

126-TRC-11-006

**SAFETY COMPLIANCE TESTING FOR FMVSS 126
Electronic Stability Control Systems**

Bayerische Motorenwerke
2011 BMW 128i
NHTSA No. CB0514

TRANSPORTATION RESEARCH CENTER INC.
10820 State Route 347
East Liberty, Ohio 43319



October 10, 2011


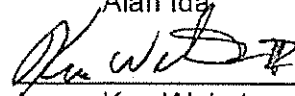
FINAL REPORT

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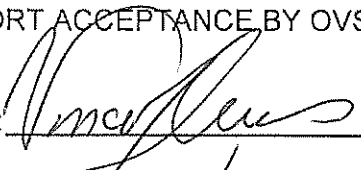
U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
1200 New Jersey Avenue, SE
West Building, 4th Floor (NVS-221)
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16. Abstract A test was conducted on a 2011 BMW 128i, NHTSA No. CB0514, in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-126-02 for the determination of FMVSS 126 compliance. Test failures identified were as follows: None			
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1.0 PURPOSE OF COMPLIANCE TEST

The purpose of this test is to determine if the test vehicle, a MY 2011 BMW 128i meets the minimum equipment and performance requirements stated in Federal Motor Vehicle Safety Standard (FMVSS) 126, "Electronic Stability Control Systems."

This standard establishes performance and equipment requirements for Electronic Stability Control (ESC) Systems installed in passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating of 4,536 kilograms or less.

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS

Testing of the MY 2011 BMW 128i was conducted at Transportation Research Center Inc. (TRC Inc.) in accordance with NHTSA TP-126-02, dated November 19, 2008.

The vehicle was inspected to ensure it was equipped with an ESC System that:

- Augments vehicle directional stability by applying and adjusting brake torques individually at each wheel to induce a correcting yaw moment to a vehicle;
- Is computer controlled with the computer using a closed-loop algorithm to limit vehicle oversteer and to limit vehicle understeer;
- Has a means to determine the vehicle's yaw rate and to estimate its side slip or side slip derivative with respect to time;
- Has a means to monitor driver steering inputs;
- Has an algorithm to determine the need, and a means to modify engine torque, as necessary, to assist the driver in maintaining control of the vehicle, and
- Is operational over the full speed range of the vehicle (except at vehicle speeds less than 20km/h (12.4mph), when being driven in reverse, or during system initialization).

The vehicle was subjected to a 0.7Hz Sine with Dwell (SWD) Steering Maneuver to ensure that it would meet the stability and responsiveness requirements of the standard as follows:

- At 1.0 second after completion of a required sine with dwell steering input, the yaw rate of the vehicle must not exceed 35 percent of the first peak value of yaw rate recorded after the steering wheel angle changes sign (between first and second peaks during the same test run).
- At 1.75 seconds after completion of a required sine with dwell steering input, the yaw rate of the vehicle must not exceed 20 percent of the first peak value of yaw rate recorded after the steering wheel angle changes sign (between first and second peaks during the same test run).
- The lateral displacement of the vehicle center of gravity with respect to its initial

straight path must be at least 1.83 m (6 feet) (for vehicles with a GVWR of 3,500kg (7,716 lb) or less) when computed 1.07 seconds after the Beginning of Steer (BOS) at the specified steering wheel angles.

System malfunction simulations were executed to verify vehicle could identify and indicate a malfunction.

The vehicle's ESC System appears to meet the performance and equipment requirements as required by FMVSS 126. The test results are summarized on the following summary sheet.

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS ...continued

DATA SUMMARY (Sheet 1 of 2)

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

VEHICLE NHTSA NO.: CB0514 VIN: WBAUP7C56BVP21469

VEHICLE TYPE: Passenger Car DATE OF MANUFACTURE: 10/10

LABORATORY: Transportation Research Center Inc.

REQUIREMENTS

PASS/FAIL

ESC Equipment and Operational Characteristics (Data Sheet 2)

The vehicle is to be equipped with an ESC System that meets the equipment PASS and operational characteristics requirements. (S126, S5.1, S5.6)

ESC Malfunction Telltale (Data Sheet 3)

The vehicle is equipped with a telltale that indicates one or more PASS ESC System malfunctions. (S126, S5.3)

“ESC Off” and other System Controls and Telltale (Data Sheet 3 & 4)

The vehicle is equipped with an ESC off telltale indicating the vehicle PASS has been put into a mode that renders the ESC System unable to satisfy the performance requirements of the standard, if such a mode exists. (S5.5.1)

If provided, off control and other system controls as well as the ESC PASS off telltale meets the operational requirements (S126, S5.4, S5.4.1, S5.4.2, S5.5.4, and S5.5.9)

2.0 TEST PROCEDURE AND DISCUSSION OF RESULTS ...continued

DATA SUMMARY (Sheet 2 of 2)

REQUIREMENTS	PASS/FAIL
If provided, off control and other system controls as well as the ESC off telltale meets the operational requirements (S126, S5.4, S5.4.1, S5.4.2, S5.5.4, and S5.5.9)	<u>PASS</u>
Vehicle Lateral Stability (Data Sheet 8)	
Yaw Rate Ratio at 1 second after COS is less than 35% of peak value. (S126, S5.2.1)	<u>PASS</u>
Yaw Rate Ratio at 1.75 seconds after COS is less than 20% of peak value. (S126, S5.2.2)	<u>PASS</u>
Vehicle Responsiveness (Data Sheet 8)	
Lateral displacement at 1.07 seconds after BOS is at least 1.83 m (6 feet) for vehicles with a GVWR of 3,500 kg (7,716 lbs.) or less, and 1.52 m (5 feet) for vehicles with a GVWR greater than 3,500 kg (7,716 lbs.). (S126 S5.2.3)	<u>PASS</u>
ESC Malfunction Warning (Data Sheet 9)	
Warning is provided to driver after malfunction occurrence. (S126. S5.3)	<u>PASS</u>
Malfunction telltale stayed illuminated as long as malfunction existed and must extinguish after malfunction was corrected. (S126, S5.3.7)	<u>PASS</u>

REMARKS

3.0 TEST DATA

DATA SHEET 1 (Sheet 1 of 2) TEST VEHICLE INSPECTION AND TEST PREPARATION

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

NHTSA No.: CB0514 TEST DATE: 6-28-11

VIN: WBAUP7C56BVP21469 MANUFACTURE DATE: 10/10

GVWR: 1,910 KG FRONT GAWR: 920 KG REAR GAWR 1,040 KG

SEATING POSITIONS: FRONT 2 REAR 2

ODOMETER READING AT START OF TEST: 71 (114) Miles (Kilometers)

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING:

Front Axle P205 / 50R 17 Rear Axle P205 / 50R 17

INSTALLED TIRE SIZE(S) ON VEHICLE:

<u>From Tire Sidewall</u>	<u>Front Axle</u>	<u>Rear Axle</u>
Manufacturer and Model	<u>Goodyear Eagle LS2</u>	<u>Goodyear Eagle LS2</u>
Tire Size Designation	<u>P205 / 50R 17 89H</u>	<u>P205 / 50R 17 89H</u>

Are installed tire sizes same as labeled tire sizes? Yes No
If no, contact COTR for further guidance.

DRIVE CONFIGURATIONS (MARK ALL THAT APPLY):

- Two Wheel Drive (2WD): () Front Wheel Drive (X) Rear Wheel Drive
- All Wheel Drive (AWD)
- Four Wheel Drive Automatic – differential not locked full time (4WD Automatic)
- Four Wheel Drive High Gear Unlocked Center Differential
- Four Wheel Drive High Gear Locked Center Differential
- Four Wheel Drive Low Gear Unlocked Center Differential
- Four Wheel Drive Low Gear Locked Center Differential
- Other (define _____)

3.0 TEST DATA....continued

**DATA SHEET 1 (Sheet 2 of 2)
TEST VEHICLE INSPECTION AND TEST PREPARATION**

DRIVE CONFIGURATIONS AND MODES: (ex. default, performance, off)
(For each of the vehicle's drive configurations identify available operating modes)

Drive Configuration 2WD
Mode(s) default

Drive Configuration _____
Mode(s) _____

Drive Configuration _____
Mode(s) _____

VEHICLE STABILITY SYSTEMS (Check applicable technologies):

ESC Traction Control Roll Stability Control
 Active Suspension Electronic Throttle Control Active Steering
 ABS

List other systems; Electronic Brake Force Distribution, Dynamic Brake Control

REMARKS:

RECORDED BY: Alan Ida
APPROVED BY: Ken Webster

DATE: 6-28-11
DATE: 7-07-11

3.0 TEST DATA....continued

DATA SHEET 2 (Sheet 2 of 2)
ESC SYSTEM HARDWARE AND OPERATIONAL CHARACTERISTICS

ESC SYSTEM OPERATIONAL CHARACTERISTICS (continued):

System is capable of modifying engine torque during ESC activation. Yes (PASS)
 No (FAIL)

Method used to modify engine torque: The interface to the engine is a pure torque interface via CAN. The ESC does command a reduction of engine torque and the digital motor electronically adjusts the torque accordingly. The digital motor electronically adjusts the commanded torque by fuel cut or ignition timing.

System is capable of activation at speeds of 20 km/h (12.4 mph) and higher. Yes (PASS)
 No (FAIL)

Speed system becomes active. 14.4 km/h (8.9 mph)

System is capable of activation during the following driving phases (acceleration, deceleration, coasting, and during activation of ABS or traction control). Yes (PASS)
 No (FAIL)

Driving phases that the system is capable of activation. The ESC system is always active.

Vehicle manufacturer submitted documentation explaining how the ESC system mitigates understeer? Yes (PASS)
 No (FAIL)

DATA INDICATES COMPLIANCE PASS/FAIL PASS

RECORDED BY: Alan Ida
APPROVED BY: Ken Webster

DATE: 7-06-11
DATE: 7-07-11

3.0 TEST DATA....continued

DATA SHEET 3 (Sheet 1 of 2)
ESC MALFUNCTION AND OFF TELLTALES

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

VEHICLE NHTSA NO. CB0514 TEST DATE: 7-06-11

ESC Malfunction Telltale

Vehicle is equipped with malfunction telltale? X Yes (Pass) No (Fail)

Telltale Location Instrument cluster, center, between speedometer and tachometer

Telltale Color Yellow

Telltale symbol or abbreviation used.



Or **ESC**

- Vehicle uses this symbol
- Vehicles uses this abbreviation
- X Neither symbol or abbreviation is used

If different than identified above, make note of any message, symbol or abbreviation used.

The DSC (ESC) malfunction telltale has a triangle with an exclamation, surrounded by a circular arrow.

Is telltale part of a common space? Yes X No

Is telltale also used to indicate activation of the ESC system? X Yes No

If yes, explain telltale operation during ESC activation: During DSC (ESC) Activation, the DSC telltale flashes.

3.0 DATA SHEETS....continued

DATA SHEET 3 (Sheet 2 of 2)
ESC MALFUNCTION AND OFF TELLTALES

“ESC OFF” Telltale (if provided)

Vehicle is equipped with “ESC Off” telltale? Yes No

Is “ESC OFF” telltale combined with “ESC Malfunction” telltale utilizing a two part telltale? Yes No

Telltale Location Instrument cluster, center, between speedometer and tachometer

Telltale Color Yellow

Telltale symbol or abbreviation used.



Or **ESC OFF**

- Vehicle uses this symbol
- Vehicle uses this abbreviation
- Neither symbol or abbreviation is used

If different than identified above, make note of any message, symbol or abbreviation used.

The ESC off telltale has a triangle with an exclamation, surrounded by a circular arrow.

Is telltale part of a common space? Yes No

DATA INDICATES COMPLIANCE PASS/FAIL PASS
(Vehicle is compliant if equipped with a malfunction telltale)

REMARKS:

The 2011 BMW 128i uses the same telltale for both ESC Malfunction and ESC Off. There is a redundant ESC Malfunction and ESC Off telltale which is digitally displayed in the common space.

RECORDED BY: Alan Ida

DATE: 7-05-11

APPROVED BY: Ken Webster

DATE: 7-07-11

3.0 TEST DATA....continued

DATA SHEET 4 (Sheet 1 of 3)
ESC AND ANCILLARY SYSTEM CONTROLS

“ESC OFF” Controls Identification and Operational Check:

Is the vehicle equipped with a control or controls whose purpose is to deactivate the ESC system or place the ESC system in a mode or modes that may no longer satisfy the performance requirements of the standard?

Yes No

Type of control or controls provided? _____ Dedicated “ESC Off” control
(mark all that apply) Multi-functional control with an
“ESC Off” mode
_____ Other (describe)

Identify each control location, labeling and selectable modes.

First Control: Location Center of instrument panel, between the center vents
Labeling DTC
Modes Dynamic Traction Control (DTC) Off (1 button press)
Dynamic Traction Control (DTC) On (1 button press)
Dynamic Stability Control (DSC) & DTC Off (press and hold
button for 3 seconds)
Dynamic Stability Control (DSC) & DTC On (1 button press)

Identify standard or default drive configuration Default – 2WD

Verify standard or default drive configuration selected. Yes No

Does the “ESC Off” telltale illuminate upon activation of the dedicated ESC off control or selection of the “ESC Off” mode on the multi-function control?

Yes No (fail)

Does the “ESC Off” telltale extinguish when the ignition is cycled from “On” (“Run”) to “Lock” or “Off” and then back again to the “On” (“Run”) position?

Yes No (fail)

If no, describe how the off control functions:

3.0 TEST DATA....continued

**DATA SHEET 5 (Sheet 1 of 3)
VEHICLE AND TEST TRACK DATA**

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

NHTSA No.: CB0514 TEST DATE: 6-29-11

Test Track Requirements: Test Surface Slope (0-1 %) 1 %

Peak Friction Coefficient (at least 0.9) 0.97

Full Fluid Levels: Fuel X Coolant X Other Fluids Washer (specify)

Tire Pressures: Required: Front Axle 220 kPa Rear Axle 240 kPa

Actual: LF: 220 kPa RF: 220 kPa LR: 240 kPa RR: 240 kPa

Vehicle Dimensions: Track Width 148.0 cm Wheelbase 265.9 cm

Roof Height 141.0 cm

Vehicle weight ratings: GAWR Front 920 KG GAWR Rear 1,040 KG

Unloaded Vehicle Weight (UVW)

Front Axle 759.0 KG Left Front 373.4 KG Right Front 385.6 KG

Rear Axle 714.8 KG Left Rear 356.6 KG Right Rear 358.2 KG

Total UVW 1,473.8 KG

Baseline Weight and Outrigger Selection (only for MPVs, Trucks, Buses)

Calculated Baseline Weight (UVW+ 73 kg) 1,546.8 KG

Outrigger size required ("Standard" or "Heavy") N/A

Standard - Baseline weight under 2,722 kg (6,000 lbs.)

Heavy - Baseline weight equal to or greater than 2,722 kg (6,000 lbs.)

3.0 TEST DATA....continued

**DATA SHEET 5 (Sheet 2 of 3)
VEHICLE AND TEST TRACK DATA**

Loaded Vehicle Weight w/ Driver and Instrumentation (No Ballast)

Front Axle 826.4 KG Left Front 413.8 KG Right Front 412.6 KG

Rear Axle 781.0 KG Left Rear 395.6 KG Right Rear 385.4 KG

Total Loaded Vehicle Weight 1,607.4 KG

$$\begin{aligned} \text{Ballast Required} &= [\text{Total Unloaded Vehicle Weight} + 168 \text{ KG}] - \text{Total Loaded Weight w/ Driver and Instrumentation} \\ &= [\underline{1,473.8} \text{ KG} + 168 \text{ KG}] - \underline{1,607.4} \text{ KG} \\ &= \underline{34.4} \text{ KG} \end{aligned}$$

Total Loaded Vehicle Weight

Front Axle 835.4 KG Left Front 412.6 KG Right Front 422.8 KG

Rear Axle 806.4 KG Left Rear 405.0 KG Right Rear 401.4 KG

Total Loaded Vehicle Weight 1,641.8 KG

3.0 TEST DATA....continued

**DATA SHEET 5 (Sheet 3 of 3)
VEHICLE AND TEST TRACK DATA**

Center of Gravity and Inertial Sensing System Location at Loaded Vehicle Condition

x-distance (longitudinal) Point of reference is the front axle centerline.
(Positive from front axle toward rear of vehicle.)

y-distance (lateral) Point of reference is the vehicle centerline.
(Positive from the center toward the right.)

z-distance (vertical) Point of reference is the ground plane.
(Positive from the ground up.)

Locations:

	Center of Gravity	Inertial Sensing System
x-distance	<u>130.6</u> cm	<u>171.2</u> cm
y-distance	<u>0.3</u> cm	<u>-2.0</u> cm
z-distance	<u>53.6</u> cm	<u>75.4</u> cm

Distance Between Ultrasonic Sensors: 141.0 cm

TEST TRACK DATA MEETS REQUIREMENTS: YES/NO YES
If no, explain: _____

REMARKS:

RECORDED BY: Alan Ida
APPROVED BY: Ken Webster

DATE: 6-29-11
DATE: 7-07-11

3.0 TEST DATA....continued

**DATA SHEET 6 (Sheet 1 of 3)
BRAKE AND TIRE CONDITIONING**

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

VEHICLE NHTSA No.: CB0514

Measured Cold Tire Pressures: LF 220 kPa RF 220 kPa

LR 240 kPa RR 240 kPa

Wind Speed 0.0 m/sec

(10m/sec (22mph) max for passenger cars; 5m/s (11mph) max. for MPVs and Trucks)

Ambient Temperature (7°C (45°F) - 40°C (104°F)) 14.4 °C

Brake Conditioning Time; 6:46 AM Date; 6-30-11

56 km/h (35 mph) Brake Stops

Number of stops executed (10 required) 10 stops

Observed deceleration rate range (.5g target) 0.50 – 0.55 g

72 km/h (45 mph) Brake Stops

Number of stops executed (3 required) 3 stops

Number of stops ABS activated (3 required) 3 stops

Observed deceleration rate range 1.00 – 1.10 g

72 km/h (45 mph) Brake Cool Down Period

Duration of cool down period (5 minutes min.) 6:00 minutes

3.0 TEST DATA....continued

DATA SHEET 7 (1 of 2) SLOWLY INCREASING STEER (SIS) MANEUVER

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

VEHICLE NHTSA No.: CB0514 TEST DATE: 6-30-11

Wind Speed 0.0 m/sec
(10m/sec (22mph) max for passenger cars; 5m/s (11mph) max. for MPVs and Trucks)

Ambient Temperature (7°C (45°F) - 40°C (104°F)) 18.3 °C

Static Data File Number: 0010

Selected Drive Configuration: 2WD

Selected Mode: default

Preliminary Left Steer Maneuver:

Lateral Acceleration measured at 30 degrees steering wheel angle ($a_{y,30 \text{ degrees}}$)

$$a_{y,30 \text{ degrees}} = \underline{0.43} \text{ g}$$

Assuming a linear relationship the following ratio should be used to calculate the steering wheel angle at .55g.

$$\frac{30 \text{ degrees}}{a_{y,30 \text{ degrees}}} = \frac{\delta_{SIS}}{0.55 \text{ g}} \qquad \delta_{SIS} = \underline{38.4} \text{ degrees @ } 0.55\text{g}$$

$$\delta_{SIS} = \underline{40} \text{ degrees (rounded)}$$

Steering Wheel Angle at Corrected 0.3 g Lateral Acceleration:

Maneuver #	Initial Steer Direction	Time Clock (5 min max between runs)	Steering Wheel Angle to nearest 0.1 degree (degrees)	All Conditions Met?
0012	Left	7:34 am	-24.5	Yes
0013	Left	7:38 am	-25.1	Yes
0016	Left	7:50 am	-24.1	Yes
0017	Right	7:53 am	25.5	Yes
0018	Right	7:56 am	25.8	Yes
0019	Right	8:00 am	26.3	Yes

3.0 TEST DATA....continued

DATA SHEET 7 (2 of 2) SLOWLY INCREASING STEER (SIS) MANEUVER

Average Overall Steering Wheel Angle:

$$\delta_{0.3 \text{ g, overall}} = (|\delta_{0.3 \text{ g, left (1)}}| + |\delta_{0.3 \text{ g, left (2)}}| + |\delta_{0.3 \text{ g, left (3)}}| + \delta_{0.3 \text{ g, right (1)}} + \delta_{0.3 \text{ g, right (2)}} + \delta_{0.3 \text{ g, right (3)}}) / 6$$

$$\delta_{0.3 \text{ g, overall}} = \underline{\quad 25.2 \quad} \text{ degrees} \\ \text{[to nearest 0.1 degree]}$$

REMARKS:

Files 0014 and 0015 were omitted due to a spike in the steering angle signal. The problem was corrected and testing resumed. Therefore, the time clock indicates more than 5 minutes between maneuvers.

RECORDED BY: Alan Ida
APPROVED BY: Ken Webster

DATE: 6-30-11
DATE: 7-07-11

3.0 TEST DATA....continued

DATA SHEET 8 (1 of 3) VEHICLE LATERAL STABILITY AND RESPONSIVENESS

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

VEHICLE NHTSA No.: CB0514 TEST DATE: 6-30-11

Tire conditioning completed	<u>X</u>	Yes	<u> </u>	No
ESC system is enabled	<u>X</u>	Yes	<u> </u>	No
On track calibration checks have been completed	<u>X</u>	Yes	<u> </u>	No
On track static data file for each sensor obtained	<u>X</u>	Yes	<u> </u>	No

Selected Drive Configuration: 2WD

Selected Mode: default

Overall steering wheel angle ($\delta_{0.3g, overall}$) 25.2 degrees

Static Data File Number 0025

Lateral Stability Test Series No. 1 – Counterclockwise Initial Steer Direction

Maneuver #	Clock Time (1.5 – 5 min between each test run)	Commanded Steering Wheel Angle ¹ (degrees)		Yaw Rates (degrees/sec)			YRR at 1.0 sec after COS [$\leq 35\%$]		YRR at 1.75 sec after COS [$\leq 20\%$]	
		Scalar	Angle	$\dot{\psi}_{Peak}$	$\dot{\psi}_{1.0sec}$	$\dot{\psi}_{1.75sec}$	%	Pass/Fail	%	Pass/Fail
0027	10:05 am	1.5* $\delta_{0.3g}$	38	13.18	-0.04	-0.02	-0.34	Pass	-0.17	Pass
0028	10:08 am	2.0* $\delta_{0.3g}$	50	17.48	-0.07	-0.11	-0.41	Pass	-0.62	Pass
0029	10:11 am	2.5* $\delta_{0.3g}$	63	21.90	-0.04	-0.08	-0.20	Pass	-0.37	Pass
0032	10:23 am	3.0* $\delta_{0.3g}$	76	25.82	0.00	-0.04	-0.02	Pass	-0.16	Pass
0033	10:28 am	3.5* $\delta_{0.3g}$	88	29.20	-0.02	-0.06	-0.07	Pass	-0.20	Pass
0034	10:31 am	4.0* $\delta_{0.3g}$	101	34.31	0.22	0.14	0.65	Pass	0.41	Pass
0035	10:34 am	4.5* $\delta_{0.3g}$	113	38.52	0.11	0.17	0.30	Pass	0.45	Pass
0036	10:37 am	5.0* $\delta_{0.3g}$	126	43.49	0.07	0.08	0.16	Pass	0.19	Pass
0037	10:40 am	5.5* $\delta_{0.3g}$	139	47.69	-0.03	0.03	-0.05	Pass	0.06	Pass
0038	10:43 am	6.0* $\delta_{0.3g}$	151	53.25	0.07	0.18	0.13	Pass	0.34	Pass
0039	10:46 am	6.5* $\delta_{0.3g}$	164	55.39	0.00	-0.05	0.00	Pass	-0.09	Pass
0040	10:49 am	7.0* $\delta_{0.3g}$	176	58.55	0.03	-0.02	0.05	Pass	-0.03	Pass
0041	10:52 am	7.5* $\delta_{0.3g}$	189	59.75	0.03	-0.03	0.05	Pass	-0.06	Pass
0042	10:55 am	8.0* $\delta_{0.3g}$	202	63.12	0.24	0.18	0.38	Pass	0.28	Pass
0043	10:58 am	8.5* $\delta_{0.3g}$	214	66.28	0.20	0.08	0.31	Pass	0.12	Pass
0044	11:01 am	9.0* $\delta_{0.3g}$	227	66.82	0.25	-0.21	0.37	Pass	-0.31	Pass
0045	11:04 am	9.5* $\delta_{0.3g}$	239	67.92	0.14	0.15	0.20	Pass	0.22	Pass
0046	11:07 am	10.0* $\delta_{0.3g}$	252	68.08	0.31	-0.12	0.46	Pass	-0.18	Pass
0047	11:10 am	10.5* $\delta_{0.3g}$	265	69.00	0.13	0.15	0.18	Pass	0.21	Pass
0048	11:13 am	10.7* $\delta_{0.3g}$	270	66.27	0.07	-0.12	0.11	Pass	-0.18	Pass

1. Maneuver execution should continue until a steering wheel angle magnitude factor of $6.5^* \delta_{0.3g, overall}$ or 270 degrees is utilized, whichever is greater provided the calculated magnitude of $6.5^* \delta_{0.3g, overall}$ is less than or equal to 300 degrees. If $6.5^* \delta_{0.3g, overall}$ is less than 270 degrees maneuver execution should continue by increasing the steering wheel angle magnitude by multiples of $0.5^* \delta_{0.3g, overall}$ without exceeding the 270 degree steering wheel angle.

3.0 TEST DATA....continued

**DATA SHEET 8 (2 of 3)
VEHICLE LATERAL STABILITY AND RESPONSIVENESS**

Lateral Stability Test Series No. 2 – Clockwise Initial Steer Direction

Maneuver #	Clock Time (1.5 – 5 min between each test run)	Commanded Steering Wheel Angle ¹ (degrees)		Yaw Rates (degrees/sec)			YRR at 1.0 sec after COS [$\leq 35\%$]		YRR at 1.75 sec after COS [$\leq 20\%$]	
		Scalar	Angle	$\dot{\psi}_{Peak}$	$\dot{\psi}_{1.0sec}$	$\dot{\psi}_{1.75sec}$	%	Pass/Fail	%	Pass/Fail
0049	11:16 am	1.5* $\delta_{0.3g}$	38	-13.47	0.22	0.17	-1.62	Pass	-1.28	Pass
0050	11:19 am	2.0* $\delta_{0.3g}$	50	-17.61	-0.13	-0.07	0.74	Pass	0.41	Pass
0051	11:22 am	2.5* $\delta_{0.3g}$	63	-21.74	-0.12	0.02	0.56	Pass	-0.08	Pass
0052	11:25 am	3.0* $\delta_{0.3g}$	76	-27.37	-0.11	-0.12	0.40	Pass	0.44	Pass
0053	11:28 am	3.5* $\delta_{0.3g}$	88	-29.79	-0.12	-0.05	0.41	Pass	0.18	Pass
0054	11:31 am	4.0* $\delta_{0.3g}$	101	-34.74	-0.22	-0.27	0.65	Pass	0.77	Pass
0055	11:34 am	4.5* $\delta_{0.3g}$	113	-38.80	-0.39	-0.19	1.02	Pass	0.49	Pass
0056	11:38 am	5.0* $\delta_{0.3g}$	126	-43.77	0.10	0.23	-0.23	Pass	-0.52	Pass
0057	11:41 am	5.5* $\delta_{0.3g}$	139	-48.58	-0.08	-0.13	0.16	Pass	0.27	Pass
0058	11:45 am	6.0* $\delta_{0.3g}$	151	-51.91	-0.06	-0.06	0.12	Pass	0.12	Pass
0059	11:48 am	6.5* $\delta_{0.3g}$	164	-56.55	-0.22	-0.18	0.39	Pass	0.31	Pass
0060	11:51 am	7.0* $\delta_{0.3g}$	176	-58.43	-0.14	-0.29	0.24	Pass	0.50	Pass
0061	11:54 am	7.5* $\delta_{0.3g}$	189	-62.82	-0.29	-0.01	0.46	Pass	0.01	Pass
0062	11:57 am	8.0* $\delta_{0.3g}$	202	-64.71	-0.14	0.00	0.22	Pass	0.00	Pass
0063	12:00 pm	8.5* $\delta_{0.3g}$	214	-66.72	0.02	-0.02	-0.02	Pass	0.04	Pass
0064	12:03 pm	9.0* $\delta_{0.3g}$	227	-68.08	-0.38	-0.15	0.56	Pass	0.23	Pass
0065	12:06 pm	9.5* $\delta_{0.3g}$	239	-68.56	-0.47	-0.03	0.69	Pass	0.05	Pass
0066	12:09 pm	10.0* $\delta_{0.3g}$	252	-70.47	0.12	-0.35	-0.18	Pass	0.50	Pass
0067	12:12 pm	10.5* $\delta_{0.3g}$	265	-70.04	-0.40	0.02	0.56	Pass	-0.03	Pass
0068	12:15 pm	10.7* $\delta_{0.3g}$	270	-70.71	-0.46	-0.17	0.65	Pass	0.25	Pass

1. Maneuver execution should continue until a steering wheel angle magnitude factor of $6.5 * \delta_{0.3g, overall}$ Or 270 degrees is utilized, whichever is greater provided the calculated $6.5 * \delta_{0.3g, overall}$ is less than or equal to 300 degrees. If $6.5 * \delta_{0.3g, overall}$ is less than 270 degrees maneuver execution should continue by increasing the steering wheel angle magnitude by multiples of $0.5 * \delta_{0.3g, overall}$ without exceeding the 270 degree steering wheel angle.

During execution of the sine with dwell maneuvers were any of the following events observed?

Rim-to-pavement contact	_____	Yes	_____	X	_____	No
Tire debanding	_____	Yes	_____	X	_____	No
Loss of pavement contact of vehicle tires	_____	Yes	_____	X	_____	No
Did the test driver experience any vehicle loss of control or spinout?	_____	Yes	_____	X	_____	No

If "Yes" explain the event and consult with the COTR. _____

3.0 TEST DATA....continued

DATA SHEET 8 (3 of 3) VEHICLE LATERAL STABILITY AND RESPONSIVENESS

Responsiveness – Lateral Displacement

Maneuver #	Initial Steer Direction	Commanded Steering Wheel Angle ($5.0^* \delta_{0.3g, overall}$ or greater)		Calculated Lateral Displacement ¹	
		Scalar	Angle (degrees)	Distance (m)	Pass/Fail
0036	Counter Clockwise	$5.0^* \delta_{0.3g}$	126	3.40	Pass
0037	Counter Clockwise	$5.5^* \delta_{0.3g}$	139	3.51	Pass
0038	Counter Clockwise	$6.0^* \delta_{0.3g}$	151	3.58	Pass
0039	Counter Clockwise	$6.5^* \delta_{0.3g}$	164	3.56	Pass
0040	Counter Clockwise	$7.0^* \delta_{0.3g}$	176	3.62	Pass
0041	Counter Clockwise	$7.5^* \delta_{0.3g}$	189	3.64	Pass
0042	Counter Clockwise	$8.0^* \delta_{0.3g}$	202	3.71	Pass
0043	Counter Clockwise	$8.5^* \delta_{0.3g}$	214	3.70	Pass
0044	Counter Clockwise	$9.0^* \delta_{0.3g}$	227	3.65	Pass
0045	Counter Clockwise	$9.5^* \delta_{0.3g}$	239	3.72	Pass
0046	Counter Clockwise	$10.0^* \delta_{0.3g}$	252	3.63	Pass
0047	Counter Clockwise	$10.5^* \delta_{0.3g}$	265	3.67	Pass
0048	Counter Clockwise	$10.7^* \delta_{0.3g}$	270	3.59	Pass
0056	Clockwise	$5.0^* \delta_{0.3g}$	126	3.31	Pass
0057	Clockwise	$5.5^* \delta_{0.3g}$	139	3.40	Pass
0058	Clockwise	$6.0^* \delta_{0.3g}$	151	3.52	Pass
0059	Clockwise	$6.5^* \delta_{0.3g}$	164	3.55	Pass
0060	Clockwise	$7.0^* \delta_{0.3g}$	176	3.58	Pass
0061	Clockwise	$7.5^* \delta_{0.3g}$	189	3.59	Pass
0062	Clockwise	$8.0^* \delta_{0.3g}$	202	3.66	Pass
0063	Clockwise	$8.5^* \delta_{0.3g}$	214	3.61	Pass
0064	Clockwise	$9.0^* \delta_{0.3g}$	227	3.63	Pass
0065	Clockwise	$9.5^* \delta_{0.3g}$	239	3.68	Pass
0066	Clockwise	$10.0^* \delta_{0.3g}$	252	3.76	Pass
0067	Clockwise	$10.5^* \delta_{0.3g}$	265	3.65	Pass
0068	Clockwise	$10.7^* \delta_{0.3g}$	270	3.66	Pass

1. Lateral displacement should be ≥ 1.83 m (6 ft) for vehicles with a GVWR of 3,500 kg (7,716 lb) or less; and ≥ 1.52 m (5ft) for vehicles with a GVWR greater than 3,500 kg (7,716 lb).

DATA INDICATES COMPLIANCE:

PASS/FAIL PASS

REMARKS:

RECORDED BY: Alan Ida
APPROVED BY: Ken Webster

DATE: 6-30-11
DATE: 7-07-11

3.0 TEST DATA....continued

**DATA SHEET 9 (Sheet 1 of 2)
MALFUNCTION WARNING TEST**

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

VEHICLE NHTSA No.: CB0514 TEST DATE: 7-05-11

METHOD OF MALFUNCTION SIMULATION:

Describe method of malfunction simulation: Disconnect the Left Front wheel speed sensor connector.

MALFUNCTION TELLTALE ILLUMINATION:

Telltale illuminates and remains illuminated after ignition locking system is activated and if necessary the vehicle is driven at least 2 minutes.

Yes No

Time for telltale to illuminate after ignition system is activated.

0 Seconds (must be within 2 minutes) Pass Fail

ESC SYSTEM RESTORATION:

Telltale extinguishes after ignition locking system is activated and if necessary the vehicle is driven at least 2 minutes.

Yes No

Time for telltale to extinguish after ignition system is activated and vehicle speed of 48 ± 8 km/h (30 ± 5 mph) is reached.

2 Seconds (must be within 2 minutes) Pass Fail

DATA INDICATES COMPLIANCE:

PASS/FAIL PASS

REMARKS:

The vehicle did not require driving to illuminate or extinguish the malfunction telltales. When the wheel speed sensor was disconnected, the ESC, ABS, and (yellow) BRAKE malfunction telltales illuminated. After the wheel speed sensor connector was restored, the ESC, ABS, and (yellow) BRAKE malfunction telltales had extinguished.

RECORDED BY: Alan Ida

DATE: 7-05-11

APPROVED BY: Ken Webster

DATE: 7-07-11

3.0 TEST DATA....continued

**DATA SHEET 9 (Sheet 2 of 2)
MALFUNCTION WARNING TEST**

VEHICLE MAKE/MODEL/BODY STYLE: BMW / 128i / Passenger Car

VEHICLE NHTSA No.: CB0514 TEST DATE: 7-05-11

METHOD OF MALFUNCTION SIMULATION:

Describe method of malfunction simulation: Remove the 40-amp ESC / ABS fuse (F90) from the fuse box.

MALFUNCTION TELLTALE ILLUMINATION:

Telltale illuminates and remains illuminated after ignition locking system is activated and if necessary the vehicle is driven at least 2 minutes.

Yes No

Time for telltale to illuminate after ignition system is activated.

0 Seconds (must be within 2 minutes) Pass Fail

ESC SYSTEM RESTORATION:

Telltale extinguishes after ignition locking system is activated and if necessary the vehicle is driven at least 2 minutes.

Yes No

Time for telltale to extinguish after ignition system is activated.

2 Seconds (must be within 2 minutes) Pass Fail

DATA INDICATES COMPLIANCE:

PASS/FAIL PASS

REMARKS:

The vehicle did not require driving to illuminate the malfunction telltales. When the 40-amp ESC / ABS fuse was removed, the ESC, ABS, and (yellow) BRAKE malfunction telltales illuminated. After the 40-amp ESC / ABS fuse was restored, the vehicle required driving in the forward direction to extinguish the telltales. After driving at approximately 20 mph, the ESC, ABS, and (yellow) BRAKE malfunction telltales extinguished.

RECORDED BY: Alan Ida

DATE: 7-05-11

APPROVED BY: Ken Webster

DATE: 7-07-11

4.0 TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

Type	Output	Range	Resolution	Accuracy	Specifics	Serial Number	Calibration
Tire Pressure Gauge	Vehicle Tire Pressure	0-60psi	0.5 psi	±0.5% of applied pressure	Moroso Model: 89562 0-60psi	<u>N/A</u>	By: <u>TRC</u> Date: <u>6-14-11</u> Due: <u>9-12-11</u>
Platform Scales	Vehicle Total, Wheel, and Axle Load	0-2500 lb per each of four pads	0.5 lb	±1.0% of applied load	Mettler Toledo Model: JXGA1000	<u>5225831-5JC</u>	By: <u>Mettler Toledo</u> Date: <u>5-16-11</u> Due: <u>8-16-11</u>
Automated Steering Machine with Steering Angle Encoder	Handwheel Angle	±800 deg	0.25 deg	±0.25 deg	Heitz Automotive Testing Model: Sprint 3	<u>60303</u>	By: <u>ATI-Heitz</u> Date: <u>2-18-11</u> Due: <u>2-18-12</u>
Multi-Axis Inertial Sensing System	Longitudinal, Lateral, and Vertical Acceleration Roll, Yaw, and Pitch Rate	Accelerometers: ±2 g Angular Rate Sensors: ±100 deg/s	Accelerometers: ≤10 ug Angular Rate Sensors: ≤0.004 deg/s	Accelerometers: ≤0.05% of full range Angular Rate Sensors: 0.05% of full range	BEI Technologies Model: MotionPAK MP-1	<u>0768</u>	By: <u>BEI Tech.</u> Date: <u>1-10-11</u> Due: <u>1-10-12</u>
Radar Speed Sensor and Dashboard Display	Vehicle Speed	0-125 mph	0.009 mph	±0.25% of full scale	A-DAT Corp. Radar Model: DRS-6 Display Model: RD-2	<u>1400603</u>	By: <u>B+S Multidata</u> Date: <u>2-14-11</u> Due: <u>2-14-12</u>
Ultrasonic Distance Measuring System	Left and Right Side Vehicle Height	5-24 inches	0.01 inches	±0.25% of maximum distance	Massa Products Corporation Model: M-5000/220	<u>104619 & 104613</u>	By: <u>Consumers Energy Laboratory Services</u> Date: <u>1-20-11</u> Due: <u>1-20-12</u>
Data Acquisition System [Amplify, Anti-Alias, and Digitize]	Record Time; Velocity; Distance; Lateral, Longitudinal, and Vertical Accelerations; Roll, Yaw, and Pitch Rates; Steering Wheel Angle.	Sufficient to meet or exceed individual sensors	200 Hz	Sufficient to meet or exceed individual sensors	Dewetron Sidehand DAS Model: DA-121-16 Digitizer Model: Dewe-Orion-1616-100 Amplifier/AntiAliasing: MDAQ-FILT-10-S	<u>120601105</u>	By: <u>Dewetron</u> Date: <u>12-02-10</u> Due: <u>12-02-11</u>
Load Cell	Vehicle Brake Pedal Force	0-300 lb	1 lb	±0.05% of full scale	DATRON Model: DTM-LPA	<u>4970-1103</u>	By: <u>TRC</u> Date: <u>per test</u> Due: <u>per test</u>
Coordinate Measurement Machine	Inertial Sensing System Location	0-10 feet	0.001 inch	±0.003% of full scale	FARO International Model: Faro Arm N10	<u>U12-05-08-07108</u>	By: <u>FARO</u> Date: <u>7-30-10</u> Due: <u>7-30-11</u>
Outriggers	No output. Safety Item.	N/A	N/A	N/A	NHTSA Titanium Outriggers Model: Docket 2007-27662-11	N/A	N/A

5.0 PHOTOGRAPHS

- 5.1 ¾ FRONT VIEW FROM LEFT SIDE OF VEHICLE
- 5.2 ¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE
- 5.3 VEHICLE CERTIFICATION LABEL
- 5.4 TIRE AND LOADING INFORMATION LABEL
- 5.5 WINDOW STICKER (MONRONEY LABEL)
- 5.6 ESC OFF AND ESC MALFUNCTION TELLTALE
- 5.7 ESC OFF CONTROL
- 5.8 ¾ FRONT VIEW - TEST VEHICLE INSTRUMENTED
- 5.9 ¾ REAR VIEW – TEST VEHICLE INSTRUMENTED
- 5.10 STEERING WHEEL CONTROLLER AND DATA ACQUISITION SYSTEM
- 5.11 STEERING CONTROLLER BATTERY BOX
- 5.12 INERTIA MEASUREMENT UNIT
- 5.13 VEHICLE SPEED SENSOR
- 5.14 BODY ROLL SENSOR (DRIVER SIDE)
- 5.15 BODY ROLL SENSOR (PASSENGER SIDE)
- 5.16 BRAKE PEDAL FORCE TRANSDUCER



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2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
JUNE 2011

5.1 ¾ FRONT VIEW FROM LEFT SIDE OF VEHICLE



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2011 BMW 128i
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5.2 ¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE



128ia

VEHICLE TYPE: PASSENGER CAR
MFD BY BAYERISCHE MOTORENWERKE 10/10

2 122 606

GVWR 4211 lbs 1910 kg
GAWR FRONT 2028 lbs 920 kg REAR 2293 lbs 1040 kg

THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S.
FEDERAL MOTOR VEHICLE SAFETY, BUMPER AND THEFT
PREVENTION STANDARDS IN EFFECT ON THE DATE OF
MANUFACTURE SHOWN ABOVE.

WBAUP7C56BVP21469



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2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
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5.3 VEHICLE CERTIFICATION LABEL

IMPORTANT!



Use inflation pressure specified above up to 100 mph only!

	100	mph
FRONT	240 35	KPA PSI
REAR	290 42	KPA PSI

BMW
6796030



**TIRE AND LOADING INFORMATION
RENSEIGNEMENTS SUR LES PNEUS ET LE CHARGEMENT**

SEATING CAPACITY TOTAL 4 FRONT 2 REAR 2
NOMBRE DE PLACES AVANT 2 ARRIÈRE 2

The combined weight of occupants and cargo should never exceed 360 kg or 794 lbs.
Le poids total des occupants et du chargement ne doit jamais dépasser 360 kg ou 794 lb.

TIRE / PNEU	SIZE DIMENSIONS	COLD TIRE PRESSURE PRESSION DES PNEUS A FROID
FRONT / AVANT	205/50 R 17	220 KPA, 32 PSI
REAR / ARRIÈRE	205/50 R 17	240 KPA, 35 PSI
SPARE DE SECOURS	NONE	NONE KPA, NONE PSI

**SEE OWNER'S MANUAL
FOR ADDITIONAL
INFORMATION**

**VOIR LE MANUEL DE
L'USAGER POUR PLUS
DE RENSEIGNEMENTS**

BMW
6796029



2011 BMW 128i
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5.4 TIRE AND LOADING INFORMATION LABEL

The Ultimate Driving Machine®

2011 BMW 128i Coupe

Manufacturer's Suggested Retail Price \$ 29,450.00
Options and Additional Charges: (Optional equipment may supersede standard equipment; check with your authorized BMW center).

Black Sapphire Metallic	\$ 550.00
Black Boston Leather	Included
Premium Package	\$ 2,650.00
- Universal garage-door opener	
- Gray Poplar Wood trim	
- Digital compass mirror	
- Moonroof	
- Auto-dimming mirrors	
- Auto-dimming rearview mirror	
- Power front seats	
- Lumbar support	
- BMW Assist with Bluetooth	
Value Package	
- iPod and USB adapter	
Transmission type controller	Included
STEPTRONIC automatic trans.	\$ 1,375.00
Heated Steering Wheel	\$ 190.00
Multi-function steering wheel	Included
Chrome-line exterior trim	Included
Automatic climate control	Included
Cruise Control	Included
Satellite radio w/1 year sub.	\$ 350.00
Destination Charge	\$ 875.00
Total Suggested Retail Price	\$ 35,440.00

Standard Features

- 3.0-liter dual overhead cam (DOHC), 24-valve inline 6-cylinder engine with composite magnesium/aluminum engine block, Valvetronic, and Double-VANOS steplessly variable valve timing
- Dynamic Stability Control (DSC), including Brake Fade Compensation, Start-off Assistant, Brake Drying, and Brake Stand-by features, with Dynamic Traction Control (DTC)
- 4-wheel ventilated anti-lock disc brakes with Dynamic Brake Control (DBC)
- Halogen free-form front foglights
- Heated dual power mirrors and heated windshield washer jets
- Automatic climate control
- Cruise Control
- Rain-sensing windshield wipers and Automatic headlight control
- 3-spoke multi-function steering wheel
- Service Interval Indicator with miles-to-service readout
- Tire Pressure Monitor
- On-board computer with Check Control vehicle monitor system
- AM/FM stereo CD/MP3 player audio system
- Auxiliary audio input for portable music players
- HD Radio
- Adaptive Brake Lights
- BMW's Advanced Safety System
- Front and rear Head Protection System (HPS)
- Driver's and passenger's front airbag supplemental restraint system (SRS) with advanced technology
- Front-seat-mounted front side-impact airbags
- Coded Driveaway Protection

BMW Delivery Quality Assurance

This BMW vehicle has been designed, engineered and manufactured under strict quality control guidelines. It has been prepared and inspected to ensure that it is free of defects in workmanship and materials in accordance with the New Vehicle Limited Warranty issued by BMW of North America, LLC.

BMW Ultimate Service

- 4 year/50,000 mile Full Maintenance Program
- 4 year/50,000 mile limited warranty
- 12 year rust perforation limited warranty
- 4 year/unlimited mile BMW Roadside Assistance Program

PARTS CONTENT INFORMATION

For Vehicles in this Car Line:
 US/Canadian Parts Content: **5%**
 Major Source of Foreign Parts Content:
GERMANY: 80%

Note: Parts content does not include final assembly, distribution, or other non-parts costs.

For this Vehicle:
 Final Assembly Point: **LEIPZIG, GERMANY**
 Country of Origin:
 Engine: **GERMANY**
 Transmission: **GERMANY**

GOVERNMENT SAFETY RATINGS

Frontal Crash	Driver Passenger	Not Rated
----------------------	-------------------------	------------------

Star ratings based on the risk of injury in a frontal impact. Frontal ratings should ONLY be compared to other vehicles of similar size and weight.

Side Crash	Front seat Rear seat	Not Rated
-------------------	-----------------------------	------------------

Star ratings based on the risk of injury in a side impact.

Rollover	Not Rated
-----------------	------------------

Star ratings based on the risk of rollover in a single vehicle crash.

Star Ratings range from 1 to 5 stars (* * * * *) with 5 being the highest. Source: National Highway Traffic Safety Administration (NHTSA).

www.safercar.gov or 1-888-327-4236

EPA Fuel Economy Estimates

CITY MPG

18

Expected range for most drivers
 14 to 22 MPG

Estimated
Annual Fuel Cost
\$2,184
 based on 15,000 miles at
 \$3.20 per gallon

HIGHWAY MPG

28

Expected range for most drivers
 23 to 33 MPG

Combined Fuel Economy

This Vehicle

22

10 33
 All Subcompact Cars

Your actual mileage will vary
 depending on how you drive and maintain your vehicle.



See the **FREE Fuel Economy Guide** at dealers or www.fueleconomy.gov



VIN: WBAUP7C56BVP21469

Sold To:
 Jake Sweeney BMW
 11535 McGillard St
 Cincinnati OH
 (513) 782-1122 45246-3136

Ship To:
 Jake Sweeney BMW
 11535 McGillard St
 Cincinnati OH
 (513) 782-1122 45246-3136

This vehicle is equipped with a front bumper that has been tested at an impact speed of 2.5 miles per hour and a rear bumper that has been tested at an impact speed of 2.5 miles per hour, and has sustained no damage to the vehicle's body and minimal damage to the bumper and attachment hardware. Minimal damage to the bumper means damage that can be repaired with the use of common repair materials and without replacing any parts. The stronger the bumper, the less likely the car will require repair after a low-speed collision.

Port of Entry: BALTIMORE, MARYLAND

Carrier: PRECISION MOTOR TRANSPORT GROUP

BMW of North America, LLC
 Woodcliff Lake, NJ 07677

VPC Location: BALTIMORE VDC

More about BMW



BMWUSA.COM
 1-800-333-0000

The Ultimate Driving Machine®

Environmental Performance

Protect the environment, choose vehicles with **higher scores**:

Global Warming Score



Smog Score



Using alternative fuels may improve scores. See www.DriveClean.ca.gov

Vehicle emissions are a primary contributor to global warming and smog. Scores are determined by the California Air Resources Board based on this vehicle's measured emissions. Please visit www.DriveClean.ca.gov for more information. **AIR RESOURCES BOARD**

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5.5 WINDOW STICKER - MONRONEY LABEL



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2011 BMW 128i
FMVSS 126
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5.6 ESC OFF AND ESC MALFUNCTION TELLTALE



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2011 BMW 128i
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5.7 ESC OFF CONTROL



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FMVSS 126
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5.8 3/4 FRONT VIEW - TEST VEHICLE INSTRUMENTED



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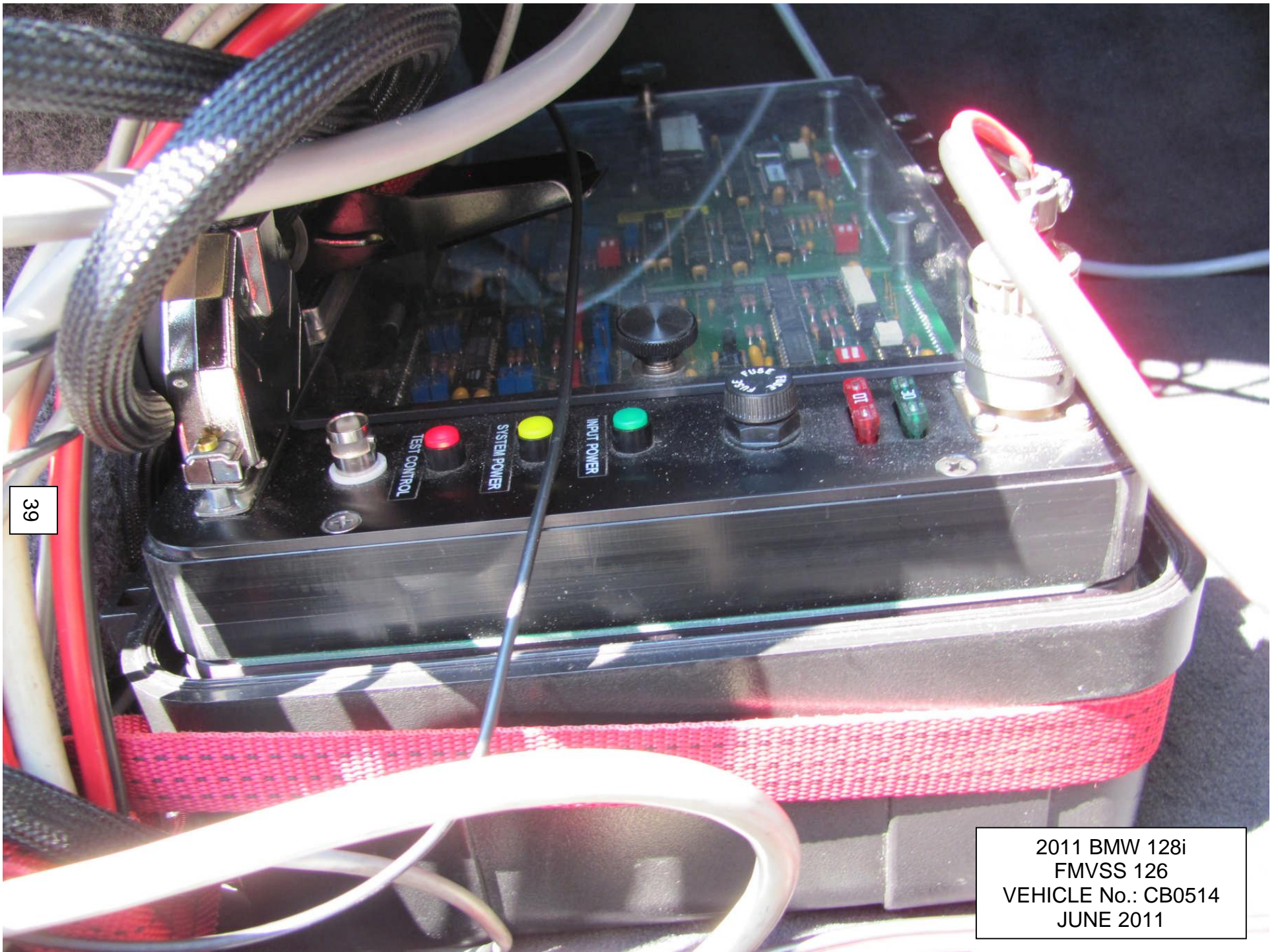
5.9 $\frac{3}{4}$ REAR VIEW - TEST VEHICLE INSTRUMENTED



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2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
JUNE 2011

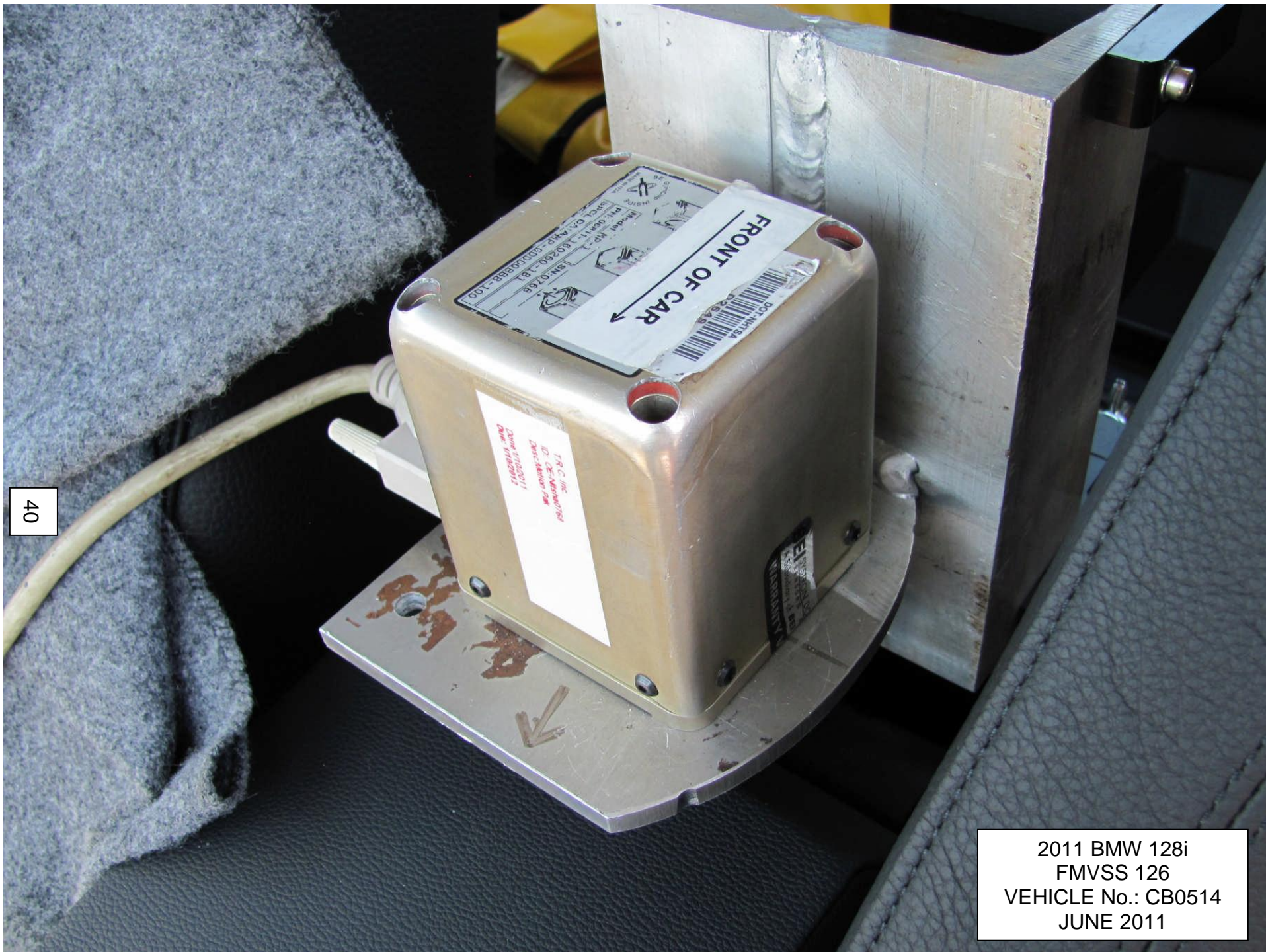
5.10 STEERING WHEEL CONTROLLER AND DATA ACQUISITION SYSTEM



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2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
JUNE 2011

5.11 STEERING CONTROLLER BATTERY BOX



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2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
JUNE 2011

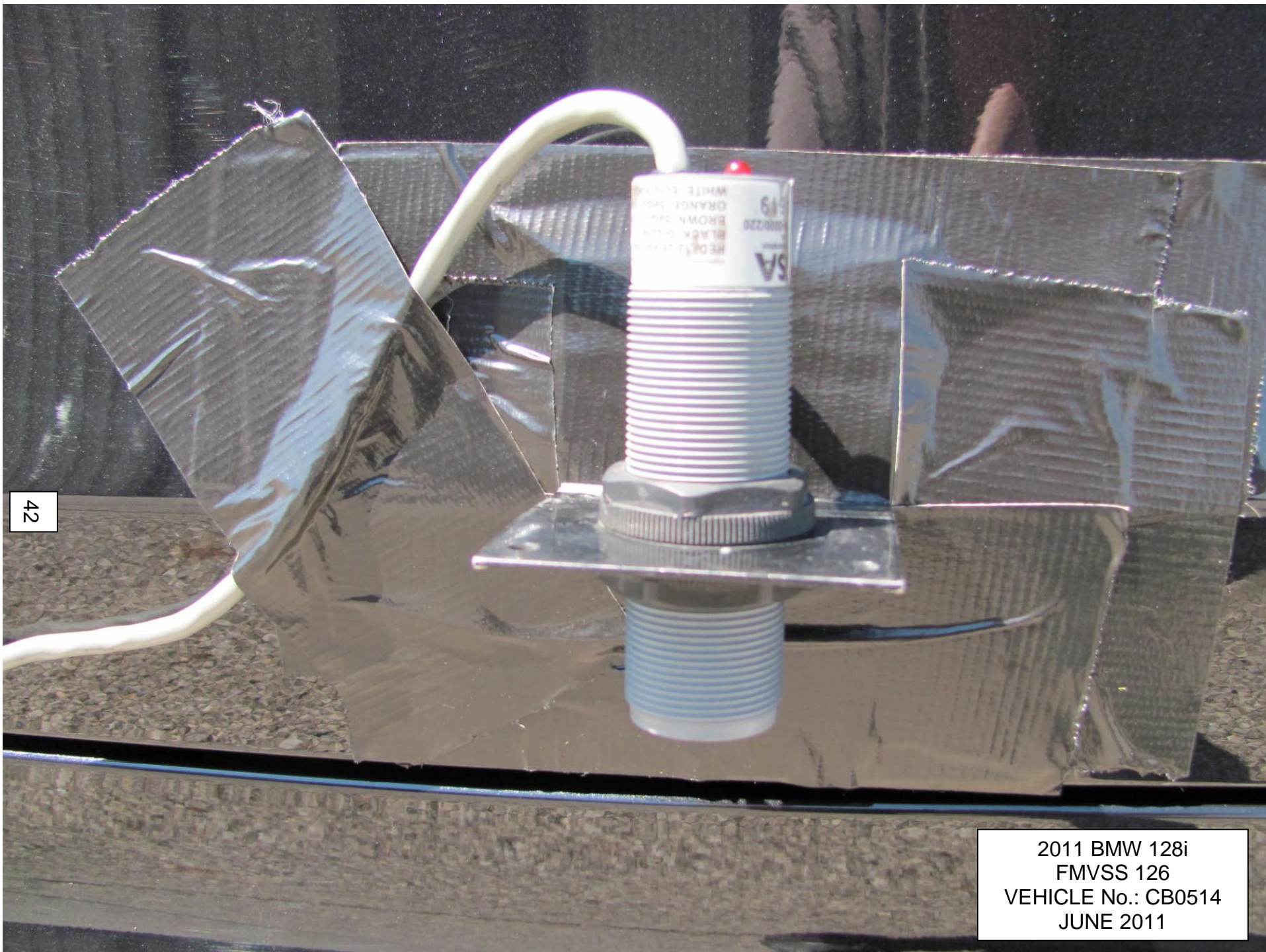
5.12 INERTIA MEASUREMENT UNIT



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2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
JUNE 2011

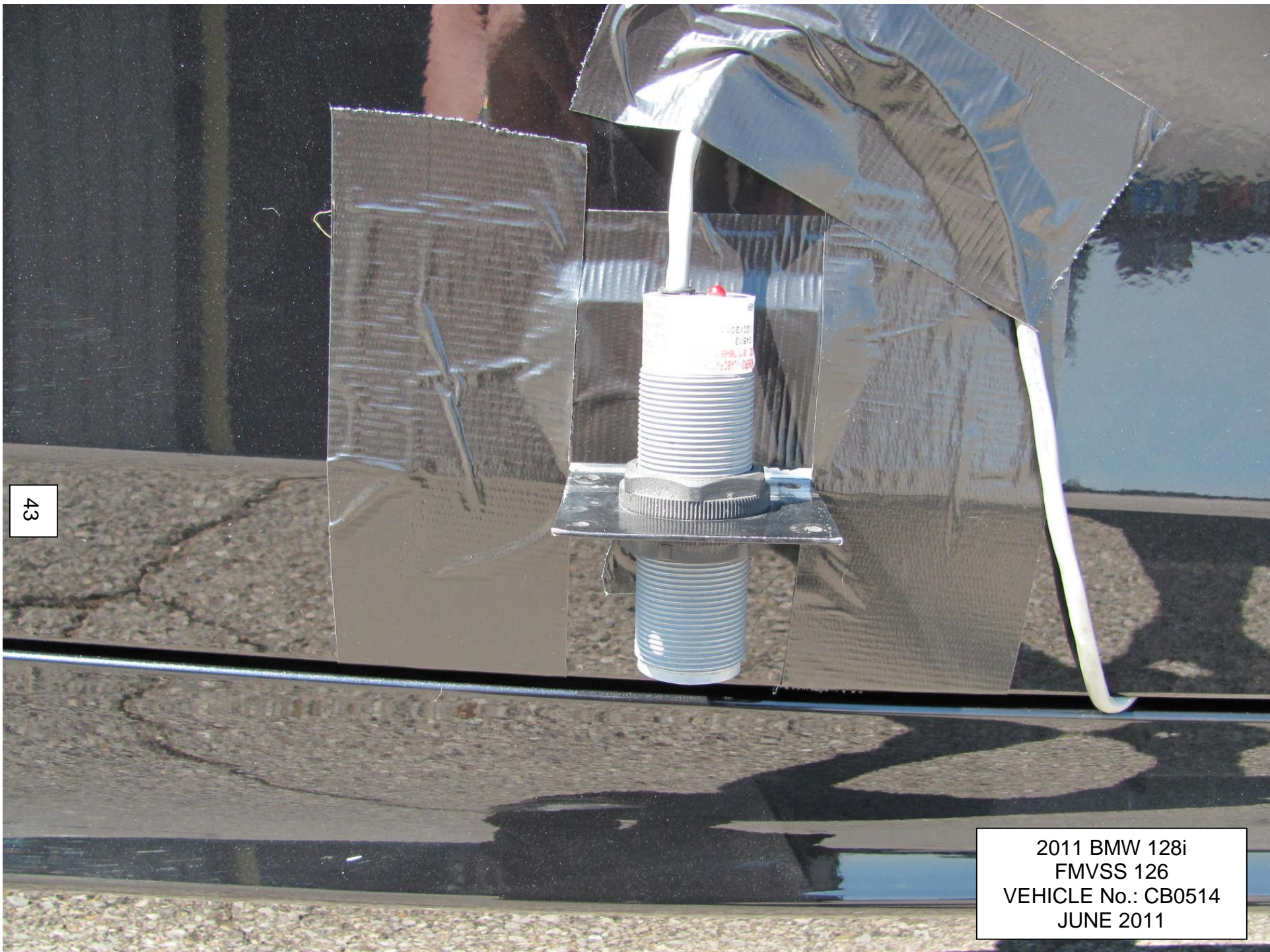
5.13 VEHICLE SPEED SENSOR



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2011 BMW 128i
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VEHICLE No.: CB0514
JUNE 2011

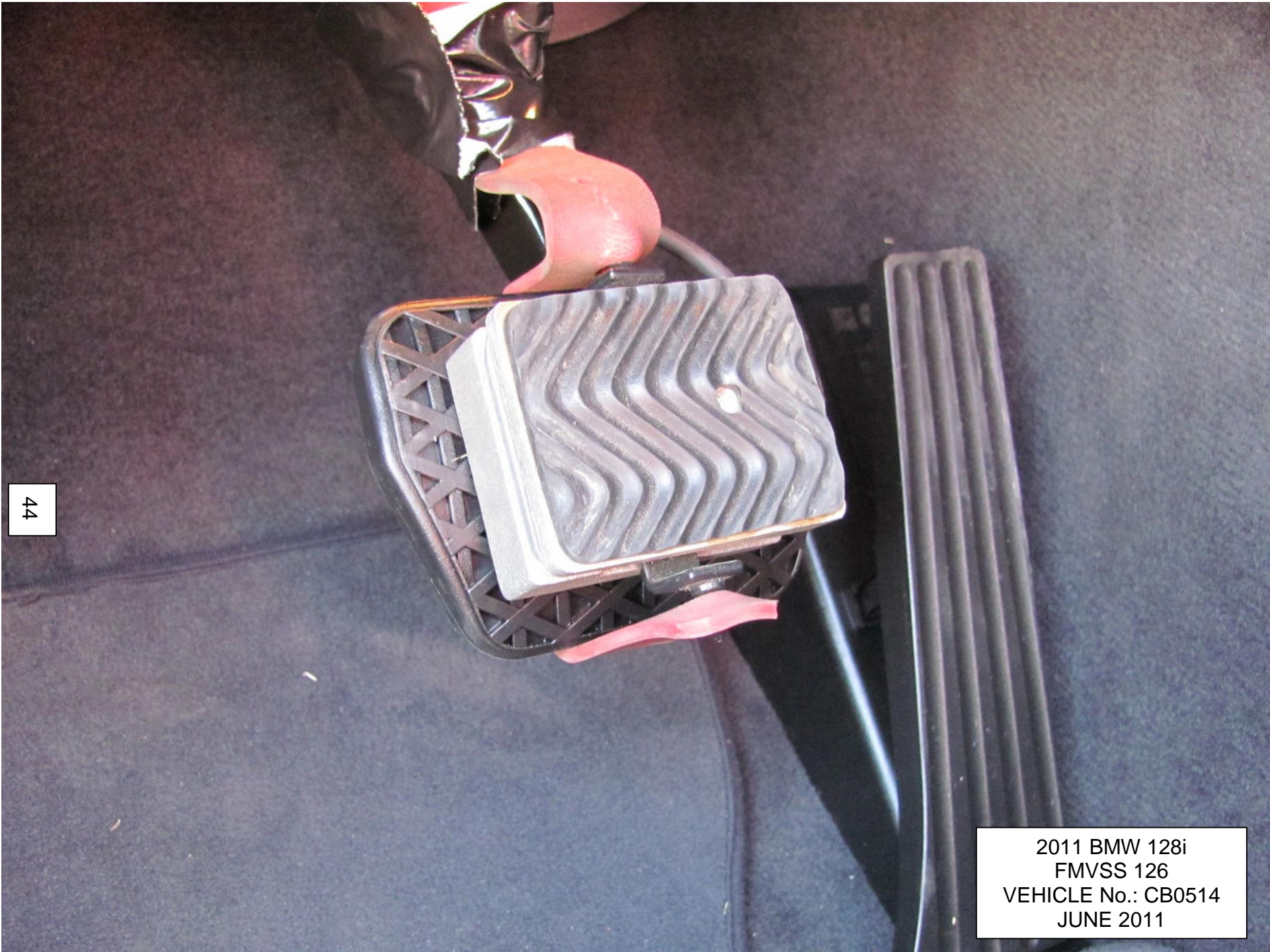
5.14 BODY ROLL SENSOR (DRIVER SIDE)



43

2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
JUNE 2011

5.15 BODY ROLL SENSOR (PASSENGER SIDE)



44

2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
JUNE 2011

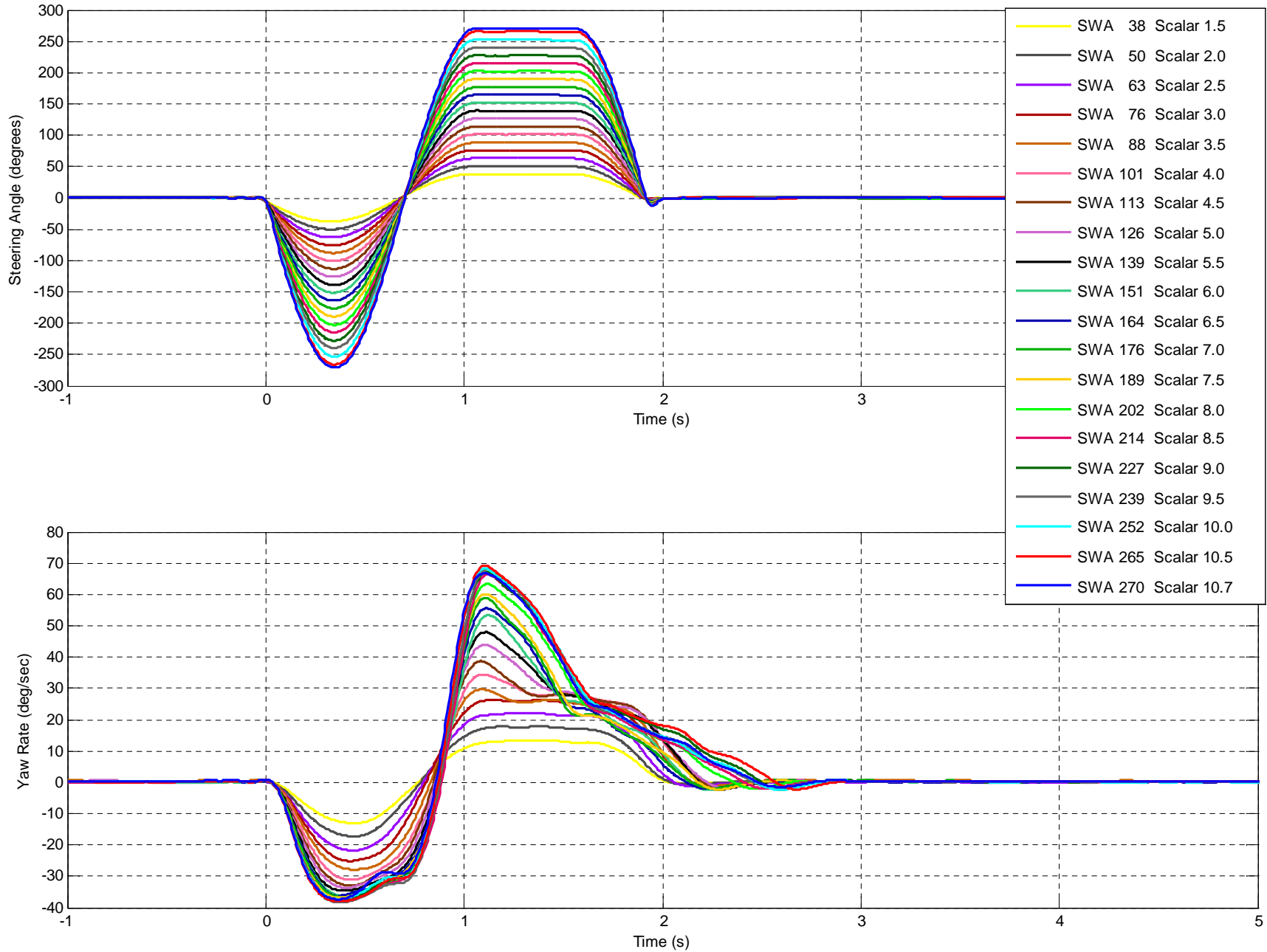
5.16 BRAKE PEDAL FORCE TRANSDUCER

6.0 DATA PLOTS

- Figure 1. Steering Angle and Yaw Rate Time History, Counter-Clockwise Initial Steer Tests
- Figure 2. Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Counter-Clockwise Initial Steer Tests
- Figure 3. Steering Angle and Yaw Rate Time History, Clockwise Initial Steer Tests
- Figure 4. Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Clockwise Initial Steer Tests

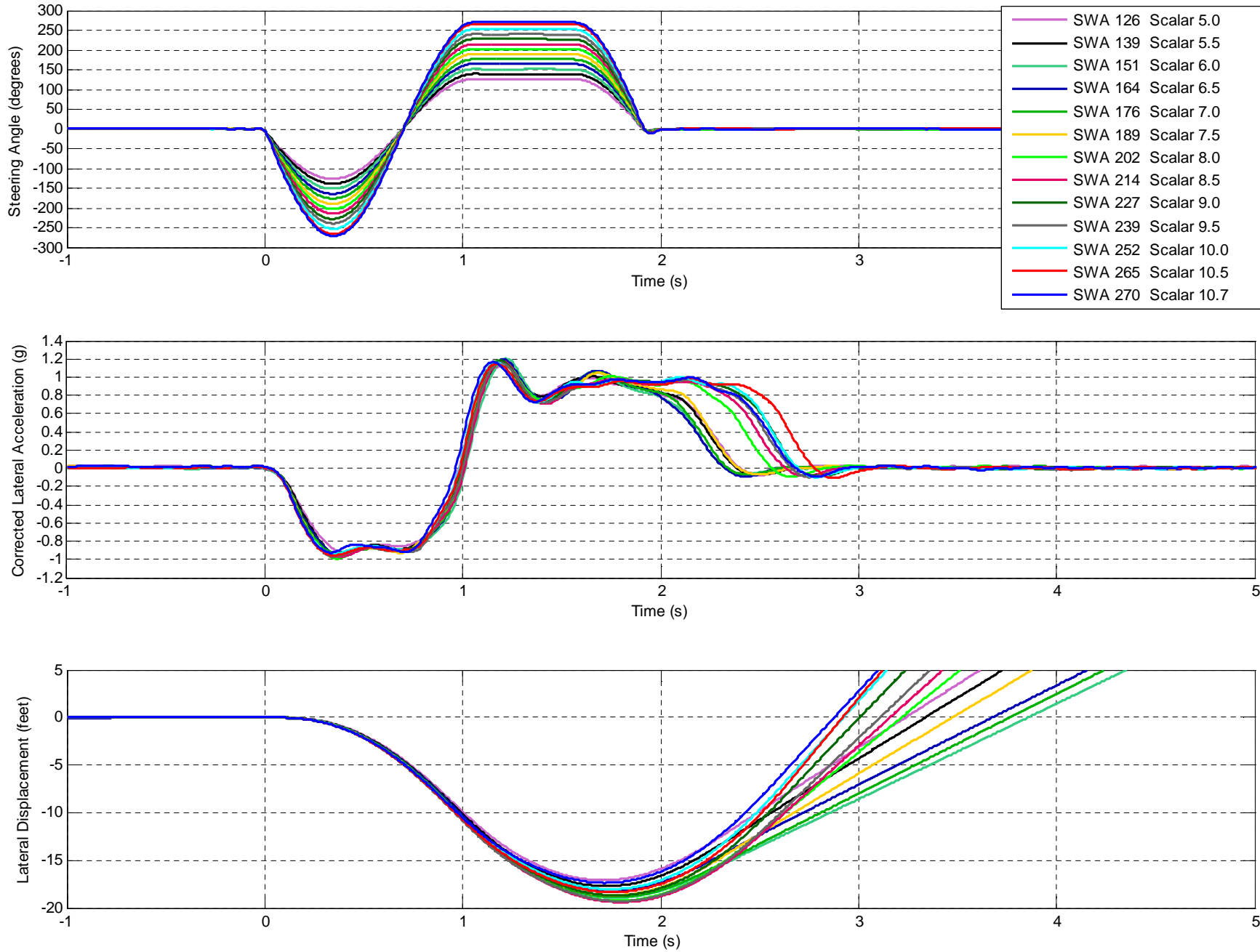
6.0 2011 BMW 128i DATA PLOTS

Figure 1. Steering Angle and Yaw Rate Time History, Counter-Clockwise Initial Steer Tests



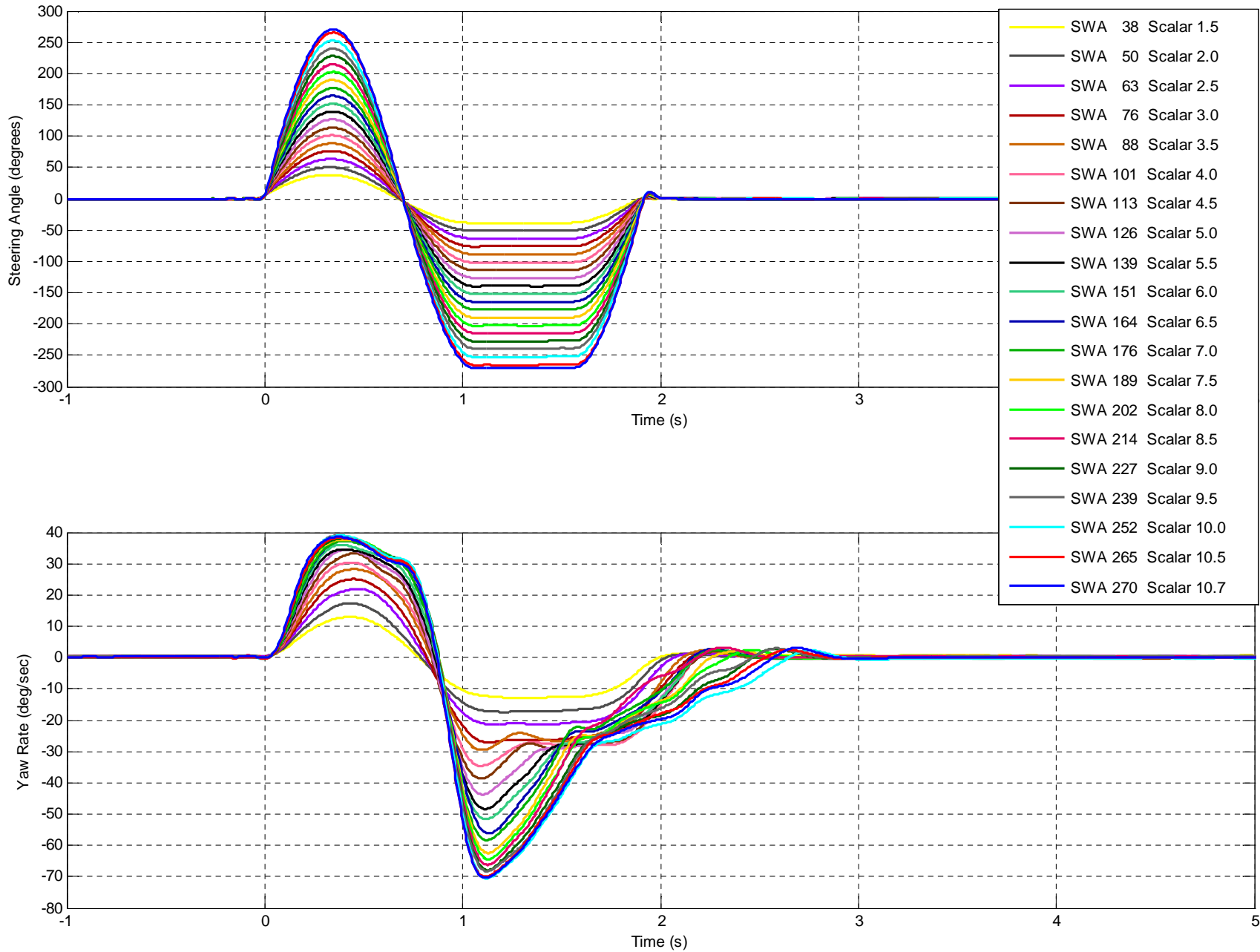
6.0 2011 BMW 128i DATA PLOTS...continued

Figure 2. Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Counter-Clockwise Initial Steer Tests



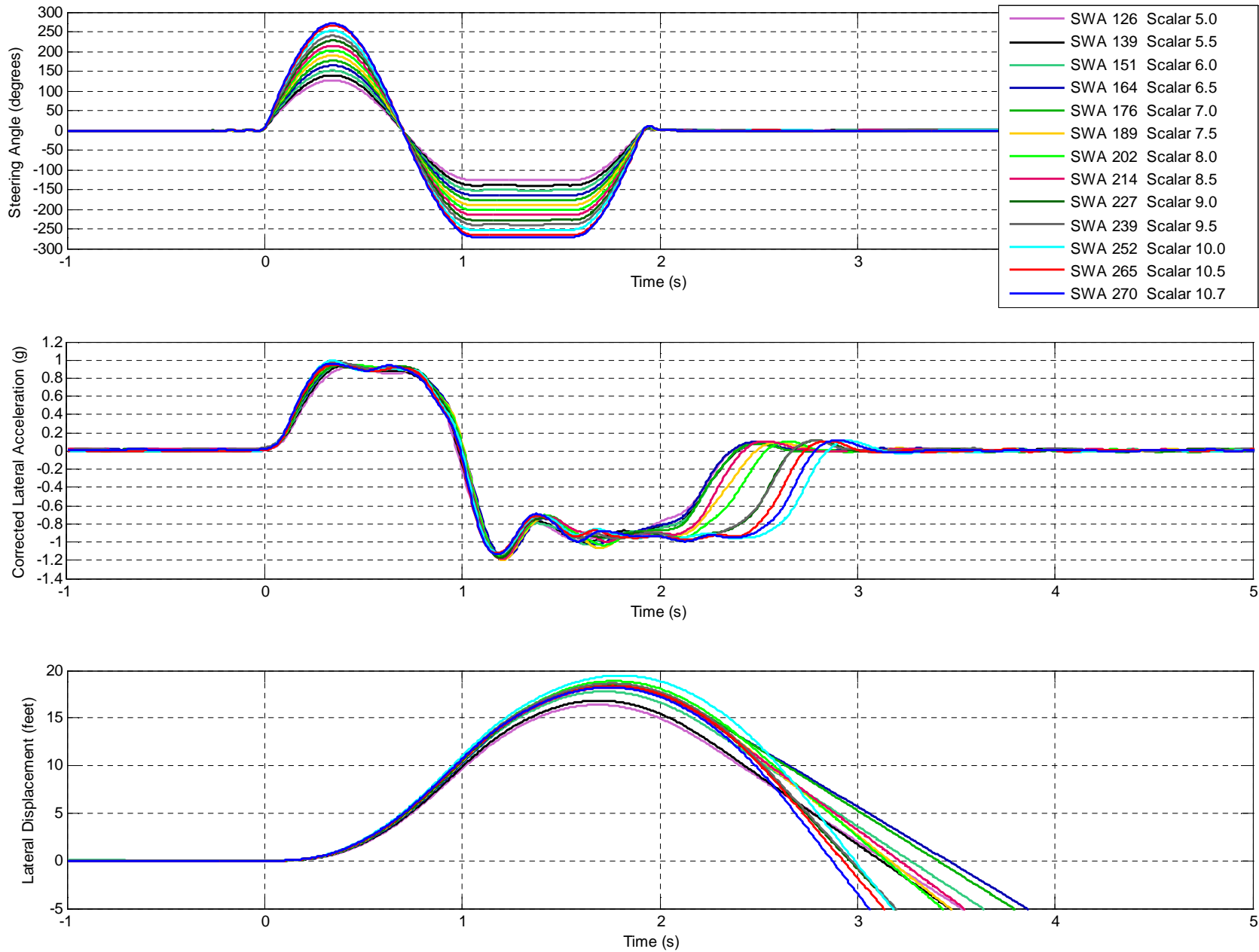
6.0 2011 BMW 128i DATA PLOTS...continued

Figure 3. Steering Angle and Yaw Rate Time History, Clockwise Initial Steer Tests



6.0 2011 BMW 128i DATA PLOTS...continued

Figure 4. Steering Angle, Lateral Acceleration, and Lateral Displacement Time History, Clockwise Initial Steer Tests



7.0 OTHER DOCUMENTATION

- 7.1 OWNER'S MANUAL PAGES
- 7.2 VEHICLE ARRIVAL CONDITION REPORT
- 7.3 VEHICLE COMPLETION CONDITION REPORT
- 7.4 SINE WITH DWELL TEST RESULTS
- 7.5 SLOWLY INCREASING STEER TEST RESULTS
- 7.6 INERTIAL SENSING SYSTEM LOCATION COORDINATES

7.1 OWNER'S MANUAL PAGES

Driving stability control systems

Your BMW has a number of systems that help to maintain the vehicle's stability even in adverse driving conditions.

Antilock Brake System ABS

ABS prevents locking of the wheels during braking. Safe steering response is maintained even during full braking. Active safety is thus increased.

ABS is operational every time you start the engine. Braking safely, refer to page 106.

Electronic brake-force distribution EBV

The system controls the brake pressure in the rear wheels to ensure stable braking behavior.


Dynamic Brake Control DBC

When you apply the brakes rapidly, this system automatically produces the maximum braking force boost and thus helps to achieve the shortest possible braking distance during full braking. At the same time, all the benefits provided by ABS are exploited.

Do not reduce the pressure on the brake for the duration of the full braking application.

Dynamic Stability Control DSC

DSC prevents the driving wheels from losing traction when you pull away from rest or accelerate. The system also recognizes unstable driving conditions, for example if the rear of the car is about to swerve or if momentum is acting at an angle past the front wheels. In these cases, DSC helps the vehicle maintain a safe course within physical limits by reducing engine output and through braking actions at the individual wheels.

 The laws of physics cannot be repealed, even with DSC. An appropriate driving style always remains the responsibility of the driver. Therefore do not reduce the additional safety margin by engaging in hazardous driving thereby running the risk of an accident. ◀

Deactivating DSC



Press the button for at least 3 seconds; the indicator lamps for DSC in the instrument cluster light up. Dynamic Traction Control DTC and DSC have been simultaneously deactivated. Stabilizing and drive-output promoting actions are no longer executed.

In the same way as with a differential interlock*, even if DSC is deactivated, brake actions are still performed on the rear axle to enhance drive output if the drive wheels experience a significant loss of traction.

To increase vehicle stability, activate DSC again as soon as possible.

Activating DSC

Press the button again; the indicator lamps for DSC in the instrument cluster go out.

For better control



If the indicator lamp flashes:
The DSC controls the driving and braking forces.



If the indicator lamps are on:
DSC is deactivated.

Dynamic Traction Control DTC

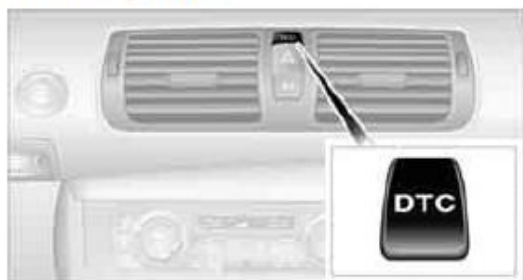
DTC is a version of DSC in which the drive output is optimized for particular road conditions, e.g. unplowed snow-covered roads. The system ensures maximum propulsion though with restricted driving stability. You therefore need to drive with suitable caution.

2011 BMW 128i
FMVSS 126
VEHICLE No.: CB0514
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In the following exceptional situations, it can be useful to briefly activate DTC:

- ▷ When driving on snow-covered inclines, in slush, or on uncleared snowy roads
- ▷ When rocking the vehicle free, driving out of deep snow or on loose surfaces
- ▷ When driving with snow chains

Activating DTC



Press the button; the indicator lamps for DTC in the instrument cluster come on.

For better control



If the indicator lamp flashes:
DTC controls the driving and braking forces.



If the indicator lamps are on:
DTC is activated.

Deactivating DTC

Press the button again; the DTC indicator lamps in the instrument cluster go out.

Drive-off assistant

The drive-off assistant enables you to drive off smoothly on uphill gradients. It is not necessary to use the parking brake for this.

1. Hold the car in place by depressing the brake.
2. Release the brake and drive off without delay.



The drive-off assistant holds the car in place for approx. 2 seconds after the

brake is released. Drive off without delay after releasing the brake. Otherwise, the drive-off assistant will no longer hold the car in place after approx. 2 seconds and the car will start to roll backwards. ◀

Flat Tire Monitor FTM*

The concept

The system does not measure the actual inflation pressure in the tires.

The system detects a pressure loss in a tire by comparing the rotational speeds of the individual wheels while moving.

In the event of a pressure loss, the diameter and therefore the rotational speed of the corresponding wheel change. This is detected and reported as a flat tire.

Functional requirement

The system must have been initialized while the tire inflation pressure was correct; otherwise, reliable signaling of a flat tire is not ensured.

Each time a tire inflation pressure has been corrected or a wheel or tire has been changed, reinitialize the system.

System limitations



It is impossible to provide advance warning of sudden, severe tire damage caused by outside influences. ◀

The system will not detect a natural, uniform pressure loss in all four tires. Therefore, check the tire inflation pressure regularly.

In the following situations, the system could be delayed or malfunction:

- ▷ System has not been initialized
- ▷ Driving on snowy or slippery road surface
- ▷ Performance-oriented style of driving: slip in the drive wheels, high lateral acceleration
- ▷ Driving with snow chains*

tiously; otherwise, there is a risk of personal injury or property damage. ◀

Driving stability control systems

Your BMW has a number of systems that help to maintain the vehicle's stability even in adverse driving conditions.

Antilock Brake System ABS

ABS prevents locking of the wheels during braking. Safe steering response is maintained even during full braking. Active safety is thus increased.

ABS is operational every time you start the engine. Braking safely, refer to page 116.

Electronic brake-force distribution EBV

The system controls the brake pressure in the rear wheels to ensure stable braking behavior.


Dynamic Brake Control DBC

When you apply the brakes rapidly, this system automatically produces the maximum braking force boost and thus helps to achieve the shortest possible braking distance during full braking. At the same time, all the benefits provided by ABS are exploited.

Do not reduce the pressure on the brake for the duration of the full braking application.

Dynamic Stability Control DSC

DSC prevents the driving wheels from losing traction when you pull away from rest or accelerate. The system also recognizes unstable driving conditions, for example if the rear of the car is about to swerve or if momentum is acting at an angle past the front wheels. In these cases, DSC helps the vehicle maintain a safe course within physical limits by reducing engine output and through braking actions at the individual wheels.

 The laws of physics cannot be repealed, even with DSC. An appropriate driving

style always remains the responsibility of the driver. Therefore do not reduce the additional safety margin by engaging in hazardous driving thereby running the risk of an accident. ◀

Deactivating DSC



Press the button for at least 3 seconds; the indicator lamps for DSC in the instrument cluster light up. Dynamic Traction Control DTC and DSC have been simultaneously deactivated. Stabilizing and drive-output promoting actions are no longer executed.

In the same way as with a differential interlock*, even if DSC is deactivated, brake actions are still performed on the rear axle to enhance drive output if the drive wheels experience a significant loss of traction.

To increase vehicle stability, activate DSC again as soon as possible.

Activating DSC

Press the button again; the indicator lamps for DSC in the instrument cluster go out.

For better control



If the indicator lamp flashes:
The DSC controls the driving and braking forces.



If the indicator lamps are on:
DSC is deactivated.

Dynamic Traction Control DTC

DTC is a version of DSC in which the drive output is optimized for particular road conditions, e.g. unplowed snow-covered roads. The system ensures maximum propulsion though with

7.2 VEHICLE ARRIVAL CONDITION REPORT

CONTRACT NO. DTNH22-08-D-00097 DATE: 6/24/11

FROM: Car Source LLC.

TO: TRC

PURPOSE: (X) Initial Receipt () Received via Transfer () Present vehicle condition

MODEL YEAR/MAKE/MODEL/BODY STYLE: 2011 / BMW / 128i / Passenger Car

MANUFACTURE DATE: 10/10 NHTSA NO.: CB0514

BODY COLOR: Black VIN: WBAUP7C56BVP21469

ODOMETER READING: 71 miles GVWR: 1,910 KG

PURCHASE PRICE: \$ rented / leased DEALER'S NAME: Car Source LLC., 1200 Stringtown Road, Grove City, OH 43123

X ALL OPTIONS LISTED ON "WINDOW STICKER" ARE PRESENT ON THE TEST VEHICLE

X TIRES AND WHEEL RIMS ARE NEW AND THE SAME AS LISTED

X THERE ARE NO DENTS OR OTHER INTERIOR OR EXTERIOR FLAWS

X THE VEHICLE HAS BEEN PROPERLY PREPARED AND IS IN RUNNING CONDITION

X THE GLOVE BOX CONTAINS AN OWNER'S MANUAL, WARRANTY DOCUMENT, CONSUMER INFORMATION, AND EXTRA SET OF KEYS

X PROPER FUEL FILLER CAP IS SUPPLIED ON THE TEST VEHICLE

X PLACE VEHICLE IN STORAGE AREA

X INSPECT THE VEHICLE'S INTERIOR AND EXTERIOR, INCLUDING ALL WINDOWS, SEATS, DOORS, ETC., TO CONFIRM THAT EACH SYSTEM IS COMPLETE AND FUNCTIONAL PER THE MANUFACTURER'S SPECIFICATIONS. ANY DAMAGE, MISADJUSTMENT, OR OTHER UNUSUAL CONDITION THAT COULD INFLUENCE THE TEST PROGRAM OR TEST RESULTS SHALL BE RECORDED. REPORT ANY ABNORMAL CONDITION TO THE NHTSA COTR BEFORE BEGINNING ANY TEST

RECORDED BY: Alan Ida

DATE: 6-24-11

APPROVED BY: Ken Webster

DATE: 7-07-11

7.3 VEHICLE COMPLETION CONDITION REPORT

CONTRACT NO. DTNH22-08-D-00097 DATE: 7/06/11

MODEL YEAR/MAKE/MODEL/BODY STYLE: 2011 / BMW / 128i / Passenger Car

MANUFACTURE DATE: 10/10 NHTSA NO.: CB0514

BODY COLOR: Black VIN: WBAUP7C56BVP21469

ODOMETER READING: 138 miles GVWR: 1,910 KG

LIST OF FMVSS TESTS PERFORMED BY THIS LAB: 126, 135

- THERE ARE NO DENTS OR OTHER INTERIOR OR EXTERIOR FLAWS
- THE VEHICLE HAS BEEN PROPERLY MAINTAINED AND IS IN RUNNING CONDITION
- THE GLOVE BOX CONTAINS AN OWNER'S MANUAL, WARRANTY DOCUMENT, CONSUMER INFORMATION, AND EXTRA SET OF KEYS
- PROPER FUEL FILLER CAP IS SUPPLIED ON THE TEST VEHICLE

REMARKS:

Equipment that is no longer on the test vehicle as noted on Vehicle Arrival Condition Report:

None.

Explanation for equipment removal:

N/A

Test Vehicle Condition:

Like new.

RECORDED BY: Alan Ida

DATE: 7-06-11

APPROVED BY: Ken Webster

DATE: 7-07-11

7.4 SINE WITH DWELL TEST RESULTS
2011 BMW 128i
NHTSA No.: CB0514

Date Created 30-Jun-11

LEFT-TO-RIGHT (INITIAL COUNTER-CLOCKWISE STEER)

File	SWA @ 5deg Ct	MES	Time@5deg	COS	Time@COS	MOS	Time@MOS	YRR1(%)	YR1 (deg/sec)	YRR1 Ct	YRR175(%)	YR175 (deg/sec)
0027	619	50.250	3.090	1000	4.991	755	3.769	-0.339	-0.045	1200	-0.171	-0.023
0028	618	50.195	3.082	999	4.987	755	3.768	-0.410	-0.072	1199	-0.615	-0.108
0029	617	50.379	3.075	999	4.985	755	3.766	-0.198	-0.043	1199	-0.374	-0.082
0032	617	50.438	3.076	999	4.989	756	3.770	-0.017	-0.004	1199	-0.164	-0.042
0033	616	50.411	3.073	999	4.989	755	3.770	-0.074	-0.022	1199	-0.203	-0.059
0034	615	50.249	3.068	999	4.985	755	3.766	0.653	0.224	1199	0.408	0.140
0035	615	50.414	3.067	998	4.985	755	3.767	0.297	0.114	1198	0.448	0.172
0036	615	50.449	3.066	998	4.984	755	3.767	0.165	0.072	1198	0.188	0.082
0037	615	50.352	3.069	999	4.988	755	3.770	-0.053	-0.025	1199	0.061	0.029
0038	615	50.543	3.065	998	4.984	755	3.767	0.130	0.069	1198	0.339	0.181
0039	615	50.386	3.067	999	4.986	755	3.768	0.002	0.001	1199	-0.089	-0.050
0040	615	50.533	3.067	999	4.986	755	3.769	0.048	0.028	1199	-0.026	-0.015
0041	615	50.296	3.065	998	4.984	755	3.767	0.052	0.031	1198	-0.058	-0.034
0042	614	50.358	3.063	998	4.982	754	3.765	0.378	0.239	1198	0.278	0.175
0043	615	50.535	3.067	999	4.987	755	3.769	0.309	0.205	1199	0.124	0.082
0044	615	50.304	3.065	998	4.984	755	3.768	0.374	0.250	1198	-0.311	-0.208
0045	615	50.379	3.067	999	4.985	755	3.769	0.203	0.138	1199	0.218	0.148
0046	615	50.731	3.068	999	4.987	756	3.770	0.460	0.313	1199	-0.177	-0.120
0047	615	50.404	3.068	999	4.987	756	3.770	0.184	0.127	1199	0.211	0.145
0048	614	50.349	3.064	998	4.983	755	3.766	0.113	0.075	1198	-0.177	-0.117

RIGHT-TO-LEFT (INITIAL CLOCKWISE STEER)

0049	620	50.436	3.092	1000	4.993	756	3.771	-1.623	0.219	1200	-1.278	0.172
0050	618	50.491	3.081	999	4.987	755	3.767	0.742	-0.131	1199	0.409	-0.072
0051	617	50.485	3.079	999	4.988	755	3.770	0.556	-0.121	1199	-0.083	0.018
0052	617	50.357	3.076	999	4.989	755	3.770	0.400	-0.109	1199	0.440	-0.120
0053	616	50.325	3.072	999	4.988	755	3.769	0.414	-0.123	1199	0.179	-0.053
0054	616	50.441	3.071	999	4.988	755	3.769	0.648	-0.225	1199	0.771	-0.268
0055	615	50.182	3.067	998	4.985	755	3.766	1.017	-0.395	1198	0.494	-0.192
0056	615	50.335	3.066	998	4.984	755	3.767	-0.230	0.101	1198	-0.523	0.229
0057	615	50.539	3.067	999	4.985	755	3.768	0.162	-0.079	1199	0.266	-0.129
0058	615	50.452	3.066	999	4.985	755	3.768	0.125	-0.065	1199	0.121	-0.063
0059	615	50.569	3.068	999	4.987	755	3.769	0.388	-0.219	1199	0.315	-0.178
0060	1357	50.365	6.777	1741	8.697	1497	7.480	0.236	-0.138	1941	0.495	-0.289
0061	615	50.464	3.066	998	4.985	755	3.768	0.457	-0.287	1198	0.011	-0.007
0062	614	50.528	3.063	998	4.983	755	3.766	0.220	-0.142	1198	-0.003	0.002
0063	614	50.407	3.063	998	4.983	755	3.766	-0.024	0.016	1198	0.035	-0.024
0064	614	50.401	3.064	998	4.984	755	3.767	0.563	-0.383	1198	0.226	-0.154
0065	615	50.419	3.068	999	4.987	756	3.770	0.692	-0.474	1199	0.048	-0.033
0066	615	50.472	3.066	998	4.985	755	3.768	-0.175	0.124	1198	0.498	-0.351
0067	615	50.550	3.068	999	4.988	756	3.770	0.564	-0.395	1199	-0.028	0.020
0068	615	50.639	3.066	999	4.986	755	3.768	0.651	-0.461	1199	0.246	-0.174

7.4 SINE WITH DWELL TEST RESULTS
2011 BMW 128i
NHTSA No.: CB0514

Date Created 30-Jun-11

LEFT-TO-RIGHT (INITIAL COUNTER-CLOCKWISE STEER)

File	YRR175 Ct	2nd Yaw Peak(deg/sec)	2nd Yaw Peak Ct	Lat Disp (ft)	Lat. Acc. 1.07s (g)	1st SWA Peak(deg)	1st SWA Peak Ct	2nd SWA Mean(deg)
0027	1350	13.185	896	-4.447	0.408	37.736	684	37.595
0028	1349	17.475	857	-5.783	0.524	50.101	684	49.876
0029	1349	21.899	869	-7.387	0.606	63.155	683	63.042
0032	1349	25.819	845	-8.497	0.654	75.956	684	75.874
0033	1349	29.204	834	-9.532	0.676	87.998	684	87.998
0034	1349	34.309	834	-10.247	0.681	101.044	683	101.247
0035	1348	38.523	832	-10.794	0.702	113.122	684	113.138
0036	1348	43.491	836	-11.152	0.688	126.109	684	126.136
0037	1349	47.694	837	-11.504	0.715	138.957	684	139.179
0038	1348	53.248	840	-11.738	0.601	151.376	683	151.444
0039	1349	55.393	838	-11.667	0.711	164.321	684	164.548
0040	1349	58.547	836	-11.874	0.722	176.377	684	176.267
0041	1348	59.749	836	-11.952	0.758	189.500	684	189.573
0042	1348	63.120	837	-12.165	0.740	202.721	683	202.592
0043	1349	66.278	839	-12.152	0.713	214.629	684	214.634
0044	1348	66.821	838	-11.977	0.776	227.815	684	227.511
0045	1349	67.925	838	-12.204	0.764	239.624	684	239.488
0046	1349	68.084	836	-11.914	0.874	253.075	684	252.623
0047	1349	68.998	836	-12.046	0.848	265.961	684	265.708
0048	1348	66.273	835	-11.792	0.943	271.087	683	270.784

RIGHT-TO-LEFT (INITIAL CLOCKWISE STEER)

0049	1350	-13.465	890	4.094	-0.383	38.184	684	38.204
0050	1349	-17.612	860	5.507	-0.480	50.408	683	50.336
0051	1349	-21.736	849	6.965	-0.545	63.623	684	63.415
0052	1349	-27.367	843	8.028	-0.618	76.403	684	76.289
0053	1349	-29.794	835	9.018	-0.611	88.319	684	88.284
0054	1349	-34.736	835	9.691	-0.672	101.424	684	101.345
0055	1348	-38.799	834	10.249	-0.695	113.455	684	113.465
0056	1348	-43.771	835	10.869	-0.695	126.568	684	126.322
0057	1349	-48.585	838	11.142	-0.709	139.444	684	139.377
0058	1349	-51.912	838	11.543	-0.689	151.783	684	151.494
0059	1349	-56.553	842	11.648	-0.623	164.584	684	164.587
0060	2091	-58.431	1581	11.749	-0.716	176.596	1426	176.531
0061	1348	-62.815	841	11.779	-0.664	189.682	684	189.681
0062	1348	-64.712	840	11.993	-0.699	202.620	683	202.527
0063	1348	-66.718	839	11.847	-0.755	214.589	683	214.523
0064	1348	-68.076	839	11.917	-0.776	227.726	683	227.641
0065	1349	-68.556	840	12.082	-0.768	239.693	684	239.465
0066	1348	-70.474	839	12.338	-0.769	252.704	684	252.670
0067	1349	-70.036	838	11.988	-0.839	265.699	684	265.724
0068	1349	-70.705	838	11.998	-0.838	270.554	684	270.515

7.5 SLOWLY INCREASING STEER TEST RESULTS
2011 BMW 128i
NHTSA No.: CB0514

Date Created 30-Jun-11

File	Vehicle	EventPt	DOS	MES [mph]	Mean SPD [mph]	AYcount_3	THETAENCF_3 [degree]	AYCG_CD2_3 [g]	r_squared	ZeroBegin	ZeroEnd
0012	2011 BMW 128i	703	1	49.983	50.104	1065	-24.536	-0.302	0.998	503	703
0013	2011 BMW 128i	704	1	50.460	49.546	1074	-25.058	-0.298	0.997	504	704
0016	2011 BMW 128i	703	1	50.274	50.496	1058	-24.072	-0.304	0.998	503	703
0017	2011 BMW 128i	705	0	50.140	50.213	1079	25.484	0.306	0.999	505	705
0018	2011 BMW 128i	698	0	49.816	49.591	1081	25.761	0.302	0.998	498	698
0019	2011 BMW 128i	698	0	49.699	49.362	1090	26.324	0.303	0.998	498	698
Averages							25.2	0.302			

Scalars	Steering Angles (deg)
1.5	38
2	50
2.5	63
3	76
3.5	88
4	101
4.5	113
5	126
5.5	139
6	151
6.5	164
7	176
7.5	189
8	202
8.5	214
9	227
9.5	239
10	252
10.5	265
10.7	270

7.6 INERTIA SENSOR MEASUREMENTS

2011 BMW 128i

NHTSA No.: CB0514

Device : U12-05-08-07108
 device version : 2.24
 device certification date : 07/30/10
 today is : 6/29/2011
 units : Millimeters

Label	ActualX	ActualY	ActualZ
C_DEVICEPOS001			
M_PLANE001	1188.783	-518.568	-303.318
M_LINE001	809.675	84.030	34.927
M_ORIGIN_FRT_AXLE_CENTER	0.000	0.000	0.000
C_COORDSYS001	0.000	0.000	0.000
M_TIRE_TREAD_CENTER	278.869	96.139	-161.730
M_INERTIA_PACK	1712.278	815.827	497.015
M_ROOF	1874.486	825.464	1108.371
M_GROUND	1874.471	-106.754	-301.604

Track Width 1479.550

Roof Height (relative to ground) 1409.975

Motion Pak - x-distance (mm) 1712.278
Motion Pak - y-distance (mm) -20.087
Motion Pak - z-distance (mm) 754.169

Motion Pak - x-distance (inches) 67.412
Motion Pak - y-distance (inches) -0.791
Motion Pak - z-distance (inches) 29.692

x-distance (longitudinal) Point of reference is the front axle centerline.
 (Positive from front axle toward rear of vehicle.)

y-distance (lateral) Point of reference is the vehicle centerline.
 (Positive from the center toward the right.)

z-distance (vertical) Point of reference is the ground plane.
 (Positive from the ground up.)