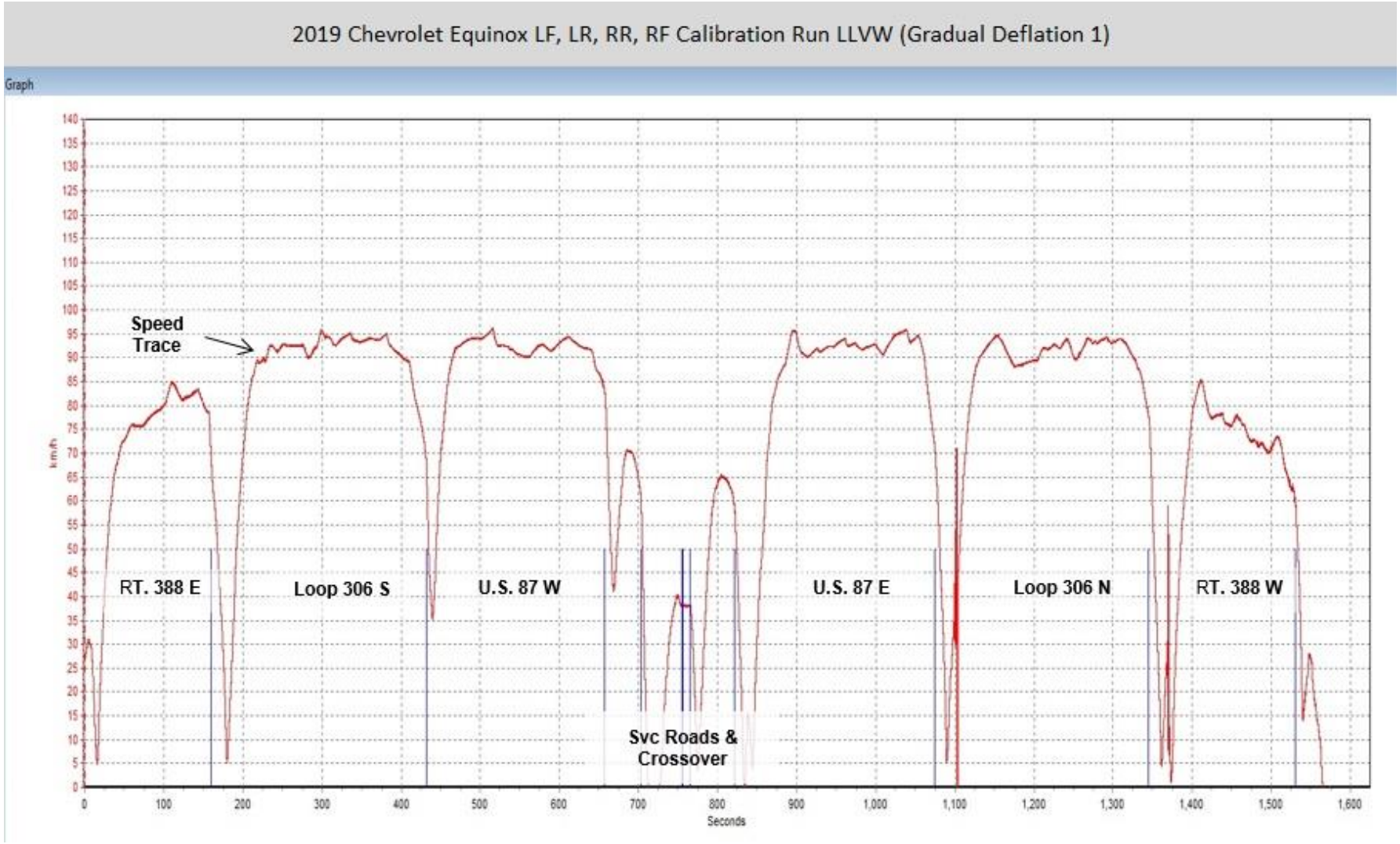
Malfunction 2: TPMS RF Module Disconnected at UVW+VCW
Test Date: 2/5/19
Data File Time: 25:17 minutes
Cumulative Driving Time: 16:04 minutes
Start Point: San Angelo Test Facility shop

Detection Phase:



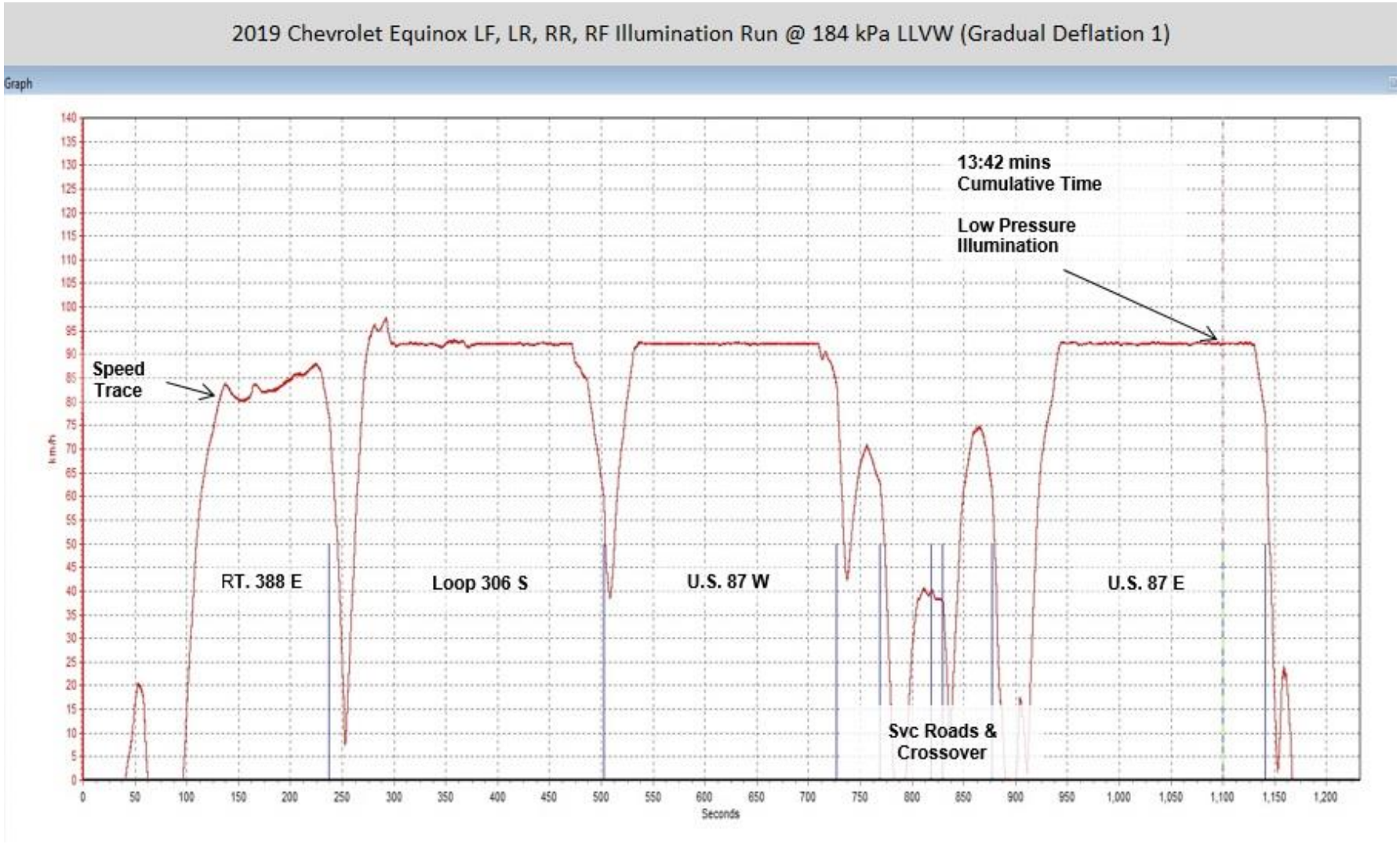
Gradual Deflation 1: Left Front, Left Rear, Right Rear, Right Front Tire at LLVW – Calibration at 240 kPa
Test Date: 1/31/19
Data File Time: 27:05 minutes
Cumulative Driving Time: 20:48 minutes
Start Point: GAFB North Gate

Calibration Phase:



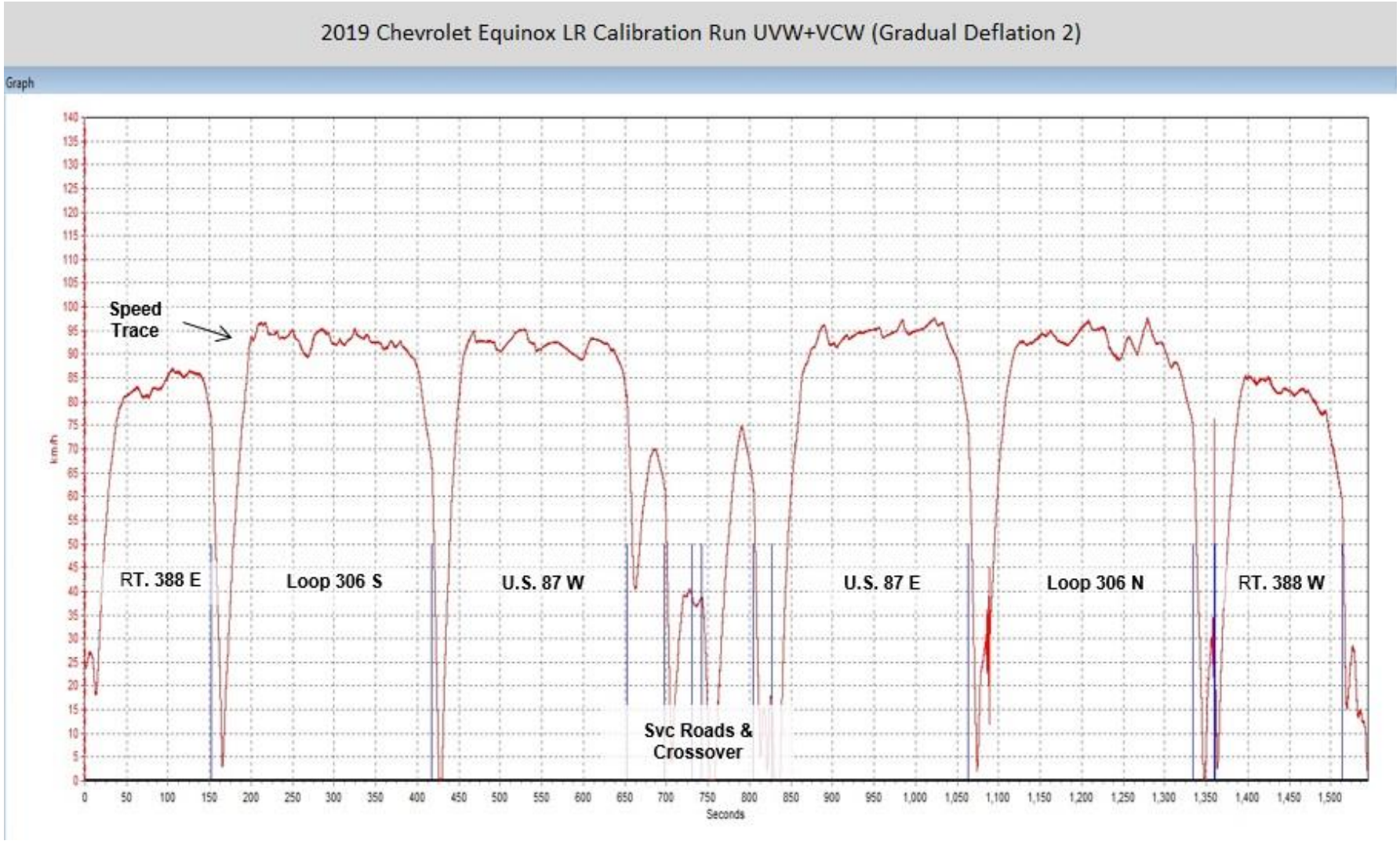
Gradual Deflation 1:	Left Front, Left Rear, Right Rear, Right Front Tires at LLVW – Illumination at 184 kPa
Test Date:	1/31/19
Data File Time:	20:32 minutes
Cumulative Driving Time:	13:42 minutes
Start Point:	GAFB North Gate

Detection Phase:



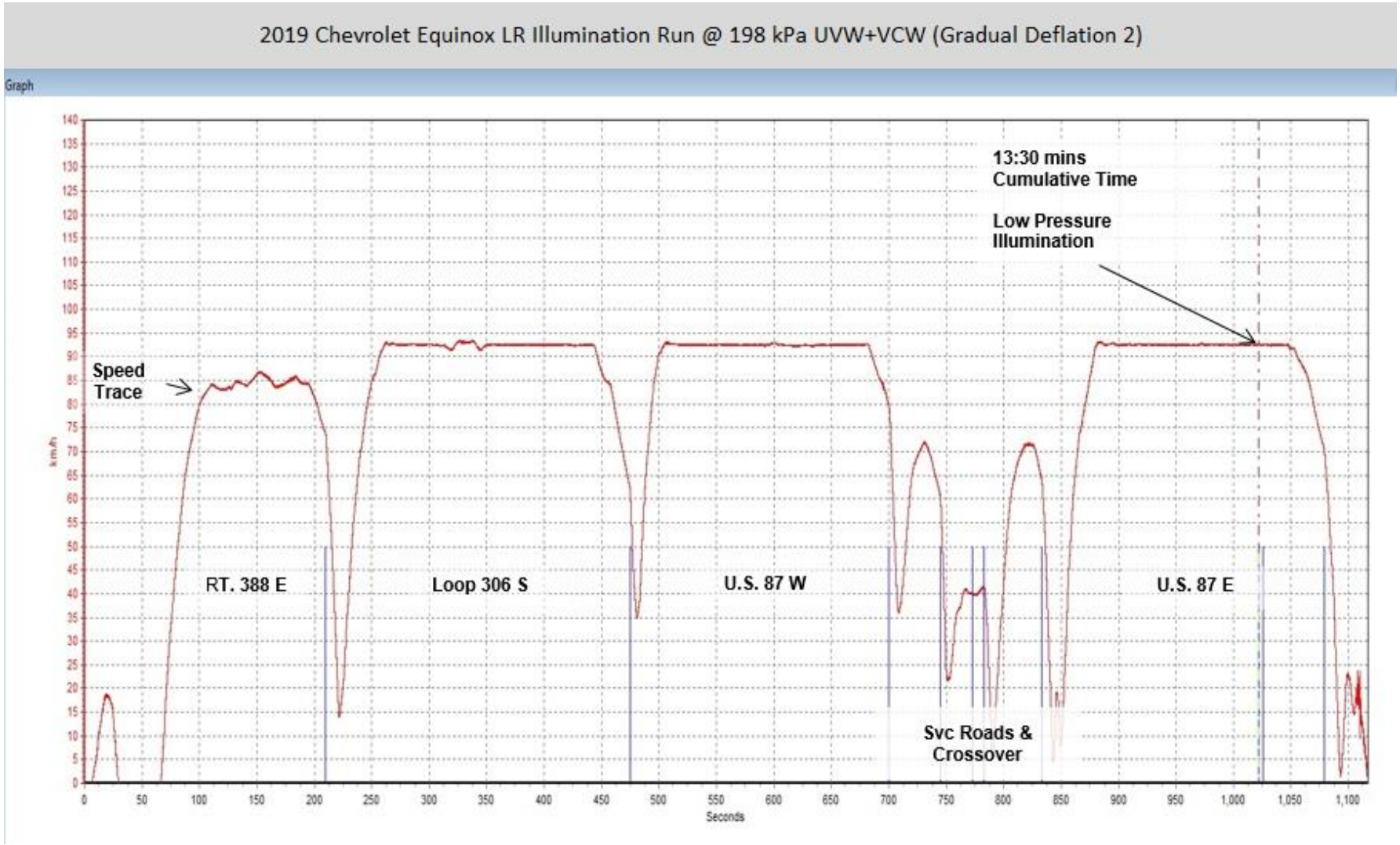
Gradual Deflation 2: Left Rear Tire at UVW+VCW – Calibration at 240 kPa
Test Date: 2/6/19
Data File Time: 25:44 minutes
Cumulative Driving Time: 20:35 minutes
Start Point: GAFB North Gate

Calibration Phase:



Gradual Deflation 2: Left Rear Tire at UVW+VCW – Illumination at 198 kPa
Test Date: 2/6/19
Data File Time: 18:37 minutes
Cumulative Driving Time: 13:30 minutes
Start Point: GAFB North Gate

Detection Phase:



SECTION 7

OWNER'S MANUAL PAGE

the air pressure in your 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* ⇨ *324*.

See *Radio Frequency Statement* ⇨ *396*.

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